ISJ ARAD

MY BLUE HOME ERASMUS PROJECT

Digital Game Missions — Ocean Museum Topics

1. "The Ocean as a source of Food & Resources" —*dealing only with fisheries, eutrophication, microplastics, oil drilling etc.*
2. "The Ocean as a means of Recreation and Transport" —*dealing with tourism and transport*
3. "The Ocean as a part of the Climate" —*dealing with ocean warming, sea level rise, etc.*
4. "The Ocean as a Blue Home" —*dealing with problems of the habitats, like acidification, pollution, alien species, noise, etc.*

#	Problem	Related to Mission/ Topic	Caused by	Sustainable Actions	Game Actions	Possible Museum Activity
1	**Low fish stock**	1	Overfishing Water pollution Destruction of underwater habitats: i. Ghost fishing gear ii. trawling	Sustainable fishing practices Reduce sources of pollution Protecting critical habitats Restoring critical habitats Preferring sustainable seafood and supporting fisheries that use responsible fishing practices	Implement new fishing nets and practices Create protected areas in the ocean where boats cannot cross or fishing cannot be done Install artificial reefs to restore habitats and reintroduce species Reduce sources of pollution	Netting Game: In this activity, students can play a game that simulates fishing. Students are given nets with different mesh sizes and have to try to catch as many "fish" as possible in a set amount of time (small objects such as paper clips or beads in a bowl of water). After each round, the number of "fish" caught is recorded, and the game continues with different variations such as decreasing the number of "fish" available or increasing the difficulty of catching them (increasing net mesh size). This game can help students understand the impact of overfishing on fish populations
2	**Decrease in production of sea algae/sea algae are dying**	1	Water pollution	Monitor acidity levels Reduce sources of pollution with impact on water acidification Find a algae species more resistant to higher levels of acidity	Monitor water acidity Stop water pollution contributing to rise in acidity levels Help setting up a new plantation in a more adequate location	Grow algae in bottles using this tutorial: https://www.wikihow.com/Grow-Algae Then do the following experiments: Impact of sunlight on algae growth: Place four small fish tanks or jars filled with seawater in a sunny area. Cover one container with a cloth, cover another with a colored plastic wrap, and leave the other two uncovered. Place an equal amount of algae in each container and observe which one grows the most Impact of water pollution on algae growth: Fill three small fish tanks or jars with seawater. Add different types of pollutants to each container, such as oil or detergent. Place an equal amount of algae in each container and observe which one grows the most Impact of temperature on algae growth: Fill three small fish tanks or jars with seawater. Keep one at room temperature, one in the refrigerator, and one in a sunny location. Place an equal amount of algae in each container and observe which one grows the most

3	**Ocean Warming**	3	Greenhouse gases (e.g., CO2, methane etc.) from fossil fuel, biomass burning etc.	Reduction of greenhouse gases (by reducing the use of fossil fuel, advancing renewable energy technology, inventing ways of containing greenhouse gas emissions etc.) Transportation using environmentally friendly means. Use renewable energy technology (eg wind, solar, wave power, etc) Reduce-reuse-recycle! Climate engineering ?	Reduce energy consumption: take actions such as turning off lights and electronics when not in use, using energy-efficient appliances and light bulbs, and adjusting the thermostat to save energy Use alternative transportation: choose to walk, bike, or use public transportation instead of driving a car to reduce their carbon footprint Reduce waste: by using reusable items such as water bottles and bags, recycling materials, and composting food scraps Conserve water: fix leaks, take shorter showers Support renewable energy: such as solar and wind power, by investing in them or advocating for policies that promote their use Educate others: spread awareness about the impacts of global warming and encourage others to take action through social media, community events, or educational campaigns	Heat transfer experiment: Fill two containers with water and add a thermometer to each. Place one container in a sunny area (or close to a lamp) and the other in a shaded area. After a few hours, compare the temperatures of the two containers to show how solar radiation affects water temperature Ice melting experiment: Fill two containers with water and add ice to each. Place one container in a sunny area and the other in a shaded area. Observe how the ice melts more quickly in the warmer container Aquarium experiment: Set up a small aquarium and add a heater to simulate ocean warming. Observe how the fish and other creatures in the aquarium react to the increased temperature and discuss the potential effects of ocean warming on marine life Thermal expansion experiment: Fill a glass bottle with water and add a balloon to the top. Heat the bottle and observe how the balloon expands as the water temperature increases. This demonstrates the concept of thermal expansion and how it can lead to sea level rise

4	**Sea Level rise**	2, 3	Thermal expansion: As the ocean absorbs more heat from the atmosphere, the water temperature increases, causing the seawater to expand. This thermal expansion accounts for about half of the observed sea level rise over the last century. Melting of land-based ice: The other major factor contributing to sea level rise is the melting of land-based ice, such as glaciers and ice sheets in Greenland and Antarctica. As these ice masses melt, they add more water to the ocean, causing sea levels to rise.	Implementing coastal protection measures: This includes building sea walls, dunes, and other barriers to protect coastal communities from flooding and erosion. Reducing greenhouse gas emissions: The primary cause of sea level rise is the increase in atmospheric greenhouse gases, so reducing emissions is crucial to mitigate its impacts. This can be achieved through transitioning to renewable energy sources, improving energy efficiency, and reducing deforestation Conserving and restoring coastal ecosystems: Wetlands, mangroves, and other coastal ecosystems provide natural protection against sea level rise by absorbing excess water and reducing erosion. Conserving and restoring these ecosystems can help to mitigate the impacts of sea level rise Encouraging sustainable land use practices: Reducing coastal development, limiting urban sprawl, and encouraging smart growth can help to reduce the impacts of sea level rise by reducing the amount of vulnerable infrastructure in coastal areas	Reduce carbon footprint: by using public transportation, biking or walking instead of driving, reducing energy use, and supporting renewable energy sources. This can help to reduce greenhouse gas emissions and slow down the rate of sea level rise Plant mangroves: Mangrove forests are known for their ability to trap sediment and absorb carbon from the atmosphere. Planting mangroves in coastal areas can help to slow down the effects of sea level rise Build seawalls or other structures that help to prevent coastal erosion and flooding due to sea level rise. This can help to protect coastal communities and infrastructure Support coastal restoration efforts for coastal ecosystems, such as wetlands, barrier islands, and coral reefs. These ecosystems can help to absorb wave energy and reduce coastal erosion Educate others	Ice Melt Experiment: Fill two containers with water and add a large stone in one that is above the water level. Add ice cubes in the water in the first one while adding ice cubes on the stone in the second. Mark the water levels on both containers. As the ice cubes melt, the water level will rise in the container with the rock. This demonstrates how melting ice sheets and glaciers can contribute to sea level rise Salt Water Intrusion Experiment: Fill a clear container with fresh water and add blue food coloring. Then add salt water (with red food coloring) to one end of the container. Observe how the salt water sinks to the bottom and spreads out along the bottom, causing the fresh water to rise. This demonstrates how rising sea levels can cause saltwater to infiltrate freshwater sources Coastal Erosion Experiment: Using sand and a small container filled with water, create a model of a coastline. Slowly pour water onto the sand, observing how the water erodes the sand and causes the coastline to change. This demonstrates how rising sea levels can contribute to coastal erosion and damage Land Ice and Sea Level Rise Experiment: Using a balloon and clay, create a model of a landmass. Place the model in a container of water and mark the water level. Then add water to the balloon to simulate ice melt from land ice sheets. Observe how the water level rises as the balloon expands. This demonstrates how melting ice sheets can contribute to sea level rise Sea Level Rise Mapping Activity: Use maps or globes to show the students areas that are at risk of flooding due to sea level rise. Have them color code areas based on their elevation, and discuss the implications of sea level rise on those areas

5	**Habitat degradation/ destruction**	3, 4	Pollution Eutrophication Ocean warming, acidification, sea level rise Overfishing Coastal development Invasive species Unsustainable fishing practices Natural disasters	Implement sustainable fishing practices: Use fishing methods that are selective and have a low impact on the environment, such as pole and line fishing, and avoid overfishing Reduce pollution: Reduce plastic and other waste, properly dispose of hazardous waste, and reduce chemical and fertilizer use to limit pollution in the ocean Protect coastal habitats: Protect and restore coastal habitats such as mangroves, wetlands, and coral reefs, which serve as important breeding and feeding grounds for marine life Manage coastal development: Manage coastal development to prevent habitat loss and minimize the impact of human activities on marine ecosystems Combat climate change: Reduce greenhouse gas emissions and promote the use of renewable energy to limit the impact of climate change on the ocean Prevent the introduction of invasive species: Prevent the introduction of non-native species by monitoring and regulating ballast water and other vectors that transport organisms Support marine conservation efforts: Support marine conservation efforts, such as marine protected areas, and	Clean up trash from the ocean and the beach to prevent marine animals from ingesting it or becoming entangled in it Promote sustainable fishing practices, such as using nets with larger mesh sizes, avoiding overfishing, and respecting fishing quotas Protect and restore habitats, such as mangroves, salt marshes, and seagrass beds, which serve as important breeding and feeding grounds for marine animals Combat pollution in the ocean, by reducing plastic waste, properly disposing of hazardous waste, and limiting the use of chemicals and fertilizers Advocate for conservation and creation of marine protected areas and support conservation efforts to protect sea habitats and the animals that rely on them Educate others	Oil Spill Experiment: Set up a large container of water and add vegetable oil to represent an oil spill. Have students observe the effects of the oil spill on the water and discuss the impacts of oil spills on sea habitats and the animals that live there Plastic Pollution Experiment: Place plastic items such as straws, bags, and bottles in a container of water and ask students to observe how the plastic affects the water and the marine animals that may ingest or become entangled in it. Discuss the importance of reducing plastic waste to protect sea habitats and the animals that live there Coral Bleaching Experiment: Show students pictures of coral reefs and explain what coral is and how it supports marine life. Follow the instructions bellow: https://www.calacademy.org/educators/lesson-plans/coral-bleaching-talking-about-climate-change-sustainable-solutions Water Quality Experiment: Set up a water quality experiment by adding pollutants such as oil, fertilizer, or soap to different containers of water. Have students observe the effects on the water and discuss how these pollutants can affect sea habitats and the animals that live there Beach Clean-up Activity: Organize a beach clean-up activity where students can collect and sort trash from the beach. Discuss how litter can harm sea habitats and the animals that live there, and the importance of properly disposing of trash

				promote public awareness of the importance of ocean conservation		
6	**Alien Species**	1, 4	Ocean warming Food availability New pathways (e.g., Suez Canal) Transport by ships	Ballast water treatment – sustainable practices Biomimetic antifouling ship hulls paints Encourage consumption of edible alien species Use of natural predators, parasites, and pathogens to control invasive species	Identify the invasive species: The game characters can learn to identify different invasive species and their characteristics. This knowledge can help them distinguish invasive species from native ones Prevent the spread of invasive species: learn about the different ways invasive species can spread and take steps to prevent their spread. For example, clean shoes, clothes, and equipment before moving from one area to another Control and manage invasive species: The characters can learn about different methods of controlling and managing invasive species, such as physical removal, chemical treatments, and biological control. They can also learn about the potential risks and benefits of each method Participate in citizen science programs that collect data on invasive species. This can help scientists and policymakers better understand the distribution and impact of invasive species and develop strategies to manage them Educate others	Seed Dispersal Game: This game can be used to demonstrate how invasive species are spread. Children can be given different types of seeds and asked to disperse them, with some seeds being designated as invasive. Afterwards, they can observe how far the seeds have spread and discuss the impact of invasive species on the environment Aquatic Invasive Species: This experiment involves setting up two aquariums, one with native aquatic species and the other with invasive species. Children can observe the growth and behavior of the species in each aquarium, and discuss the impact of invasive species on aquatic ecosystems Alien Invaders Game: This is a fun activity that simulates the spread of invasive species. The students can role-play as invasive species and native species and move around the classroom. They can use a dice to determine their movement and follow the game rules to see which species dominates Marine Invader Jars: This experiment involves creating a mini-ecosystem in a jar to observe the effects of invasive species on native species. Students can use jars or clear plastic bottles filled with saltwater and add a few plants, snails, and other marine life. They can then add an invasive species and observe how it affects the other organisms

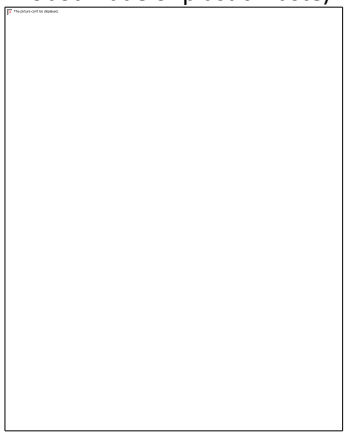
7	**Water pollution/ Contamination/ Eutrophication**	1, 2, 4	Waste from industrial plants Sewage effluent Discharges from oil tankers Plastic and other litter Agriculture (fertil.)	Regulatory action on waste release from human activities (industry, farming) Promotion of sustainable waste management and farming practices, etc. Proper disposal of oil and other petroleum products Use of eco-friendly products Reduction of fertilizer and pesticide use Proper disposal of hazardous waste Environmental regulations and policies	Implementing a waste management system: promote proper waste disposal methods such as recycling, composting, and proper disposal of hazardous materials Promote sustainable agriculture, use of sustainable farming practices that reduce the use of fertilizers and pesticides that contribute to eutrophication Encouraging the use of eco-friendly products: promote the use of eco-friendly products such as reusable water bottles, bags, and straws to reduce plastic waste Advocating for policies that protect water resources such as wetlands, rivers, and lakes Participating in beach cleanups to remove trash and other pollutants from the shoreline and prevent them from entering the water Educate the public Examples about eutrophication may come from the video	Oil Spill Cleanup: Students can simulate an oil spill by adding vegetable oil to water and then testing different materials like dish soap, cotton balls, and paper towels to see which ones absorb the oil the best. This can help them understand the challenges of cleaning up oil spills and the importance of preventing them Microplastic Pollution: Students can simulate microplastic pollution by adding small pieces of plastic to water and then using a microscope to observe the plastic particles. This experiment can help them understand the impact of plastic pollution on aquatic life and the environment

8	**Ocean Acidification**	1, 4	CO2 emissions Dissolving CO2	Monitor acidity levels Reduce sources of pollution with impact on water acidification Find a algae species more resistan	Monitor water acidity Stop water pollution contributing to rise in acidity levels Help setting up a new plantation in a more adequate location Reduce carbon emissions: The character can take steps to reduce their carbon footprint by choosing to walk, bike or use public transportation instead of driving, reducing energy consumption, and using renewable energy sources such as solar or wind power Support marine conservation efforts: The character can support marine conservation organizations that work to protect coral reefs, mangroves, and other vital ocean ecosystems that help to mitigate ocean acidification Raise awareness: The character can use social media and other platforms to raise awareness about the causes and impacts of ocean acidification and the need for action to combat it Support policy change: The character can lobby policymakers to enact policies and regulations that reduce carbon emissions	Acid-base indicators: Using acid-base indicators, demonstrate how carbon dioxide (CO2) dissolved in seawater (using CO2-releasing tablets from pet shops) lowers its pH and increases its acidity. Students can compare the colors of different indicators (such as red cabbage juice or bromothymol blue) in water with and without CO2 Shell dissolution experiment: In this experiment, students can observe the effects of increased acidity on the shells of marine organisms. Provide some seashells, vinegar (which is an acid), and a container with saltwater. Students can place the shells in the vinegar and observe how they dissolve over time. Next, they can place some shells in the saltwater and add vinegar to the container to simulate ocean acidification Carbon cycle experiment: Teach students about the carbon cycle and how it affects ocean acidification. They can create a model of the carbon cycle using small cups or bottles, balloons, straws, and seltzer tablets. Students can fill the cups halfway with water and add seltzer tablets (which release CO2 when mixed with water) to represent carbon emissions. They can then attach balloons to the top of the cups with straws to simulate the exchange of gases between the ocean and the atmosphere pH testing: Provide students with pH test strips and samples of seawater from different locations (such as the ocean, a river, and a lake). Have them test the pH levels of each sample and discuss the differences and potential causes. This can help them understand how human activities can affect the acidity of seawater

9	**Offshore drilling**	1, 2, 4	Human activity Demand for fossil fuels and the need for energy resources to support various industries such as transportation, manufacturing, and power generation Decision for conducting offshore drilling is often influenced by economic and political factors, as well as technological advancements in drilling and extraction methods	Shifting to renewable energy sources like solar, wind, and tidal energy can reduce our dependence on fossil fuels and decrease the need for offshore drilling Reducing oil consumption by carpooling, using public transport, and switching to fuel-efficient vehicles can reduce the demand for oil and gas, thus decreasing the need for offshore drilling Encourage recycling which reduces the need for new products made from petroleum-based plastics, which are derived from offshore drilling Individuals and organizations can advocate for policies that regulate offshore drilling and prioritize renewable energy sources Reducing demand for single-use plastics and switching to biodegradable alternatives can reduce the need for offshore drilling for plastics production Supporting marine conservation efforts can protect the health of ocean ecosystems and prevent the destruction of habitats that result from offshore drilling Increase public awareness	Advocacy: raise awareness about the environmental impacts of offshore drilling and encourage others to take action Lobbying: work with lawmakers and government officials to advocate for stricter regulations and laws against offshore drilling Sustainable energy: promote the use of sustainable energy sources, such as wind and solar power, as a viable alternative to offshore drilling Education: educate others about the importance of protecting marine life and the environment, and inspire them to take action against offshore drilling Activism: organize protests, rallies, and other forms of activism to raise awareness and put pressure on companies and governments to stop offshore drilling	Oil Spill Demonstration: You can simulate an oil spill in a clear container of water and show how the oil spreads and damages marine life. You can add different materials to the water, such as toy animals or plants, to represent the different types of marine life that are affected by oil spills Sedimentation Demonstration: You can create a mini-ocean environment in a clear container of water, with sand and rocks representing the ocean floor. Then you can add a substance such as baking soda to simulate drilling mud, and show how it can settle on the ocean floor and impact the marine life there Offshore Drilling Model: You can create a model of an offshore oil rig using materials such as cardboard, straws, and clay. Then you can demonstrate how the oil is extracted from the ocean floor, and explain the various environmental risks and impacts of offshore drilling
10	**Dredging (excavation)**	4	Marine construction activity (ports, canal construction, etc.)			

11	**Ocean noise**	4	Shipping and maritime transportation: Large vessels such as cargo ships, tankers, and cruise ships can produce significant amounts of noise through their engines, propellers, and sonar systems Military activities: Navy ships and submarines often use sonar and other technologies that can generate high levels of noise Oil and gas exploration: Seismic surveys, which involve blasting compressed air into the water to map the ocean floor, can create loud underwater noise Environmental monitoring (acoustic instruments)	Reducing ship traffic: Ship traffic is one of the main causes of ocean noise pollution. Reducing the number of ships on the water, particularly in areas with high marine mammal populations, can significantly reduce the noise pollution Using quieter vessels: Switching to quieter ships and boats, such as those with electric engines, can also help to reduce ocean noise pollution Implementing regulations: Governments can implement regulations to control the amount of noise that ships and other vessels are allowed to emit. For example, they can set limits on the amount of noise that can be emitted by sonar or seismic surveying equipment Protecting marine mammal habitats: Establishing marine protected areas and conserving important habitats for marine mammals can help reduce their exposure to ocean noise pollution Conducting research: Conducting research on the effects of ocean noise pollution on marine life can help to develop more effective strategies for mitigating its impact Public education and awareness: Educating the public about the impact of ocean noise pollution on marine life can increase awareness and lead to changes in behavior	Use low-noise technology: The characters can choose to use quieter vessels and equipment while navigating through the ocean to reduce the amount of noise pollution they generate Reduce speed: Slowing down the speed of the vessel can significantly decrease the noise pollution in the surrounding water Avoid sensitive areas: The characters can choose to navigate around sensitive areas like coral reefs or areas where marine mammals are known to live, to avoid disturbing their natural behavior with excessive noise Use underwater sound barriers: The characters can install sound barriers around construction sites, offshore wind farms, or other sources of ocean noise to prevent the noise from spreading throughout the surrounding area Support research: The characters can support scientific research on the effects of ocean noise pollution and help to promote the development of innovative noise reduction technologies. Promote noise reduction awareness: The characters can educate others on the importance of reducing ocean	Sound waves experiment: Use a tuning fork and a jar of water to demonstrate how sound waves travel through water. Strike the tuning fork and place it near the jar of water, and the sound waves will be visible in the form of ripples in the water Noise pollution demonstration: Play a recording of various ocean noises, such as sounds made by marine animals, waves crashing, and boats, to show how loud noises can disturb marine life Build a hydrophone: Using a piezoelectric transducer and some basic electronics, children can build a simple hydrophone that can detect underwater sounds. This can be used to listen to sounds in a fish tank or aquarium (instructions here: https://flypaper.soundfly.com/produce/how-to-build-a-diy-hydrophone/) Analyze sound waves: Use a software program or app to analyze sound waves and identify different types of ocean noises. This can help children understand the different sources of ocean noise and how they affect marine life (a freely available such software is "Audacity") Sound scavenger hunt: Have children go on a sound scavenger hunt around the school or neighborhood to identify different sounds they hear. This can include natural sounds like birds chirping, as well as human-made sounds like cars and construction

				that reduce the amount of noise produced in the ocean	noise pollution and encourage them to take action to reduce their own noise output	

12	**Marine Litter/ Microplastics**	1	Improper waste management on land, where litter and plastic waste can make its way to waterways and eventually the ocean Discarded fishing gear, such as nets and lines, which can entangle and kill marine animals Shipping and fishing activities, which can release plastic pellets, packaging materials, and other debris into the water Consumer products such as single-use plastics, including straws, bottles, and bags, which are frequently disposed of improperly	Reduce single-use plastics: Use reusable water bottles, bags, and utensils instead of single-use plastic ones Properly dispose of waste: Make sure that all waste is properly disposed of, either by recycling or by placing it in the trash Participate in beach cleanups: Organize or participate in beach cleanups to remove litter and plastics from the shorelines and prevent them from entering the ocean Spread awareness: Educate others about the impacts of marine litter and microplastics on the ocean ecosystem and encourage them to take action Reduce use of synthetic textiles: Synthetic textiles such as polyester, nylon, and acrylic release microplastic fibers into the water when washed. Reducing the use of such textiles can help to reduce the amount of microplastics entering the ocean Dispose of hazardous waste properly: Make sure that hazardous waste, such as batteries and electronics, is properly disposed of so that it does not end up in the ocean Support policies and regulations: Advocate for policies and regulations that promote	Clean up the beach: The characters can organize a beach cleanup with friends and family to pick up litter and prevent it from entering the ocean Reduce plastic use: The characters can choose to use reusable bags, water bottles, and containers to avoid single-use plastic items that end up in the ocean Recycle: use proper recycling practices to prevent plastic waste from ending up in the ocean Spread awareness: use social media platform or create a campaign to raise awareness about the harmful effects of marine litter and microplastics Avoid littering: The characters can set a good example by not littering and encouraging others to do the same Support policies: The characters can advocate for policies that reduce plastic pollution and increase efforts to clean up the ocean Use natural alternatives: The characters can encourage the use of natural alternatives to plastics, such as bamboo or paper straws, to reduce the amount of plastic waste entering the ocean	Microplastic Pollution: In this experiment, children can create their own microplastics by shredding pieces of plastic and then scatter them in a fishbowl or container filled with water. They can then observe how the microplastics behave and the difficulties in removing them Plastic Recycling: In this experiment, children can collect various plastic items, such as water bottles, straws, and bags, and sort them into different recycling categories. They can also learn how to create eco-bricks by filling plastic bottles with other plastic waste, such as wrappers or plastic bags Trash Timeline: In this experiment, children can create a timeline of trash, starting with an apple core or banana peel and ending with a plastic bottle or other long-lasting item. They can then discuss the importance of reducing waste and recycling to protect the environment Beach Clean-Up: Children can organize a beach clean-up event and collect litter and microplastics that have washed up on the shore. They can then sort and record the types of items found, exhibit them in the museum and discuss ways to prevent this waste from entering the ocean in the first place (example of Robot made of plastic waste) 

				sustainable practices and reduce marine litter and microplastics	Participate in citizen science: participate in citizen science initiatives to help track and monitor the impact of marine litter and microplastics on marine life	
13	**Deep Sea Mining**	1, 4	Increasing demand for minerals and metals, which are essential components for many industries, including electronics, energy, and construction Depletion of terrestrial deposits and the need to find alternative sources of these valuable minerals and metals Deep sea mining has significant environmental impacts, including habitat destruction, sediment plumes, and noise pollution, which can have long-term effects on deep-sea ecosystems			
14						