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LESSON

Marine Protected Areas Exploration

Students explore Marine Protected Areas on an interactive map and compare and contrast three case studies. They learn how the MPA classification system works in the United States, apply that system to example scenarios, and create case studies of their own.

GRADES

9 - 12+

SUBJECTS

Conservation, Earth Science, Oceanography, Geography, Human Geography, Physical Geography

CONTENTS

3 Activities

ACTIVITY 1: MARINE PROTECTED AREAS | 1 HR 15 MINS

DIRECTIONS

1. Have students use Google Earth to explore Marine Protected Areas.

Explain to students that a Marine Protected Area (MPA) is “any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein.” Ask students to brainstorm reasons a MPA might be established. Write their responses on the board. Project the website Google Earth: Ocean Gallery—Marine Protected Areas on the board. Demonstrate for students how to download the Marine Protected Areas layer as a .kml file. After downloading, select the Marine Protected Areas layer, and demonstrate how to locate and explore MPAs around the world. Show students the icon they

are looking for and how to examine the photos, videos, and stories that accompany each location. For tutorials and additional information regarding the use of Google Earth, refer to this activity's "For Further Exploration" section. Divide students into pairs and assign each group two MPAs from the worksheet Pre-Selected List of Marine Protected Areas. Have each pair use Google Earth's MPA layer to research their assigned MPAs. Tell students to draw four squares on both sides of a piece of paper, and record the following information in the four squares for each of their assigned MPAs:

- Name and location of the MPA
- Ecosystem type
- Purpose of the MPA
- One interesting fact about the MPA

2. Have students share what they learned about their assigned Marine Protected Areas.

After students have had time to record information about both of their assigned MPAs, lead a discussion in which pairs present their findings to the class. Encourage students to think about why the MPAs were established and what natural and cultural resources they are meant to protect. As students discuss their MPAs, have them mark those areas on the Water Planet Mega Map, included in the World Physical MapMaker Kit.

3. Have students compare and contrast marine and terrestrial protected areas.

Draw a T-chart on the board. Ask students to brainstorm differences between terrestrial and marine protected areas. Write students' ideas on the board. If needed, prompt students with the following characteristics:

- Terrestrial Protected Areas—more discrete boundaries; more internally controlled by the life processes of the dominant organisms; people live nearby; food is obtained by farming (cultured); have a longer history
- Marine Protected Areas—relatively open; subject to forces such as tides, circulation patterns, and shifts in overall productivity; people do not live there; food is obtained by fishing (wild); have not been established as long; animals and pollutants typically travel longer distances due to global currents

Explain that because of these differences, marine systems require different approaches to studying and managing them.

4. Have students reflect on their ideas about Marine Protected Areas in writing.

Write the following questions on the board and ask students to work independently to record their answers:

- *Why do people value national parks and other terrestrial areas that are protected? Does the general population value marine protected areas in the same way? Why or why not?*
- *Do you think a system of marine protected areas is necessary? Why or why not?*
- *What ecological and human factors should be considered when establishing a marine protected area?*
- *Is the establishment of a protected area the only way to preserve the natural and cultural resources of an area? Provide two or three alternatives that could help to protect terrestrial or marine ecosystems.*
- *What value could a marine protected area provide to society?*

If students have difficulty providing alternatives that could help to protect terrestrial or marine ecosystems, provide them with the following examples: fish catches can be managed by limiting the size and amount of fish caught; certain trails may be closed for a time so vegetation and wildlife can reestablish without human interference; and some types of development, such as oil drilling, coal mining, industry, and coastal residences, may be illegal in a particular area due to the presence of a critical habitat or an endangered species.

5. Have a whole-class discussion about students' responses.

After students have finished recording their answers, tell them that thinking about difficult questions and articulating ideas in response to those questions is important to any decision-making process. Have a whole-class discussion about their responses and ideas. Encourage students to also discuss the similarities and differences between the MPAs they researched.

Modification

Have students watch Enric Sala's [TED talk: Glimpses of a Pristine Ocean](#) at home before beginning this activity. The talk presents a case study of the Line Islands that will help students engage in this activity.

Modification

In Step 2, if time is limited, have each group only present one of its assigned MPAs.

Informal Assessment

Review students' written responses to see how well they articulated their ideas. Be sure to identify and address any questions they still have.

Extending the Learning

Have students identify a marine or terrestrial area in their community that is in need of protection, and then write a brief article about the area. Ask students to include the environmental issues the area faces, the natural and cultural resources that are in need of protection, and any stories of local environmental stewardship projects or other human actions that have helped or are currently helping the area.

OBJECTIVES

Subjects & Disciplines

Earth Science

- [Oceanography](#)

Geography

- [Human Geography](#)
- [Physical Geography](#)

Learning Objectives

Students will:

- list reasons a Marine Protected Area might be established
- compare and contrast marine and terrestrial protected areas
- give and support their opinions about resource management of marine areas

Teaching Approach

- Learning-for-use

Teaching Methods

- Brainstorming
- Discussions
- Multimedia instruction
- Writing

Skills Summary

This activity targets the following skills:

- 21st Century Themes
 - Global Awareness
- Critical Thinking Skills
 - Analyzing
 - Understanding
- Geographic Skills
 - Acquiring Geographic Information
 - Analyzing Geographic Information

National Standards, Principles, and Practices

NATIONAL COUNCIL FOR SOCIAL STUDIES CURRICULUM STANDARDS

- Theme 3:

People, Places, and Environments

NATIONAL GEOGRAPHY STANDARDS

- Standard 14:

How human actions modify the physical environment

- **Standard 16:**

The changes that occur in the meaning, use, distribution, and importance of resources

- **Standard 5:**

That people create regions to interpret Earth's complexity

NATIONAL SCIENCE EDUCATION STANDARDS

- **(9-12) Standard F-3:**

Natural resources

- **(9-12) Standard F-6:**

Science and technology in local, national, and global challenges

OCEAN LITERACY ESSENTIAL PRINCIPLES AND FUNDAMENTAL CONCEPTS

- **Principle 5c:**

Some major groups are found exclusively in the ocean. The diversity of major groups of organisms is much greater in the ocean than on land.

- **Principle 6e:**

Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution (such as point source, non-point source, and noise pollution) and physical modifications (such as changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.

- **Principle 6g:**

Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.

Preparation

BACKGROUND & VOCABULARY

Background Information

The term *Marine Protected Area* is widely used around the world, but its meaning in one country may be different from its meaning in another. In the United States, the definition of a Marine Protected Area (MPA) is, by presidential executive order, "any area of the marine environment that has been reserved by federal, state, territorial, tribal or local laws or regulations to provide lasting protection to part or all of the natural or cultural resources therein." Examples of MPAs include national marine sanctuaries, fishery management zones, national parks, marine reserves, and wildlife refuges.

Prior Knowledge

["An understanding of the types of Marine Protected Areas as well as human impacts on the ocean addressed throughout this unit."]

Recommended Prior Activities

- [Marine Protected Areas: Case Studies](#)
- [Marine Protected Area: Stakeholder Debate](#)
- [MPA Designation and Management](#)
- [Protecting the Ocean](#)

Vocabulary

Term	Part of Speech	Definition
marine protected area (MPA)	noun	area of the ocean where a government has placed limits on human activity.

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ACTIVITY 2: MARINE PROTECTED AREAS:
CASE STUDIES | 1 HR 30 MINS

DIRECTIONS

1. Activate prior knowledge by reviewing the purpose and importance of Marine Protected Areas.

Have a whole-class discussion. Ask: *What is the purpose of a MPA?* (A MPA is “any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein.”) Ask: *Do you think the establishment of Marine Protected Areas is important? Why or why not?*

2. For homework, have students read two Marine Protected Area case studies.

Give each student a copy of the Point Sur case study, Cocos Island case study, and the Case Studies Comparison worksheet. Briefly review what a case study is. Remind students that case studies are created to establish and manage MPAs. Case studies outline important information about an area’s history, geography, habitats, species, human uses, and management goals. They also describe threats to the area and explain why the area should be protected. Briefly introduce the two MPAs. Then read aloud the directions for the Case Studies Comparison worksheet. Explain that students will first independently read and take notes for each case study as homework. Then they will discuss and take additional notes for each case study in class. Answer any questions. Tell students that they should think about the analysis questions at the bottom of the worksheet while they are reading. They do not have to answer these questions until the class discussion.

3. During the next class period, discuss the MPA case studies reading assignment and worksheet.

Divide students into pairs and have them trade their Case Studies Comparison worksheets with one another. Tell them to compare their notes and add any important information that they may have overlooked. Then lead a whole-class discussion and tell students to continue adding notes to their worksheets. Wrap up the discussion by asking students to answer the worksheet’s analysis questions. Ask: *How are the two MPAs similar? How are they different?* Encourage students to use specific information and examples to support their conclusions. They should be able to identify similarities and differences between the MPA’s stakeholders, environmental issues, human threats, management strategies, and important species.

4. Introduce the U.S. MPA classification system and have students classify their two MPA case studies.

Give each pair of students a copy of the Marine Protected Areas Classification worksheet and the Definition and Classification System for U.S. Marine Protected Areas handout from NOAA. Have volunteers read aloud the first and last paragraphs of the “Toward a Common Language for Marine Protected Areas” section on the NOAA handout. Ask a student volunteer to summarize the two passages for the class. Ask:

- *What are the five functional characteristics common to most MPAs? (conservation focus, level of protection, permanence of protection, constancy of protection, and ecological scale of protection)*
- *Why is this classification system so important in the establishment and management of MPAs? (This five-level classification system outlines “why the site was established, what it is intended to protect, how it achieves that protection, and how it may affect local ecosystems and local human uses.”)*

Have students turn to the “User’s Guide to the Classification System” section of the NOAA handout. Discuss the criteria that comprise each of the five levels of the MPA classification system. Have students follow along using their MPA Classification worksheets and take notes. Address any terms that may be unfamiliar to them. Read aloud the directions on their Marine Protected Areas Classifications worksheets. Tell students that they will use the U.S. MPA Classification criteria to classify the Point Sur and Cocos Island MPAs. Explain that there is no right or wrong set of classifications, but they must support their classification designations. Their task is to work together and make informed decisions about the best management classification option for each case study. Allow students enough time to discuss each case study and assign it a set of classifications.

5. Have a whole-class discussion about students’ classifications.

For each case study, invite students to share their classifications and the reasoning behind them. Have students compare and contrast the different classifications and revise their classifications, as needed. Ask: *Why is it important to classify MPAs using this system? What problems do you think MPA managers might face if these classifications and criteria were not established?*

Modification

Assign ELL or other challenged learners the Galápagos Marine Reserve case study from the Marine Protected Areas activity [Marine Critical Issues: Case Studies](#). Their familiarity with that case study will support their learning in this activity.

Informal Assessment

Choose an appropriate local or regional marine area that is not already designated as a Marine Protected Area and have students make recommendations for classification as an MPA. Make sure students support their recommendations with valid reasoning.

Extending the Learning

Have students select one of the two case study areas to research in greater depth. Ask them to identify the industries, such as fishing or tourism, that are affected by the MPA designation and describe how the existing management plan directly affects those particular industries.

OBJECTIVES

Subjects & Disciplines

Earth Science

- [Oceanography](#)

Geography

- [Human Geography](#)
- [Physical Geography](#)

Learning Objectives

Students will:

- compare and contrast two different Marine Protected Areas
- identify characteristics for classifying Marine Protected Areas
- explain the importance of classifying Marine Protected Areas
- describe different management practices based on the type of Marine Protected Area

Teaching Approach

- Learning-for-use

Teaching Methods

- Cooperative learning
- Discussions
- Information organization
- Reading

Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
 - Learning and Innovation Skills
 - Communication and Collaboration
 - Critical Thinking and Problem Solving
- 21st Century Themes
 - Global Awareness
- Critical Thinking Skills
 - Analyzing
 - Applying
 - Understanding
- Geographic Skills
 - Acquiring Geographic Information
 - Analyzing Geographic Information

National Standards, Principles, and Practices

NATIONAL COUNCIL FOR SOCIAL STUDIES CURRICULUM STANDARDS

- Theme 3:

People, Places, and Environments

NATIONAL GEOGRAPHY STANDARDS

- **Standard 14:**

How human actions modify the physical environment

- **Standard 16:**

The changes that occur in the meaning, use, distribution, and importance of resources

- **Standard 4:**

The physical and human characteristics of places

NATIONAL SCIENCE EDUCATION STANDARDS

- **(9-12) Standard F-3:**

Natural resources

- **(9-12) Standard F-4:**

Environmental quality

- **(9-12) Standard F-6:**

Science and technology in local, national, and global challenges

OCEAN LITERACY ESSENTIAL PRINCIPLES AND FUNDAMENTAL CONCEPTS

- **Principle 5c:**

Some major groups are found exclusively in the ocean. The diversity of major groups of organisms is much greater in the ocean than on land.

- **Principle 5d:**

Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (such as symbiosis, predator-prey dynamics and energy transfer) that do not occur on land.

- **Principle 5e:**

The ocean is three-dimensional, offering vast living space and diverse habitats from the surface through the water column to the seafloor. Most of the living space on Earth is in the ocean.

- **Principle 5f:**

Ocean habitats are defined by environmental factors. Due to interactions of abiotic factors such as salinity, temperature, oxygen, pH, light, nutrients, pressure, substrate and circulation, ocean life is not evenly distributed temporally or spatially, i.e., it is “patchy”. Some regions of the ocean support more diverse and abundant life than anywhere on Earth, while much of the ocean is considered a desert.

- **Principle 5h:**

Tides, waves and predation cause vertical zonation patterns along the shore, influencing the distribution and diversity of organisms.

- **Principle 6b:**

From the ocean we get foods, medicines, and mineral and energy resources. In addition, it provides jobs, supports our nation's economy, serves as a highway for transportation of goods and people, and plays a role in national security.

- **Principle 6c:**

The ocean is a source of inspiration, recreation, rejuvenation and discovery. It is also an important element in the heritage of many cultures.

- **Principle 6d:**

Much of the world's population lives in coastal areas.

- **Principle 6e:**

Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution (such as point source, non-point source, and noise pollution) and physical modifications (such as changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.

- **Principle 6g:**

Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.

Preparation

BACKGROUND & VOCABULARY

Background Information

Marine Protected Areas (MPAs) can have a strict management structure, such as protecting an area for science or wilderness reasons and excluding extractive activities like mining and fishing. They can have a more broad management focus, such as protecting an area for sustainable use of natural resources. Or they can fall somewhere in between. Comprehensive classification systems for MPA networks have been created to distinguish between the different management levels. These systems ensure ecosystem diversity and viability and address the full range of human activities and stakeholders.

Prior Knowledge

["An understanding of the types of Marine Protected Areas as well as human impacts on the ocean addressed throughout this unit."]

Recommended Prior Activities

- [Marine Critical Issues: Case Studies](#)
- [Marine Protected Areas](#)
- [Marine Protected Area: Stakeholder Debate](#)
- [MPA Designation and Management](#)
- [Protecting the Ocean](#)

Vocabulary

Term	Part of Speech	Definition
case study	noun	form of problem-based learning, where the teacher presents a situation that needs a resolution. The learner is given details about the situation, often in a historical context. The stakeholders are introduced. Objectives and challenges are outlined. This is followed by specific examples and data, which the learner then uses to analyze the situation, determine what happened, and make recommendations.
marine protected area (MPA)	noun	area of the ocean where a government has placed limits on human activity.
stakeholder	noun	person or organization that has an interest or investment in a place, situation, or company.

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ACTIVITY 3: MARINE PROTECTED AREAS: STUDENT CASE STUDIES 1 2 HRS

DIRECTIONS

1. Assign student pairs a Marine Protected Area to study.

Briefly review what Marine Protected Areas and case studies are and why they are important. Explain that they are used to establish and manage marine areas that contain important natural and cultural resources. Divide students into pairs. Using the worksheet Pre-Selected List of Marine Protected Areas, assign each pair one MPA to research and present.

2. Have student pairs research and create a case study for their assigned Marine Protected Area.

Distribute copies of the MPA Case Studies: Research Notes worksheet. Read aloud the directions. Explain to students that their assignment is to create and present a MPA case study that includes the following:

- a description of the MPA, including size and location
- the purpose, or mission, of the MPA
- an inventory of species
- an explanation of how the MPA contributes to natural, economic, or cultural resources
- information about who is managing the area and what is being managed
- evaluation of whether or not the MPA is succeeding in its management goals
- a list of stakeholders; for example, environmental or non-governmental organizations, local government agencies, public interest groups, citizens, scientists, and fishermen
- an example of a challenge encountered during the MPA designation process
- an example of a success encountered during the MPA designation process

Make sure students understand all of the items they are expected to research for their MPAs. Have students begin their research with the Protect Planet Ocean: Marine Reserves Studied Around the World website. Give students time to conduct research and take notes on their assigned MPAs using additional online and library resources.

3. Have students create posters or other media to present their case studies.

Ask each pair to create a poster or other media that provides information about their Marine Protected Area case study in a quick, visually-appealing way. Use standard class presentation format or have students create an interactive poster using online presentation tools.

Encourage students to enhance their text with graphics from magazines or online resources. Emphasize to students that they should not try to include all of their case study research on the poster. Instead, they should provide a visually-appealing overview of the information.

Give each student pair a copy of the Peer Assessment Form: Student Gallery Walk worksheet. Explain that the rubric outlines the criteria by which they will be evaluated: design, content, organization, and creativity. Briefly discuss the criteria with students and use it to focus the creation of their case study presentations.

4. Have students conduct a gallery walk to evaluate their peers' work.

Assign each student pair a location to display its MPA case study. Number the locations 1-16, according to the MPA list in Step 1. Read aloud the directions for the Peer Assessment Form: Student Gallery Walk worksheet. Explain that each student pair will have 20 minutes to complete their gallery walk. During that time, they will evaluate one pre-assigned MPA case study using the peer assessment portion of the worksheet. For example, have the student pair that researched MPA #1, Lundy, United Kingdom, peer assess MPA #9, Great Barrier Reef Marine Park, Australia. Then have the MPA #2, Western Mediterranean, peer assess MPA #10, California. Have students review as many other case studies as time allows. For each of the case study reviews, ask them to write two sentences about what they learned and one question they have about the MPA.

5. Discuss peer assessments and case study reviews.

Lead a discussion about how case studies are used to represent the key characteristics of Marine Protected Areas. Ask students to share what they learned about the MPAs presented in the gallery walk. Discuss the questions that students recorded in their case study reviews. Ask students to identify the challenges they encountered while conducting their research and presenting their case studies. Ask: *What characteristics made some case studies more effective and informative than others? How might different stakeholders interpret the information presented in a case study?* As time allows, select one or two example MPA case studies and discuss how different stakeholders might interpret the information presented in each case study differently. Ask: *Are all MPAs successful? Why or why not? Use examples to explain.*

Peer Evaluation

Have students complete the Peer Assessment Form: Student Gallery Walk worksheet.

Extending the Learning

Have students conduct further research to learn more about how their case study area is being managed. If there are any monitoring programs, have students identify what is being monitored and why, how it is being monitored, the frequency of the monitoring, and how the information is being used by MPA managers. Then ask students to identify how enforcement is being handled, including enforcement protocols, how enforcement is being paid for, and by whom.

OBJECTIVES

Subjects & Disciplines

- Conservation

Learning Objectives

Students will:

- create posters or other media that provide information on a Marine Protected Area in a visually-appealing way
- evaluate and discuss case studies about different Marine Protected Areas throughout the world

Teaching Approach

- Application: Coach

Teaching Methods

- Assessment
- Brainstorming
- Cooperative learning

Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
 - Information, Media, and Technology Skills
 - Information Literacy
 - Information, Communications, and Technology Literacy
 - Media Literacy
 - Learning and Innovation Skills
 - Communication and Collaboration
 - Creativity and Innovation
 - Critical Thinking and Problem Solving
 - Life and Career Skills
 - Flexibility and Adaptability
 - Initiative and Self-Direction
 - Leadership and Responsibility
 - Productivity and Accountability
 - Social and Cross-Cultural Skills
- 21st Century Themes
 - Civic Literacy
 - Environmental Literacy
 - Financial, Economic, Business, and Entrepreneurial Literacy
 - Global Awareness

National Standards, Principles, and Practices

ENERGY LITERACY ESSENTIAL PRINCIPLES AND FUNDAMENTAL CONCEPTS

- **Fundamental Concept 1.1:**

Energy is a quantity that is transferred from system to system.

- **Fundamental Concept 1.2:**

The energy of a system or object that results in its temperature is called thermal energy.

- **Fundamental Concept 1.3:**

Energy is neither created nor destroyed.

- **Fundamental Concept 1.4:**

Energy available to do useful work decreases as it is transferred from system to system.

- **Fundamental Concept 1.5:**

Energy comes in different forms and can be divided into categories.

- **Fundamental Concept 1.6:**

Chemical and nuclear reactions involve transfer and transformation of energy.

- **Fundamental Concept 1.7:**

Many different units are used to quantify energy.

- **Fundamental Concept 1.8:**

Power is a measure of energy transfer rate.

- **Fundamental Concept 2.1:**

Earth is constantly changing as energy flows through the system.

- **Fundamental Concept 2.2:**

Sunlight, gravitational potential, decay of radioactive isotopes, and rotation of the Earth are the major sources of energy driving physical processes on Earth.

- **Fundamental Concept 2.3:**

Earth's weather and climate are mostly driven by energy from the sun.

- **Fundamental Concept 2.4:**

Water plays a major role in the storage and transfer of energy in the Earth system.

- **Fundamental Concept 2.5:**

Movement of matter between reservoirs is driven by Earth's internal and external sources of energy.

- **Fundamental Concept 2.6:**

Greenhouse gases affect energy flow through the Earth system.

- **Fundamental Concept 2.7:**

The effects of changes in Earth's energy system are often not immediately apparent.

- **Fundamental Concept 3.1:**

The sun is the major source of energy for organisms and the ecosystems of which they are a part.

- **Fundamental Concept 3.2:**

Food is a biofuel used by organisms to acquire energy for internal living processes.

Preparation

BACKGROUND & VOCABULARY

Background Information

Marine Protected Areas (MPAs) are created to protect vulnerable habitat and species, increase biodiversity, prevent overfishing, conserve resources for future generations, and aid in scientific research. A case study is a written summary of real-life cases based upon data and research. MPAs exhibit a high level of complexity and diversity, which is highlighted in the case studies, along with geographic information, stakeholders, and general characteristics. Poster sessions and peer reviews afford students the opportunity to examine different types of MPAs, identify similarities and differences that exist, and better understand the complexities among ocean ecosystems and management practices.

Prior Knowledge

["marine protected areas and their importance in the preservation and management of marine resources"]

Recommended Prior Activities

- [Marine Protected Areas](#)
- [Marine Protected Areas: Case Studies](#)

Vocabulary

Term	Part of Speech	Definition
case study	noun	form of problem-based learning, where the teacher presents a situation that needs a resolution. The learner is given details about the situation, often in a historical context. The stakeholders are introduced. Objectives and challenges are outlined. This is followed by specific examples and data, which the learner then uses to analyze the situation, determine what happened, and make recommendations.
marine protected area (MPA)	noun	area of the ocean where a government has placed limits on human activity.
stakeholder	noun	person or organization that has an interest or investment in a place, situation, or company.

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