Government of Western Australia
School Curriculum and Standards Authority

MARINE AND MARITIME STUDIES

GENERAL COURSE

Year 12 syllabus

IMPORTANT INFORMATION

This syllabus is effective from 1 January 2020.

Users of this syllabus are responsible for checking its currency.

Syllabuses are formally reviewed by the School Curriculum and Standards Authority on a cyclical basis, typically every five years.

Content

Rationale

A significant relationship between the marine environment and humans has existed throughout history. Australia is an island nation, with Western Australia's mainland and islands having approximately twenty-one thousand kilometres of coastline. It is therefore relevant to Western Australians to study the sea and how people interact with it. The Marine and Maritime Studies General course provides students with the opportunity to understand and explore this relationship, and the importance of developing and maintaining a sustainable future.

The Marine and Maritime Studies General course draws from a diverse range of disciplines, including science, technology and the humanities. It provides students with opportunities to engage in unique theoretical and practical learning experiences, and to equip them with a broad range of skills and knowledge.

The Marine and Maritime Studies General course provides opportunities for students to apply theoretical knowledge through practical activities with a focus on active learning experiences, both within and outside of the classroom.

Students are given the opportunity to develop responsible and competent boat-handling and navigation skills, and in doing so, to demonstrate an understanding of nautical concepts. They develop knowledge of the properties inherent in seaworthy craft, and the basics of good boat design, construction and maintenance. Students will also be provided with the opportunity to develop personal water-based skills (swimming/snorkelling/scuba) to allow them to engage directly with the marine environment.

Students investigate oceanography concepts to develop a strong understanding of the interdependence between elements of the marine environment; conduct research into the safe and sustainable management of the oceans' resources for conservation and commercialism; and also are introduced to the world of maritime archaeology.

The course will provide students with a solid foundation of skills and knowledge suitable for a wide range of vocational or recreational pathways in boating (commercial and recreational), scuba, vessel design and construction (maritime engineering), resource management, maritime archaeology or marine science.

Course outcomes

The Marine and Maritime Studies General course is designed to facilitate achievement of the following outcomes.

Outcome 1 – Marine and maritime knowledge

Students develop an understanding of marine and maritime related knowledge.

In achieving this outcome, students develop an understanding of:

- oceanographic concepts
- aspects of marine life and the relationships between components of the underwater world
- maritime engineering concepts
- nautical concepts
- Western Australian maritime history.

Outcome 2 – Marine and maritime skills

Students develop marine and maritime related skills.

In achieving this outcome, students develop:

- seamanship skills
- nautical skills
- water–based skills: swimming/snorkelling/scuba
- scientific investigation and research skills.

Outcome 3– Marine and maritime application

Students apply knowledge and skills to interact with and investigate elements of the marine and maritime environment.

In achieving this outcome, students apply their understandings to:

- management of marine resources
- interrelationships within the marine environment.

Organisation

This course is organised into a Year 11 syllabus and a Year 12 syllabus. The cognitive complexity of the syllabus content increases from Year 11 to Year 12.

Structure of the syllabus

The Year 12 syllabus is divided into two units which are delivered as a pair. The notional time for the pair of units is 110 class contact hours.

Unit 3

This unit investigates Western Australian marine ecosystems, with a focus on estuaries, mangroves, coral reefs and seagrass meadows. Students identify the key species and food webs for each of these ecosystems, as well as examine adaptations of organisms living in mangrove ecosystems. Environmental and resource management will focus on aquaculture as a solution to declining fish stocks.

Students gain an understanding of maritime studies, including the characteristics of construction materials, design and construction of water craft, and repair of fibreglass craft. The basic parts of the outboard motor, including features of two stroke and four stroke motors, will be studied, as well as features of small craft systems, including bilges, electrical, fuel, mooring lines and anchoring equipment.

Through a practical approach, students gain an understanding of the concepts and safe practices of power boating. Science inquiry skills will be developed through the design process in relation to construction materials used, and variations in design of water craft. Students will also be involved in practical activities to collect and analyse data related to trip planning, such as weather maps and aquaculture systems.

Unit 4

This unit examines global surface ocean currents, atmospheric circulation systems and the impact of climate change on global sea levels, thermohaline circulation and marine ecosystems. The process of coastal erosion and coastal engineering structures is studied. Students study types of marine tourism activities with a focus on the importance and impacts of ecotourism.

Students gain an understanding of maritime studies, including common forms of construction material protection, and the possible side effects of using these materials. Aspects of small craft maintenance, including the use of a maintenance log, fuel and ignition, cooling system and engine diagnostics, are studied.

Through a practical approach, students gain an understanding of the concepts and safe practices of power boating. Science inquiry skills will be developed through practical activities to collect and analyse data related to coastal erosion and coastal engineering structures, construction material protection and maintenance of small craft.

Each unit includes:

- a unit description – a short description of the focus of the unit
- unit content – the content to be taught and learned.

Organisation of content

Science strand descriptions

The Marine and Maritime Studies General course has three interrelated strands: Science Inquiry Skills, Science as a Human Endeavour and Science Understanding which build on students' learning in the P–10 Science curriculum. The three strands of the Marine and Maritime Studies General course should be taught in an integrated way. The content descriptions for Science Inquiry Skills, Science as a Human Endeavour and Science Understanding have been written so that this integration is possible in each unit.

Science Inquiry Skills

Science inquiry involves identifying and posing questions; planning, conducting and reflecting on investigations; processing, analysing and interpreting data; and communicating findings. This strand is concerned with evaluating claims, investigating ideas, solving problems, reasoning, drawing valid conclusions, and developing evidence-based arguments.

Science investigations are activities in which ideas, predictions or hypotheses are tested and conclusions are drawn in response to a question or problem. Investigations can involve a range of activities, including experimental testing, field work, locating and using information sources, conducting surveys, and using modelling and simulations.

Through the Marine and Maritime Studies General course, students will continue to develop their science inquiry skills, building on the skills acquired in the P–10 Science curriculum. Each unit provides specific skills to be taught. These specific skills align with the Science Understanding and Science as a Human Endeavour content of the unit.

Science as a Human Endeavour

Science concepts, models and theories are reviewed as their predictions and explanations are continually re-assessed through new evidence, often through the application of new technologies. This review process involves a diverse range of scientists working within an increasingly global community of practice.

The application of science may provide great benefits to individuals, the community and the environment, but may also pose risks and have unintended consequences. As an ever-evolving body of knowledge, science frequently informs public debate, but is not always able to provide definitive answers.

Science Understanding

Science understanding is evident when a person selects and integrates appropriate science concepts, models and theories to explain and predict phenomena, and applies those concepts, models and theories to new situations.

The Science Understanding content in each unit develops students' understanding of the key concepts, models and theories that underpin the subject, and of the strengths and limitations of different models and theories for explaining and predicting complex phenomena.

Safety

Science learning experiences may involve the use of potentially hazardous substances and/or hazardous equipment. It is the responsibility of the school to ensure that duty of care is exercised in relation to the health and safety of all students and that school practices meet the requirements of the *Work Health and Safety Act 2011,* in addition to relevant state or territory health and safety guidelines.

Animal ethics

Through a consideration of research ethics as part of Science Inquiry Skills, students will examine their own ethical position, draw on ethical perspectives when designing investigation methods, and ensure that any activities that impact on living organisms comply with the *Australian code of practice for the care and use of animals for scientific purposes 8th* edition *2013* (www.nhmrc.gov.au/guidelines/publications/ea28).

Any teaching activities that involve the care and use of, or interaction with, animals must comply with the *Australian code of practice for the care and use of animals for scientific purposes 8th edition 2013*, in addition to relevant state or territory guidelines.

The *Animal Welfare Act 2002* can be found at www.slp.wa.gov.au. The related animal welfare regulations, along with the licences required for the use and supply of animals, can be downloaded from www.dlg.wa.gov.au

Information regarding the care and use of animals in Western Australian schools and agricultural colleges can be viewed at www.det.wa.edu.au/curriculumsupport/animalethics/detcms/portal/

Mathematical skills expected of students studying the Marine and Maritime Studies General course

The Marine and Maritime Studies General course requires students to use the mathematical skills they have developed through P–10 Mathematics curriculum, in addition to the numeracy skills they have developed through the Science Inquiry Skills strand of the Science curriculum.

Within the Science Inquiry Skills strand, students are required to gather, represent and analyse numerical data to identify the evidence that forms the basis of scientific arguments, claims or conclusions. In gathering and recording numerical data, students are required to make measurements using appropriate units to an appropriate degree of accuracy.

It is assumed that students will be able to:

- perform calculations involving addition, subtraction, multiplication and division of quantities
- perform approximate evaluations of numerical expressions
- express fractions as percentages, and percentages as fractions
- calculate percentages
- recognise and use ratios
- transform decimal notation to power of ten notation
- substitute physical quantities into an equation using consistent units so as to calculate one quantity and check the dimensional consistency of such calculations

- solve simple algebraic equations
- comprehend and use the symbols/notations <, >, Δ, ≈
- translate information between graphical, numerical and algebraic forms
- distinguish between discrete and continuous data then select appropriate forms, variables and scales for constructing graphs
- construct and interpret frequency tables and diagrams, pie charts and histograms
- describe and compare data sets using mean
- interpret the slope of a linear graph.

Representation of the general capabilities

The general capabilities encompass the knowledge, skills, behaviours and dispositions that will assist students to live and work successfully in the twenty-first century. Teachers may find opportunities to incorporate the capabilities into the teaching and learning program for the Marine and Maritime Studies General course. The general capabilities are not assessed unless they are identified within the specified unit content.

Literacy

Literacy is important in students' development of Science Inquiry Skills and their understanding of content presented through the Science Understanding and Science as a Human Endeavour strands. Students gather, interpret, synthesise and critically analyse information presented in a wide range of formats and representations (including text, flow diagrams, symbols, graphs and tables). They evaluate information sources and compare and contrast ideas, information and opinions presented within and between texts. They communicate processes and ideas logically and fluently and structure evidence-based arguments, selecting genres and employing appropriate structures and features to communicate for specific purposes and audiences.

Numeracy

Numeracy is key to students' ability to apply a wide range of Science Inquiry Skills, including making and recording observations; ordering, representing and analysing data; and interpreting trends and relationships. They employ numeracy skills to interpret complex spatial and graphic representations, and to appreciate the ways in which marine systems are structured, interact and change across spatial and temporal scales. They engage in analysis of data, including issues relating to reliability and probability, and they interpret and manipulate mathematical relationships to calculate and predict values.

Information and communication technology capability

Information and communication technology (ICT) capability is a key part of Science Inquiry Skills. Students use a range of strategies to locate, access and evaluate information from multiple digital sources; to collect, analyse and represent data; to model and interpret concepts and relationships; and to communicate and share science ideas, processes and information. Through exploration of Science as a Human Endeavour concepts, students assess the impact of ICT on the development of science and the application of science in society, particularly with regard to collating, storing, managing and analysing large data sets.

Critical and creative thinking

Critical and creative thinking is particularly important in the science inquiry process. Science inquiry requires the ability to construct, review and revise questions and hypotheses about increasingly complex and abstract scenarios and to design related investigation methods. Students interpret and evaluate data; interrogate, select and cross-reference evidence; and analyse processes, interpretations, conclusions and claims for validity and reliability, including reflecting on their own processes and conclusions. Science is a creative endeavour and students devise innovative solutions to problems, predict possibilities, envisage consequences and speculate on possible outcomes as they develop Science Understanding and Science Inquiry Skills. They also appreciate the role of critical and creative individuals and the central importance of critique and review in the development and innovative application of science.

Personal and social capability

Personal and social capability is integral to a wide range of activities in the Marine and Maritime Studies General course, as students develop and practise skills of communication, teamwork, decision-making, initiative-taking and self-discipline with increasing confidence and sophistication**.** In particular, students develop skills in both independent and collaborative investigation; they employ self-management skills to plan effectively, follow procedures efficiently and work safely; and they use collaboration skills to conduct investigations, share research and discuss ideas. In considering aspects of Science as a Human Endeavour, students also recognise the role of their own beliefs and attitudes in their response to science issues and applications, consider the perspectives of others, and gauge how science can affect people's lives.

Ethical understanding

Ethical understanding is a vital part of science inquiry. Students evaluate the ethics of experimental science, codes of practice, and the use of scientific information and science applications. They explore what integrity means in science, and they understand, critically analyse and apply ethical guidelines in their investigations. They consider the implications of their investigations on others, the environment and living organisms. They use scientific information to evaluate the claims and actions of others and to inform ethical decisions about a range of social, environmental and personal issues and applications of science.

Intercultural understanding

Intercultural understanding is fundamental to understanding aspects of Science as a Human Endeavour, as students appreciate the contributions of diverse cultures to developing science understanding and the challenges of working in culturally diverse collaborations. They develop awareness that raising some debates within culturally diverse groups requires cultural sensitivity, and they demonstrate open-mindedness to the positions of others. Students also develop an understanding that cultural factors affect the ways in which science influences and is influenced by society.

Representation of the cross-curriculum priorities

The cross-curriculum priorities address the contemporary issues which students face in a globalised world. Teachers may find opportunities to incorporate the priorities into the teaching and learning program for the Marine and Maritime Studies General course. The cross-curriculum priorities are not assessed unless they are identified within the specified unit content.

Aboriginal and Torres Strait Islander histories and cultures

Contexts that draw on Aboriginal and Torres Strait Islander histories and cultures provide opportunities for students to recognise the importance of Aboriginal and Torres Strait Islander Peoples' knowledge in developing richer understandings of the marine environment. Students could develop an appreciation of historical craft types; the sustainable management strategies used in the local marine environment; and impacts of legislation designed to protect marine environments on Aboriginal and Torres Strait Islander Peoples' traditional use of the marine environment.

Asia and Australia's engagement with Asia

Contexts that draw on Asian scientific research and development and collaborative endeavours in the Asia Pacific region provide an opportunity for students to investigate Asia and Australia's engagement with Asia**.** Students could consider collaborative projects between Australian and Asian scientists in such areas as ocean acidification, adaptability to climate change, the identification of new technologies to aid in marine science research, and the contribution these make to scientific knowledge.

Sustainability

In the Marine and Maritime Studies General course, the Sustainability cross-curriculum priority provides authentic contexts for exploring, investigating and understanding the function and interactions of biotic and abiotic systems across a range of spatial and temporal scales. By investigating the relationships between marine biological systems and system components, and how systems respond to change, students develop an appreciation for the interconnectedness of the Earth's biosphere, geosphere, hydrosphere and atmosphere. Students appreciate that the Marine and Maritime Studies General course provides the basis for decision making in many areas of society, and that these decisions can affect the Earth system. They understand the importance of using science to predict possible effects of human and other activity, and to develop management plans, or alternative technologies, that minimise these effects and provide for a more sustainable future.

Unit 3

Unit description

This unit investigates Western Australian marine ecosystems, with a focus on estuaries, mangroves, coral reefs and seagrass meadows. Students identify the key species and food webs for each of these ecosystems, as well as examine adaptations of organisms living in mangrove ecosystems. Environmental and resource management will focus on aquaculture as a solution to declining fish stocks.

Students gain an understanding of maritime studies, including the characteristics of construction materials, design and construction of water craft, and repair of fibreglass craft. The basic parts of the outboard motor, including features of two stroke and four stroke motors, will be studied, as well as features of small craft systems, including bilges, electrical, fuel, mooring lines and anchoring equipment.

Through a practical approach, students gain an understanding of the concepts and safe practices of power boating. Science inquiry skills will be developed through the design process in relation to construction materials used, and variations in design of water craft. Students will also be involved in practical activities to collect and analyse data related to trip planning, such as weather maps and aquaculture systems.

Unit content

An understanding of the Year 11 content is assumed knowledge for students in Year 12. It is recommended that students studying Unit 3 and Unit 4 have completed Unit 1 and Unit 2.

This unit includes the knowledge, understandings and skills described below.

Science Inquiry Skills

- construct questions for investigation; propose hypotheses; and predict possible outcomes
- plan investigations, including the procedure/s to be followed, the materials required, and the type and amount of data to be collected; assess risk and address ethical issues associated with these methods
- conduct investigations, including using ecosystem surveying techniques and line transects, safely, competently and methodically for the collection of reliable data
- represent data in meaningful and useful ways; organise and analyse data to identify trends, patterns and relationships; qualitatively describe sources of measurement error and inconsistencies in data; and use evidence to make and justify conclusions
- interpret a range of scientific and media texts, and evaluate the conclusions by considering the quality of available evidence
- construct and use appropriate representations, including classification keys to communicate conceptual understanding, solve problems and make predictions
- communicate scientific ideas and information for a specific purpose, using appropriate language, nomenclature and formats, including scientific reports

Science as a Human Endeavour

- Southeast Asia has a long history of aquaculture, but rapid expansion did not start until after the mid-1970s, with output of food fish exceeding five million tonnes in 2005, and the region producing a significant proportion of the world aquaculture output in terms of volume and value. Modern, extensive aquaculture technologies have been employed and a rapidly growing volume and range of species have been raised in tanks and ponds on land, or in cages and nets in oceans, lakes and rivers, helping to meet the growing demand for protein
- accurate weather forecasting is vital to the public and private sectors; for example, to provide severe weather warnings and to inform decision-making in marine industries. There is a huge demand to increase the accuracy and reliability of weather forecasting over longer periods of time. Weather predictions are based on interpretation of changes in factors, such as air and water temperature, the direction and speed of air and water currents, humidity and atmospheric pressure. Contemporary weather predictions are informed by computer models that take into account a range of atmospheric factors, but still rely on human input to determine the best forecast model, and to interpret the model data into weather forecasts that are understandable to the end user
- maritime communication systems, including distress signals and rules and regulations for avoiding collisions within navigable waters, are based on international conventions, and are subject to change through debate and resolution

Science Understanding

Marine

Oceanography

- location and characteristics of Western Australian marine ecosystems, including:
  - estuaries
  - mangroves
  - coral reefs
  - seagrass meadows
- classification of key species relevant to the Western Australian ecosystems studied
- food chains and webs relevant to the ecosystems studied
- adaptations of organisms living in mangrove ecosystems
- construction and use of simple apparatus that can be used to measure abiotic factors of a marine ecosystem
- methods of measuring biotic factors, such as transects and quadrats

Environmental and resource management

- aquaculture as a solution to declining fish stocks
- aquaculture management by Fisheries – Department of Primary Industries and Regional Development
- Western Australian aquaculture regions and key species farmed

Maritime

Design

- characteristics of maritime construction materials; for example, wood, metals, metal alloys, fibreglass, carbon fibre and plastic
- maritime equipment, marine or water craft, design and construction; for example, surfboards, boat hulls and anchors
- repair process and maintenance of fibreglass craft

Small craft

- the outboard motor – basic parts, function, operating temperature, compression, horsepower
- features of two-stroke and four-stroke motors
- features of small craft systems, including:
  - bilges – bilge pump
  - electrical – batteries, fuses, spark plugs
  - fuel – fuel lines
  - mooring lines – fenders, care of
  - anchoring equipment – scope, shackles
- equipment care and maintenance, including:
  - record of slippings and refits
  - rollers and fume detectors

Concepts and skills

Power boating

Trip planning

- boat preparation – safety equipment check, ramp etiquette, launch and recovery of a vessel
- components of weather – temperature, rainfall, wind, clouds, seas and swell, storms and cyclones
- marine weather forecasts – bureau of meteorology and other models
- weather map and forecast interpretation relating to:
  - local weather effects
  - wind against tide or current
  - wind strength/frontal squalls
- log on, log off
- chart symbols, chart types and local boating guides

Rules and regulations

- skipper's responsibilities and duty of care – new crew induction, sinking, breakdown, fire, grounding, health-related problems, man overboard, search for and rescue a man overboard, collision, capsize, abandon ship, grab bags, survival in water, duties of passengers/crews, code of conduct, rules, reporting of accidents

- registration of vessels
- port authority; licensing; recognition of operational areas and commercial regulations, including certificates of operation and certificates of competency

Safety equipment

- mandatory safety equipment – bilge pump, fire extinguisher, anchor, life jacket, flares, emergency positioning indicator radio beacon (EPIRB), parachute flares, marine radio (VHF, 27 MHz)
- safety equipment expiry dates, care and maintenance, stowage and accessibility
- non-mandatory safety equipment – chart, first-aid kit, minor tool kit, knife, mask and snorkel, torch, clothing, extra lines (ropes), sunscreen, water and extra fuel
- distress signals – radio (mayday, pan-pan, securite), emergency positioning indicator radio beacon (EPIRB), flares and phone

Collision avoidance

- IALA buoyage (System A) – lateral, cardinal, special, isolated danger, safe water, wreck, marine safety signs and leads (sector light)
- rules and regulations for preventing collisions within navigable waters

Maintenance

- routine checks – electrical, fuel, cooling system, oil and propellers

Unit 4

Unit description

This unit examines global surface ocean currents, atmospheric circulation systems and the impact of climate change on global sea levels, thermohaline circulation and marine ecosystems. The process of coastal erosion and coastal engineering structures is studied. Students study types of marine tourism activities with a focus on the importance and impacts of ecotourism.

Students gain an understanding of maritime studies, including common forms of construction material protection, and the possible side effects of using these materials. Aspects of small craft maintenance, including the use of a maintenance log, fuel and ignition, cooling system and engine diagnostics, are studied.

Through a practical approach, students gain an understanding of the concepts and safe practices of power boating. Science inquiry skills will be developed through practical activities to collect and analyse data related to coastal erosion and coastal engineering structures, construction material protection and maintenance of small craft.

Unit content

This unit builds on the content covered in Unit 3.

This unit includes the knowledge, understandings and skills described below.

Science Inquiry Skills

- construct questions for investigation; propose hypotheses; and predict possible outcomes
- plan investigations, including the procedure/s to be followed, the materials required, and the type and amount of data to be collected; assess risk and address ethical issues associated with these methods
- conduct investigations, including measurement of coastal erosion, safely, competently and methodically for the collection of reliable data
- represent data in meaningful and useful ways; organise and analyse data to identify trends, patterns and relationships; qualitatively describe sources of measurement error and inconsistencies in data; and use evidence to make and justify conclusions
- interpret a range of scientific and media texts, and evaluate the conclusions by considering the quality of available evidence
- construct and use appropriate representations, including charts of global currents and weather patterns to communicate conceptual understanding, solve problems and make predictions
- communicate scientific ideas and information for a specific purpose, using appropriate language, nomenclature and formats, including scientific reports

Science as a Human Endeavour

- identification of cyclical changes in global atmospheric circulation systems (El Niño, La Niña) require systematic collection and analysis of data, such as air pressure and sea-surface temperature records, to reveal patterns over time

- the global ocean conveyor is important in regulating global climate. Advances in remote sensing with satellites have enabled scientists to develop models of the complex pathways involved ,and to measure their characteristics. The global ocean conveyor is partly driven by thermohaline circulation, the movement of water due to density changes resulting from temperature or salinity. The places where these deepwater currents are created are believed to compose less than 1% of the ocean's surface area. Analysis of geological evidence indicates that when these vulnerable areas are disrupted, the global ocean conveyor can be "shut down" and the world's climate can be drastically altered in just a few years. Some scientists predict that melting of the Greenland ice sheet could influence the global ocean conveyor, causing changes in global climate

Science Understanding

Marine

Oceanography

- global surface ocean currents – names, locations, role in energy transfer
- impacts of global atmospheric circulation systems (El Niño, La Niña) on weather patterns and nutrient upwelling
- impact of climate change on:
  - global sea levels
  - thermohaline current
  - marine habitats; for example, coral reefs
- cause, effect and measurement of coastal erosion, including longshore currents, accreting and eroding beaches, deposition and sand budgets
- features, role and impact of coastal engineering structures, for example, physical barriers, sand bypass systems
- artificial reefs, ports and canals

Environmental and resource management

- types of marine tourism activities in Western Australia
- ecotourism and its importance in the maintenance of marine area integrity
- potential impacts of marine tourism, including environmental, social and economic effects

Maritime

Design

- common forms of construction material protection used in marine craft, such as:
  - antifouling agents
  - sacrificial anodes
- possible side effects of construction material protection methods; for example, copper and antifouling agents

Small craft

- maintenance log – use, purpose
- effect of poor marine craft maintenance on the marine environment
- fuel and ignition – petrol/oil mix, petrol and diesel
- cooling system – basic operation, checks, tell-tale
- engine diagnostics
- management of engine failure in small craft – protocols/procedures

Concepts and skills

Power boating

- operating a vessel safely
- using berthing and mooring equipment
- tying knots – reef, bowline, sheet bend, clove hitch, round turn and two half hitches, coiling, throwing a line, using bitts and cleats
- conducting a safety briefing
- preparation and starting of motors
- skipper's logging on and logging off
- departing the berth
- performing a man overboard
- driving a transit
- performing a controlled stop
- returning to the berth: securing a vessel

School-based assessment

The Western Australian Certificate of Education (WACE) Manual contains essential information on principles, policies and procedures for school-based assessment that needs to be read in conjunction with this syllabus.

Teachers design school-based assessment tasks to meet the needs of students. The table below provides details of the assessment types for the Marine and Maritime Studies General Year 12 syllabus and the weighting for each assessment type.

Assessment table – Year 12

Type of assessment	Weighting
Science inquiry Science inquiry involves identifying and posing questions; planning, conducting and reflecting on investigations; processing, analysing and interpreting data; and communicating findings. **Scientific skills** Scientific skills can include: classification exercises; ecosystem surveying techniques, such as transects and quadrats; design and construction of scientific testing/collecting equipment or models and microscope work. **Investigations** Investigations are more extensive activities which can include: experimental testing; environmental and field work; conducting surveys scientific research into specific marine and maritime issues and/or comprehensive scientific reports.	15%
Practical Practical tasks assess how students perform in a practical activity where they demonstrate specific skills or strategies. Practical tasks can include: trip planning, certificates of operation and certificates of competency, distress signals, safety briefings. Assessment can take the form of direct observation and judgement of student's performance as they demonstrate a skill.	40%
Extended response Tasks requiring an extended response may involve selecting and integrating appropriate science concepts, models and theories to explain and predict phenomena, and applying those concepts, models and theories to new situations; interpreting scientific and media texts and evaluating processes, claims and conclusions by considering the quality of available evidence; and using reasoning to construct scientific arguments. Assessment may take the form of answers to specific questions based on individual research; exercises requiring analysis; and interpretation and evaluation of information in scientific journals, fisheries reports and/or media texts.	10%
Test Tests typically consist of multiple-choice questions and questions requiring short and extended answers. They should be designed so that students may apply their understanding and skills in the Marine and Maritime Studies General course to analyse, interpret, solve problems and construct scientific arguments.	20%
Externally set task A written task or item or set of items of 50 minutes duration developed by the School Curriculum and Standards Authority and administered by the school.	15%

Teachers are required to use the assessment table to develop an assessment outline for the pair of units.

The assessment outline must:

- include a set of assessment tasks
- include a general description of each task
- indicate the unit content to be assessed
- indicate a weighting for each task and each assessment type
- include the approximate timing of each task (for example, the week the task is conducted, or the issue and submission dates for an extended task).

All assessment types must be included in the assessment outline at least twice with the exception of the externally set task which only occurs once.

The set of assessment tasks must provide a representative sampling of the content for Unit 3 and Unit 4.

Assessment tasks not administered under test/controlled conditions require appropriate validation/authentication processes.

Externally set task

All students enrolled in the Marine and Maritime Studies General Year 12 course will complete the externally set task developed by the Authority. Schools are required to administer this task in Term 2 at a time prescribed by the Authority.

Externally set task design brief – Year 12

Time	50 minutes
Format	Written
	Conducted under invigilated conditions
	Typically between two and six questions
Content	The Authority informs schools during Term 3 of the previous year of the Unit 3 syllabus content on which the task will be based

Refer to the WACE Manual for further information.

Grading

Schools report student achievement in terms of the following grades:

Grade	Interpretation
A	Excellent achievement
B	High achievement
C	Satisfactory achievement
D	Limited achievement
E	Very low achievement

The teacher prepares a ranked list and assigns the student a grade for the pair of units. The grade is based on the student's overall performance as judged by reference to a set of pre-determined standards. These standards are defined by grade descriptions and annotated work samples. The grade descriptions for the Marine and Maritime Studies General Year 12 syllabus are provided in Appendix 1. They can also be accessed, together with annotated work samples, through the Guide to Grades link on the course page of the Authority website at www.scsa.wa.edu.au

To be assigned a grade, a student must have had the opportunity to complete the education program, including the assessment program (unless the school accepts that there are exceptional and justifiable circumstances).

Refer to the WACE Manual for further information about the use of a ranked list in the process of assigning grades.

Appendix 1 – Grade descriptions Year 12

A	**Understanding and applying concepts** Applies models and principles to explain the behaviours of systems and processes in detail. Uses appropriate language, conventions and clearly labelled and accurate diagrams. Selects and assesses the relevance of scientific information from a variety of sources to support a point of view. Analyses issues, organises information and presents clear and logical arguments which are always supported by evidence.
	Science inquiry skills Formulates a hypothesis that states the relationship between dependent and independent variables. Plans an investigation to collect appropriate data. Identifies controlled variables with specific detail. Provides a clear and logical experimental procedure with sufficient detail to allow the investigation to be repeated by others. Organises data logically and presents it in a range of forms, including appropriate graphs and tables, and identifies patterns and relationships. Processes experimental data to describe trends and explains these using relevant scientific concepts. Processes numerical data using appropriate units. Uses evidence to make and justify conclusions that relate to the hypothesis. Evaluates experimental method and makes specific suggestions to improve the design of the investigation. Communicates information and concepts logically, using correct scientific language, conventions and representations.
	Practical Independently uses a variety of resources and equipment to achieve results that meet most design or performance requirements. Manages aspects of the work and/or leisure environment through hazard recognition and demonstration of safety and selection of appropriate operational procedures for working with selected equipment. Performs tasks competently with minor skill faults, which are self-corrected within the allocated time.

B	**Understanding and applying concepts** Describes and briefly explains the behaviours of systems and processes using models. Uses scientific language, conventions and supporting diagrams where appropriate. Provides scientific information from a variety of sources to support a point of view. Organises information and presents arguments or statements which are often supported by evidence.
	Science inquiry skills With guidance, formulates a hypothesis that states the relationship between dependent and independent variables. Plans an investigation to collect appropriate data. Identifies some controlled variables without detail. Provides an experimental procedure that lacks detail. Presents data in a range of forms, including appropriate graphs and tables, and identifies relationships. Describes trends and briefly explains these using relevant scientific concepts. Processes numerical data using appropriate units. Uses evidence to make conclusions that relate to the hypothesis. Evaluates experimental method and makes general suggestions to improve the design of the investigation. Communicates information and concepts logically, generally using scientific language and representations. Makes some errors in the use of conventions.
	Practical Uses resources as directed and achieves results that meet most design or performance requirements. Manages the work and/or leisure environment through hazard recognition and demonstration of safety and selection of appropriate operational procedures for working with selected equipment. Performs tasks with a few obvious skill faults, which are not always self-corrected within the allocated time.

C	**Understanding and applying concepts** Describes the behaviours of some systems and processes. Uses some scientific language, conventions and supporting diagrams. Selects some scientific information to support a point of view. Presents general statements supported by some evidence, including some irrelevant or incorrect information.
	Science inquiry skills Formulates a hypothesis, that includes dependent and independent variables, within a context that has been provided. Plans an investigation to collect appropriate data; inconsistently identifies controlled variables. Outlines the main steps in the experimental procedure. Presents data using basic tables and graphs. Describes trends in the data with limited explanation of the trends. Completes some processing of straightforward numerical data. Draws general conclusions that may not be linked to the hypothesis. Describes difficulties experienced in conducting the investigation and suggests general improvements. Communicates information and concepts, without detail, using some scientific language and conventions. Provides responses that are often not supported by appropriate examples and diagrams lack detail.
	Practical With guidance and direction, makes use of resources and achieves results that meet some design or performance requirements. With guidance, meets safety standards, including the management of the work and/or leisure environment. Performs tasks with some indecisiveness, leading to a substantial number of obvious skill faults, even with additional guidance and time.

D	**Understanding and applying concepts** Recognises systems and processes. Describes some concepts using everyday language and provides simple diagrams. Makes little use of evidence to support a point of view. Presents responses that are incomplete and include irrelevant or incorrect information.
	Science inquiry skills Makes a simple prediction for an investigation. Does not distinguish between dependent, independent and controlled variables. Follows a provided experimental procedure to collect data. Presents data that is disorganised and lacks appropriate processing. Provides incomplete or incorrect tables and graphs. Identifies trends in the data incorrectly or overlooks trends. Offers conclusions that are not supported by the data. Identifies difficulties experienced in conducting the investigation. Communicates information using everyday language with frequent errors in the use of conventions. Provides responses which are often incomplete or irrelevant.
	Practical With guidance and direction, makes limited use of resources and achieves limited results that meet some design or performance requirements. With guidance, meets safety standards, including the management of the work and/or leisure environment. Performs tasks with high levels of indecisiveness, leading to a substantial number of obvious skill faults, and substandard performance, even with additional guidance and time.

E	Does not meet the requirements of a D grade and/or has completed insufficient assessment tasks to be assigned a higher grade.

Appendix 2 – Glossary

This glossary is provided to enable a common understanding of the key terms in this syllabus.

Accuracy	The extent to which a measurement result represents the quantity it purports to measure; an accurate measurement result includes an estimate of the true value and an estimate of the uncertainty.
Animal ethics	Consideration of respectful, fair and just treatment of animals. The use of animals in science involves consideration of replacement (substitution of insentient materials for conscious living animals), reduction (using only the minimum number of animals to satisfy research statistical requirements) and refinement (decrease in the incidence or severity of 'inhumane' procedures applied to those animals that still have to be used).
Biosecurity	Policy and regulatory frameworks designed to safeguard against biological threats to environments, organisms and human health; biosecurity measures aim to restrict entry of disease causing agents, genetically modified species, or invasive alien species or genotypes.
Data	The plural of datum; the measurement of an attribute; for example, the volume of gas or the type of rubber. This does not necessarily mean a single measurement: it may be the result of averaging several repeated measurements. Data may be quantitative or qualitative and be from primary or secondary sources.
Evidence	In science, evidence is data that is considered reliable and valid and which can be used to support a particular idea, conclusion or decision. Evidence gives weight or value to data by considering its credibility, acceptance, bias, status, appropriateness and reasonableness.
Genre	The categories into which texts are grouped; genre distinguishes texts on the basis of their subject matter, form and structure (for example, scientific reports, field guides, explanations, procedures, biographies, media articles, persuasive texts, narratives).
Hypothesis	A scientific statement based on the available information that can be tested by experimentation. When appropriate, the statement expresses an expected relationship between the independent and dependent variables for observed phenomena.
Investigation	A scientific process of answering a question, exploring an idea or solving a problem that requires activities, such as planning a course of action, collecting data, interpreting data, reaching a conclusion and communicating these activities. Investigations can include observation, research, field work, laboratory experimentation and manipulation of simulations.
Law	A statement describing invariable relationships between phenomena in specified conditions, frequently expressed mathematically.
Measurement error	The difference between the measurement result and a currently accepted or standard value of a quantity.
Media texts	Spoken, print, graphic or electronic communications with a public audience. Media texts can be found in newspapers, magazines and on television, film, radio, computer software and the internet.

Mode	The various processes of communication – listening, speaking, reading/viewing and writing/creating.
Model	A representation that describes, simplifies, clarifies or provides an explanation of the workings, structure or relationships within an object, system or idea.
Primary data	Data collected directly by a person or group.
Primary source	Report of data created by the person or persons directly involved in observations of one or more events, experiments, investigations or projects.
Reliable data	Data that has been judged to have a high level of reliability; reliability is the degree to which an assessment instrument or protocol consistently and repeatedly measures an attribute, achieving similar results for the same population.
Reliability	The degree to which an assessment instrument or protocol consistently and repeatedly measures an attribute, achieving similar results for the same population.
Representation	A verbal, visual, physical or mathematical demonstration of understanding of a science concept or concepts. A concept can be represented in a range of ways and using multiple modes.
Research	To locate, gather, record, attribute and analyse information in order to develop understanding.
Research ethics	Norms of conduct that determine ethical research behaviour; research ethics are governed by principles, such as honesty, objectivity, integrity, openness and respect for intellectual property and include consideration of animal ethics.
Risk assessment	Evaluations performed to identify, assess and control hazards in a systematic way that is consistent, relevant and applicable to all school activities. Requirements for risk assessments related to particular activities will be determined by jurisdictions, schools or teachers as appropriate.
Secondary data	Data collected by a person or group other than the person or group using the data.
Secondary source	Information that has been compiled from records of primary sources by a person or persons not directly involved in the primary event.
Simulation	A representation of a process, event or system which imitates a real or idealised situation.
System	A group of interacting objects, materials or processes that form an integrated whole. Systems can be open or closed.
Theory	A set of concepts, claims and/or laws that can be used to explain and predict a wide range of related observed or observable phenomena. Theories are typically founded on clearly identified assumptions, are testable, produce reproducible results and have explanatory power.
Uncertainty	Range of values for a measurement result, taking account of the likely values that could be attributed to the measurement result, given the measurement equipment, procedure and environment.
Validity	The extent to which tests measure what was intended; the extent to which data, inferences and actions, produced from tests and other processes, are accurate.