



The Hunger Games – Year 11 & 12 Program Overview & Schedule

Program Duration: 45 minutes

Minimum Participants: 10 students

Maximum Participants: 100 students

Location: Shark Bay

Relevant Subjects: Biology, Marine Science

Program Overview:

Aligning with the Queensland Syllabi for Biology and Marine Science and Australian Curriculum for Biology, this program builds on the students' understanding of interactions and interdependence between marine organisms and the abiotic components of their environment. During this program, students will observe the mesmerising inhabitants of Shark Bay to construct a food web summarising the roles and relationships in a marine ecosystem, including predation, competition, symbiosis and disease. This information will be inserted into various ecological pyramids as a means of demonstrating energy transfer and the carrying capacity of the modelled ecosystem. Students will consider how the carrying capacity of a population is affected by both the abiotic factors of the environment and the number of organisms above and below a species in the ecological pyramids. The concept of keystone species will be defined using sharks as an example and students will investigate their niche in the ecosystem to demonstrate how they are more significant than their relative abundance or biomass would suggest. Students will articulate the various threats posed to sharks due to human activity and will hypothesise how a reduction in shark numbers can alter the biodiversity of the entire ecosystem. Students will reflect on the significance of sharks, despite the negative way sharks are often viewed by the public, and will identify personal and collective management strategies that could be employed to protect sharks specifically and ecosystems in general.

Program Schedule:

Time

9:15am Arrival

The school will arrive promptly at 9:15am and will be met by a Marine Education Officer on the lawn next to the flagpoles out the front of Sea World.

9:20am Park Entry

The Marine Education Officer will lead the school group through the admissions gate to Shark Bay for the education program.

9:30am Education Program

This program is approximately 45 minutes and will finish by 10:30am at the latest. Please note: selection of this program will prevent the school group from seeing the morning *Seal Guardians Presentation*.

10:30am Program Conclusion

At the conclusion of this session, students will be free to enjoy the park for the rest of the day, at the discretion of school staff.

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Program Mapping

Alignment with Queensland Senior Syllabi:

Science as a Human Endeavour - General

- Science is a global enterprise that relies on clear communication, international conventions, peer review and reproducibility
- Development of complex models and/or theories often requires a wide range of evidence from multiple individuals and across disciplines.
- Advances in science understanding in one field can influence other areas of science, technology and engineering.
- The use and acceptance of scientific knowledge is influenced by social, economic, cultural and ethical contexts.
- The use of scientific knowledge may have beneficial and/or harmful and/or unintended consequences.
- Scientific knowledge can enable scientists to offer valid explanations and make reliable predictions.
- Scientific knowledge can be used to develop and evaluate projected economic, social and environmental impacts and to design action for sustainability.
- Models and theories are contested and refined or replaced when new evidence challenges them, or when a new model or theory has greater explanatory power.
- Science can be limited in its ability to provide definitive answers to public debate; there may be insufficient reliable data available, or interpretation of the data may be open to question.

BIOLOGY (2019)

Unit 3: Biodiversity and the interconnectedness of life

Unit objectives	1. Describe and explain biodiversity and ecosystem dynamics
	2. Apply understanding of biodiversity and ecosystem dynamics
	7. Communicate understandings, findings, arguments and conclusions about biodiversity and ecosystem dynamics.

Topic 1: Describing biodiversity

Biodiversity	Recognise that biodiversity includes the diversity of species and ecosystems
Classification processes	Explain the classification of organisms according to the following species interactions: predation, competition, symbiosis and disease

Topic 2: Ecosystem dynamics

Functioning ecosystems	Sequence and explain the transfer and transformation of solar energy into biomass as it flows through biotic components of an ecosystem, including: <ul style="list-style-type: none"> • Converting light to chemical energy • Producing biomass and interacting with components of the carbon cycle
	Analyse and calculate energy transfer (food chains, webs and pyramids) and transformations within ecosystems, including: <ul style="list-style-type: none"> • Efficiencies of energy transfer from one trophic level to another • Biomass
	Construct and analyse simple energy-flow diagrams illustrating the movement of energy through ecosystems, including the productivity (gross and net) of the various trophic levels

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Functioning ecosystems (continued)	Define <i>ecological niche</i> in terms of habitat, feeding relationships and interactions with other species
	Understand the competitive exclusion principle
	Define <i>keystone species</i> and understand the critical role they play in maintaining the structure of a community
Population ecology	Define the term <i>carrying capacity</i>
	Explain why the carrying capacity of a population is determined by limiting factors (biotic and abiotic)
	Discuss the effect of changes within population-limiting factors on the carrying capacity of the ecosystem.
Changing ecosystems	Predict the impact of human activity on the reduction of biodiversity and on the magnitude, duration and speed of ecosystem change.
MARINE SCIENCE (2019)	
Unit 2: Marine biology	
Unit objectives	1. Describe and explain marine ecology and biodiversity, and marine environmental management
	2. Apply understanding of marine ecology and biodiversity, and marine environmental management
	7. Communicate understandings, findings, arguments and conclusions about marine ecology and biodiversity, and marine environmental management
<i>Topic 1: Marine ecology and biodiversity</i>	
Biodiversity	Define the three main types of diversity (i.e. genetic, species and ecosystem)
	Identify the variety of ecosystems (e.g. estuaries, coastal lakes, saltmarshes, mangroves, seagrass, rocky shores, temperate reefs, coral reefs, lagoons, shelf and deep water) that constitute Australia's marine biomes
	Describe the implications of connectivity to marine ecosystems
	Identify factors that lead to a loss of diversity (e.g. natural hazard, loss/fragmentation of habitat, pollution, exploitation, introduction of new species, disease)
Biotic components of marine ecosystems	Identify biotic components of marine ecosystems (i.e. trophic levels, food chains, food webs, interactions and population dynamics)
	Categorise biotic interactions based on the following terms <ul style="list-style-type: none"> • symbiosis (i.e. parasitism, mutualism, commensalism and amensalism) • competition (i.e. intraspecific and interspecific) • predation
	Classify organisms in trophic levels in a food web based on the following terms <ul style="list-style-type: none"> • producers • primary consumers • secondary consumers • tertiary consumers • decomposers

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Biotic components of marine ecosystems (continued)	Describe how matter cycles through food webs, including the process of bioaccumulation
	Recall the terms population size, density, abundance, distribution (i.e. clumped, uniform, random), carrying capacity, niche, K-strategists and r-strategists, keystone species
Abiotic components of the marine ecosystem	Understand that marine ecosystems are influenced and limited by abiotic factors in ways that may be different from terrestrial ecosystems due to the different physical and chemical properties of water compared to air
	Distinguish abiotic components of marine ecosystems: light availability, depth, stratification, temperature, currents (water and wind), tides, sediment type and nutrient availability
Topic 2: Marine environmental management	
Marine conservation	Recall the arguments for preserving species and habitats (i.e. ecological, economic, social, aesthetic, ethical)
	Describe the direct and indirect values of marine ecosystems of Australia
	Describe the role of stakeholders in the use and management of marine ecosystems
	Discuss the specific value systems that identified stakeholders use (i.e. ecocentric, technocentric and anthropogenic)
	Recognise the issues affecting a selected marine ecosystem
Resources and sustainable use	Recall the precautionary principle of the marine environmental planning and management process as well as a requirement that any network of marine protected areas be comprehensive, adequate and representative
	Understand that criteria are used to inform decisions regarding the design of protected marine areas
Unit 4: Ocean issues and resource management	
Unit objectives	1. Describe and explain oceans of the future and managing fisheries
	2. Apply understanding of oceans of the future and managing fisheries
	7. Communicate understandings, findings, arguments and conclusions about oceans of the future and managing fisheries
Topic 1: Oceans of the future	
Management and conservation	Recall and use the arguments for preserving species and habitats (i.e. ecological, economic, aesthetic, ethical) through identifying their associated direct and indirect values in a given case study
	Identify management strategies used to support marine ecosystem health (e.g. managing threats, zoning, permits, plans, longitudinal monitoring)
Topic 2: Managing fisheries	
Fisheries and population dynamics	Understand that the term fishery has a variety of meanings and that there are three main types (i.e. artisanal, recreational and commercial)
	Understand the significance of wild caught fish as the major source of protein globally

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Fisheries and population dynamics (continued)	Understand that the world's fisheries are in decline
	Assess the impact of bioaccumulation through the food web into edible seafood
	Explain how the alteration of thermal regimes caused by climate change is affecting the distribution of fish populations
	Recognise that fisheries management has shifted from single species maximum sustainable yield towards ecosystem-based fisheries management
	Understand the value of marine protected areas including estuarine and open-water environments to fisheries sustainability.

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Alignment with Australian Curriculum:

BIOLOGY

Science as a Human Endeavour

The use of scientific knowledge is influenced by social, economic, cultural and ethical considerations (ACSBL011)

The use of scientific knowledge may have beneficial and/or harmful and/or unintended consequences (ACSBL012)

Scientific knowledge can enable scientists to offer valid explanations and make reliable predictions (ACSBL013)

Scientific knowledge can be used to develop and evaluate projected economic, social and environmental impacts and to design action for sustainability (ACSBL014)

Unit 1: Biodiversity and the interconnectedness of life

Describing Biodiversity	Ecosystems are diverse, composed of varied habitats and can be described in terms of their component species, species interactions and the abiotic factors that make up the environment (ACSBL019)
	Relationships and interactions between species in ecosystems include predation, competition, symbiosis and disease (ACSBL020)
Ecosystem Dynamics	The biotic components of an ecosystem transfer and transform energy originating primarily from the sun to produce biomass, and interact with abiotic components to facilitate biogeochemical cycling, including carbon and nitrogen cycling; these interactions can be represented using food webs, biomass pyramids, water and nutrient cycles (ACSBL022)
	Species or populations, including those of microorganisms, fill specific ecological niches; the competitive exclusion principle postulates that no two species can occupy the same niche in the same environment for an extended period of time (ACSBL023)
	Keystone species play a critical role in maintaining the structure of the community; the impact of a reduction in numbers or the disappearance of keystone species on an ecosystem is greater than would be expected based on their relative abundance or total biomass (ACSBL024)
	Ecosystems have carrying capacities that limit the number of organisms (within populations) they support, and can be impacted by changes to abiotic and biotic factors, including climatic events (ACSBL025)
	Ecological succession involves changes in the populations of species present in a habitat; these changes impact the abiotic and biotic interactions in the community, which in turn influence further changes in the species present and their population size (ACSBL026)
	Human activities (for example, over-exploitation, habitat destruction, monocultures, pollution) can reduce biodiversity and can impact on the magnitude, duration and speed of ecosystem change (ACSBL028)