EDUCATORS' GUIDE

SECRETS OF THE SEA
RECOMMENDED ACTIVITY SEQUENCE

1 SLIDES

The slides introduce the Comprehensive Marine Biodiversity Survey, Singapore's first extensive marine biodiversity survey to assess and document the diversity of marine habitats and life.

RECOMMENDED FOR: ALL

DURATION: 10–15 MINUTES

2 BUILD THE RESEARCH WORKFLOW

Discover how scientists study hidden (cryptic) biodiversity in coral reefs using Autonomous Reef Monitoring Structures (ARMS), through matching photographs to stages of the research workflow.

RECOMMENDED FOR: AGES 10 & ABOVE

DURATION: 20–25 MINUTES

3 HIDDEN ARCHITECT OF THE SEA

Explore and take apart an ARMS model to study the hidden life living among coral reefs. Uncover various organism magnets, representing reef organisms such as sponges, brittle stars, corals, and bryozoans among the plates.

Through a show-and-tell, get to know more about these lesser-known reef organisms.

RECOMMENDED FOR: AGES 10 & ABOVE

DURATION: 20–25 MINUTES

4 WHAT MARINE SNAIL AM I?

How do scientists identify species?

In this activity, explore how scientists use morphology, the observable physical features of organisms, as one of the ways to distinguish species. By closely examining shell characteristics, students will practise observing and identifying different Nerite snails.

RECOMMENDED FOR: AGES 10 & ABOVE

DURATION: 25–35 MINUTES

5 FIND MY BABY PHOTO

Marine biodiversity encompasses a diversity of life stages across many animal groups.

Learn about plankton and match the photos of adult marine invertebrates to their correct planktonic "baby" photos!

RECOMMENDED FOR: ALL

DURATION: 10–15 MINUTES

6 ADDITIONAL ACTIVITIES

Micro Marine Marvels

RECOMMENDED FOR: ALL

DURATION: 20–25 MINUTES

Cryptic Critters Hunt @ LKCNHM

RECOMMENDED FOR: ALL

DURATION: 20–30 MINUTES

EDUCATORS' GUIDE

SECRETS OF THE SEA
PRIMARY SCHOOL SCIENCE SYLLABUS LINKS

BUILD THE RESEARCH WORKFLOW

Primary 3–6

- Theme: Diversity
  - Diversity of Living and Non-living Things

HIDDEN ARCHITECT OF THE SEA

Primary 3–6

- Theme: Diversity
  - Diversity of Living and Non-living Things
- Theme: Interactions
  - Interactions within the Environment

WHAT MARINE SNAIL AM I?

Primary 3–6

- Theme: Diversity
  - Diversity of Living and Non-living Things
- Theme: Interactions
  - Interactions within the Environment

FIND MY BABY PHOTO

Primary 3–6

- Theme: Diversity
  - Diversity of Living and Non-living Things
- Theme: Interactions
  - Interactions within the Environment
- Theme: Cycles
  - Cycles in Plants and Animals

ADDITIONAL ACTIVITIES

Micro Marine Marvels

Primary 3–6

- Theme: Diversity
  - Diversity of Living and Non-living Things
- Theme: Interactions
  - Interactions within the Environment

Cryptic Critters Hunt @ LKCNHM

Primary 3–6

- Theme: Diversity
  - Diversity of Living and Non-living Things

THINK AND WORK LIKE A SCIENTIST!

The activities in this toolkit incorporates the Practices of Science (POS) framework and provide opportunities for students to develop key scientific inquiry and reasoning skills:

- Demonstrating Ways of Thinking and Doing in Science
- Understanding the Nature of Scientific Knowledge
- Relating Science, Technology, Society and Environment

NUS National University of Singapore | Lee Kong Chian Natural History Museum

EDUCATORS' GUIDE

SECRETS OF THE SEA

SECONDARY SCHOOL SCIENCE SYLLABUS LINKS

BUILD THE RESEARCH WORKFLOW

Lower Secondary Science
- Theme: Interactions
  - Interactions within Ecosystems

Upper Secondary Biology
- Section: Living Together – Plants, Animals and Ecosystems
  - Organisms and their Environment
- Section: Continuity of Life
  - Molecular Genetics

HIDDEN ARCHITECT OF THE SEA

Lower Secondary Science
- Theme: Interactions
  - Interactions within Ecosystems

Upper Secondary Biology
- Section: Living Together – Plants, Animals and Ecosystems
  - Organisms and their Environment

WHAT MARINE SNAIL AM I?

Lower Secondary Science
- Theme: Interactions
  - Interactions within Ecosystems

Upper Secondary Biology
- Section: Continuity of Life (*note: optional*)
  - Molecular Genetics

FIND MY BABY PHOTO

Lower Secondary Science
- Theme: Interactions
  - Interactions within Ecosystems

Upper Secondary Biology
- Section: Living Together – Plants, Animals and Ecosystems
  - Organisms and their Environment

ADDITIONAL ACTIVITIES

Micro Marine Marvels

Lower Secondary Science
- Theme: Interactions
  - Interactions within Ecosystems

Upper Secondary Biology
- Section: Living Together – Plants, Animals and Ecosystems
  - Organisms and their Environment

THINK AND WORK LIKE A SCIENTIST!

The activities in this toolkit incorporates the Practices of Science (POS) framework and provide opportunities for students to develop key scientific inquiry and reasoning skills:

- Demonstrating Ways of Thinking and Doing in Science
- Understanding the Nature of Scientific Knowledge
- Relating Science, Technology, Society and Environment

NUS National University of Singapore | Lee Kong Chian Natural History Museum

EDUCATORS' GUIDE

SECRETS OF THE SEA

SECONDARY SCHOOL GEOGRAPHY SYLLABUS LINKS

COMPREHENSIVE MARINE BIODIVERSITY SURVEY

The Comprehensive Marine Biodiversity Survey (CMBS) is Singapore's largest effort at consolidating a local database of marine biodiversity. In the face of climate change, with future impacts like **sea-level rise**, **rising sea surface temperatures** and **ocean acidification** threatening the existence of our marine biodiversity, the project provides critical baseline data on marine biodiversity in Singapore to **support evidence-based planning for future coastal development and conservation**.

Upper Secondary

- Cluster: Climate
  - Climate change and its impacts on aquatic ecosystems
  - Climate action

BUILD THE RESEARCH WORKFLOW

Lower Secondary

- Theme: Sustainable Resource Use and Management
  - Ecosystem services
  - Research-guided biodiversity conservation

Upper Secondary

- Cluster: Geography in Everyday Life
  - Ecosystem services
  - Research-guided biodiversity conservation

HIDDEN ARCHITECT OF THE SEA

Lower Secondary

- Theme: Sustainable Resource Use and Management
  - Ecosystem services
  - Research-guided biodiversity conservation

Upper Secondary

- Cluster: Geography in Everyday Life
  - Ecosystem services
  - Research-guided biodiversity conservation

WHAT MARINE SNAIL AM I?

Lower Secondary

- Theme: Sustainable Resource Use and Management
  - Ecosystem services
  - Research-guided biodiversity conservation

Upper Secondary

- Cluster: Geography in Everyday Life
  - Research-guided biodiversity conservation

FIND MY BABY PHOTO

Lower Secondary

- Theme: Sustainable Resource Use and Management
  - Ecosystem services
  - Research-guided biodiversity conservation

Upper Secondary

- Cluster: Geography in Everyday Life
  - Ecosystem services
  - Research-guided biodiversity conservation

NUS National University of Singapore | Lee Kong Chian Natural History Museum

EDUCATORS' GUIDE

SECRETS OF THE SEA

JUNIOR COLLEGE H1/2/3 BIOLOGY SYLLABUS LINKS

BUILD THE RESEARCH WORKFLOW

Core Idea: Genetics and Inheritance

- Principles and procedures of molecular techniques **(H2 only)**

Core Idea: Biological Evolution

- Use of genome sequences and molecular methods in classifying organisms **(H2 only)**

Extension Topic: Impact of Climate Change on Animals and Plants

- Effects of climate change on plants and animals **(H2 and H3)**

WHAT MARINE SNAIL AM I?

Core Idea: Biological Evolution

- Classification based on shared characteristics **(H2 only)**
- Use of genome sequences and molecular methods in classifying organisms **(H2 only)**
- Concept of species **(H1 and H2)**

Core Idea: Genetics and Inheritance

- Effect of the environment on phenotype **(H1 and H2)**

ADDITIONAL ACTIVITIES

Micro Marine Marvels

Core Idea: Biological Evolution

- Classification based on shared characteristics **(H2 only)**
- Natural selection and evolution **(H1 and H2)**

Core Idea: The Cell and Biomolecules of Life

- Interpret and recognise biological structures in micrographs **(H1 and H2)**

Core Idea: Genetics and Inheritance

- Effect of the environment on phenotype **(H1 and H2)**

Extension Topic: Impact of Climate Change on Animals and Plants

- Effects of climate change on plants and animals **(H2 and H3)**

HIDDEN ARCHITECT OF THE SEA

Core Idea: Biological Evolution

- Classification based on shared characteristics **(H2 only)**
- Use of genome sequences and molecular methods in classifying organisms **(H2 only)**
- Concept of species **(H1 and H2)**

Core Idea: Energy and Equilibrium

- Introduction to photosynthesis with reef-building corals **(H1 and H2)**
- Importance of photosynthetic carbon fixation in mitigating global warming **(H3 only)**

FIND MY BABY PHOTO

Core Idea: Biological Evolution

- Classification based on shared characteristics **(H2 only)**
- Natural selection and evolution **(H1 and H2)**
- Concept of species **(H1 and H2)**

Core Idea: Energy and Equilibrium

- Introduction to photosynthesis with phytoplanktons **(H1 and H2)**
- Importance of photosynthetic carbon fixation in mitigating global warming **(H3 only)**

THINK AND WORK LIKE A SCIENTIST!

The activities in this toolkit incorporates the Practices of Science (POS) framework and provide opportunities for students to develop key scientific inquiry and reasoning skills:

- Demonstrating Ways of Thinking and Doing in Science
- Understanding the Nature of Scientific Knowledge
- Relating Science, Technology, Society and Environment

NUS National University of Singapore | Lee Kong Chian Natural History Museum

EDUCATORS' GUIDE

SECRETS OF THE SEA

JUNIOR COLLEGE H1/2/3 GEOGRAPHY SYLLABUS LINKS

COMPREHENSIVE MARINE BIODIVERSITY SURVEY

The Comprehensive Marine Biodiversity Survey (CMBS) is Singapore's largest effort at consolidating a local database of marine biodiversity. As coastal and marine environments face pressures from **development, habitat loss, pollution and climate change**, CMBS supports **evidence-based decisions** for the **sustainable management and conservation of Singapore's marine biodiversity.**

Junior College Clusters

- Development, Economy and Environment (H1 & H2)
- Sustainable Future and Climate Change (H2 & H3)
- Fieldwork (H1 & H2), similar skills applied in Independent Research Component (H3)

BUILD THE RESEARCH WORKFLOW

Development, Economy and Environment

- Environment and Resources
  - Ecosystem services
  - Impacts of human activities

Sustainable Future and Climate Change

- Cities in a Sustainable Future
  - Sustainable urban development
- The Future with Climate Change
  - Effects of climate change

Fieldwork

- Pre-fieldwork: Develop a plan
- Fieldwork: Data collection
- Post-fieldwork: Present and analyse data

HIDDEN ARCHITECT OF THE SEA

Development, Economy and Environment

- Environment and Resources
  - Ecosystem services
  - Impacts of human activities

Sustainable Future and Climate Change

- Cities in a Sustainable Future
  - Sustainable urban development
- The Future with Climate Change
  - Effects of climate change

Fieldwork

- Fieldwork: Data collection
- Post-fieldwork: Present and analyse data

WHAT MARINE SNAIL AM I?

Development, Economy and Environment

- Environment and Resources
  - Ecosystem services
  - Impacts of human activities

Sustainable Future and Climate Change

- Cities in a Sustainable Future
  - Sustainable urban development
- The Future with Climate Change
  - Effects of climate change

Fieldwork

- Pre-fieldwork: Develop a plan
- Fieldwork: Data collection
- Post-fieldwork: Present and analyse data

FIND MY BABY PHOTO

Development, Economy and Environment

- Environment and Resources
  - Ecosystem services
  - Impacts of human activities

Sustainable Future and Climate Change

- Cities in a Sustainable Future
  - Sustainable urban development
- The Future with Climate Change
  - Effects of climate change

Fieldwork

- Fieldwork: Data collection
- Post-fieldwork: Present and analyse data

NUS National University of Singapore | Lee Kong Chian Natural History Museum