



Government of **Western Australia**  
School Curriculum and Standards Authority

# MARINE AND MARITIME STUDIES

ATAR COURSE

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Year 11 syllabus

## IMPORTANT INFORMATION

This syllabus is effective from 1 January 2017.

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.

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## 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 ATAR course provides students with the opportunity to understand and explore this relationship and the importance of developing and maintaining a sustainable future for our coastal and marine environments.

The Marine and Maritime Studies ATAR 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 ATAR 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 under power, and in doing so, 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 are also 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, and maritime archaeology or marine science.

## Course outcomes

The Marine and Maritime Studies ATAR 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 demonstrate 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 understand and apply:

- seamanship skills
- nautical skills
- water-based skills (swimming/snorkelling/scuba)
- science inquiry 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 investigate:

- management of marine resources
- aspects of maritime archaeology
- 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 11 syllabus is divided into two units, each of one semester duration, which are typically delivered as a pair. The notional time for each unit is 55 class contact hours.

#### Unit 1

This unit explores types of Western Australian marine ecosystems, marine resources, nautical craft design features, power boating, historic sea routes and mapping of the Western Australian coastline.

#### Unit 2

This unit explores the cycling of matter through marine ecosystems and global ocean currents. Historical and archaeological understandings and the skills associated with power boating are further developed. Students investigate management of local Western Australian fisheries.

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 ATAR course has three interrelated strands: Science Inquiry Skills, Science as a Human Endeavour and Science Understanding, which build on students' learning in the Year 7–10 Science curriculum. The three strands of the Marine and Maritime Studies ATAR 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.

In science investigations, the collection and analysis of data to provide evidence plays a major role. This can involve collecting or extracting information and reorganising data in the form of tables, graphs, flow charts, diagrams, text, keys, spreadsheets and databases. The analysis of data to identify and select evidence, and the communication of findings, involve the selection, construction and use of specific representations, including mathematical relationships, symbols and diagrams.

Through the Marine and Maritime Studies ATAR course, students will continue to develop their science inquiry skills, building on the skills acquired in the Year 7–10 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**

Through science, we seek to improve our understanding and explanations of the natural world. The Science as a Human Endeavour strand highlights the development of science as a unique way of knowing and doing, and explores the use and influence of science in society.

As science involves the construction of explanations based on evidence, the development of science concepts, models and theories is dynamic and involves critique and uncertainty. 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 and can involve the use of international conventions and activities such as peer review.

The use and influence of science are shaped by interactions between science and a wide range of social, economic, ethical and cultural factors. 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 a result, decision-making about socio-scientific issues often involves consideration of multiple lines of evidence and a range of stakeholder needs and values. 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. Models in science can include diagrams, physical replicas, mathematical representations, word-based analogies (including laws and principles) and computer simulations. Development of models involves selection of the aspects of the system(s) to be included in the model, and thus models have inherent approximations, assumptions and limitations.

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](http://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](http://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](http://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/](http://www.det.wa.edu.au/curriculumsupport/animalethics/detcms/portal/)

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

The Marine and Maritime Studies ATAR course requires students to use the mathematical skills they have developed through the Year 7–10 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  $<$ ,  $>$ ,  $\Delta$ ,  $\approx$
- 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, median and inter-quartile range
- interpret the slope of a linear graph.

## Progression from the Year 7–10 curriculum

This syllabus continues to develop student understanding and skills from across the three strands of the Year 7–10 Science curriculum. In the Science Understanding strand, this syllabus draws on knowledge and understanding from across the four sub-strands of Biological, Physical, Chemical and Earth and Space Sciences.

In particular, this syllabus continues to develop the key concepts introduced in the Biological Sciences sub-strand, that is, that a diverse range of living things have evolved on Earth over hundreds of millions of years, that living things are interdependent and interact with each other and their environment, and that the form and features of living things are related to the functions their systems perform.

## 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 ATAR 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 ATAR course. 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 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 ATAR 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, and 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 ATAR 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 could develop an appreciation for the interconnectedness of the Earth's biosphere, geosphere, hydrosphere and atmosphere. Students appreciate that the Marine and Maritime Studies ATAR course provides the basis for decision making in many areas of society and that these decisions can impact 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 1

## Unit description

This unit explores properties and characteristics of sea water and types of Western Australian marine ecosystems.

Common nautical craft design features and features of hull designs are investigated. Maritime history and archaeology are introduced in this unit. Historic sea routes and exploration and mapping of the Western Australian coastline are studied.

Nautical concepts, such as trip planning, rules and regulations, safety equipment, emergency situations, collision avoidance, and maintenance associated with small boat handling, are examined. Students further develop the skills associated with scientific inquiry.

## Unit content

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

### Science Inquiry Skills

- identify, research and construct questions for investigation; propose hypotheses; and predict possible outcomes
- design investigations, including the procedure(s) to be followed, the materials required, and the type and amount of primary and/or secondary data to be collected; conduct risk assessments; and consider research ethics, including animal ethics
- conduct investigations using ecosystem surveying techniques, including line transects, safely, competently and methodically for the collection of valid and 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 uncertainty and limitations in data; and select, synthesise and use evidence to make and justify conclusions
- interpret a range of scientific and media texts, and evaluate processes, claims and conclusions by considering the quality of available evidence; and use reasoning to construct scientific arguments
- select, construct and use appropriate representations, including classification keys to communicate conceptual understanding, solve problems and make predictions
- communicate to specific audiences, and for specific purposes, using appropriate language, nomenclature, genres and modes, including scientific reports

### Science as a Human Endeavour

- human activities may contribute to habitat disturbance within ecosystems. Techniques, including transects and video surveying, in conjunction with measurement of abiotic factors, can be used so that a complete picture of the health of an ecosystem and its resilience to change may be obtained

- decisions about whether to and how to extract a resource depends on the value, location and volume of the resource. Consultation and negotiation with local and indigenous communities is required to further assess impacts on, and costs to, the marine environment and the community of removing the resource
- impact of technological advances on navigation and the subsequent consequences for exploration of the Western Australian coastline
- satellite technologies enable the accurate estimation of position fixing, allowing faster response in emergency situations on a global scale

## **Science Understanding**

### **Marine**

#### **Oceanography**

- properties and characteristics of sea water: salinity, solvent properties, heat capacity, density, viscosity, buoyancy, water pressure, light, displacement (including plimsoll line), effect on light, velocity of sound, and dissolved gases
- location and characteristics of Western Australian marine ecosystems, including:
  - sea grass meadows
  - reefs
  - deep seas (> 400 m)
  - estuaries
  - mangroves
- classification and identification of species relevant to the Western Australian marine ecosystems studied
- construction and use of simple apparatus to measure abiotic factors of a marine ecosystem
- methods of measuring biotic factors: transects and quadrats

#### **Environmental and resource management**

- the use of the Western Australian marine environment to obtain salt, seawater, petroleum and gas: extraction processes, location, general impacts and economic value
- Australian Exclusive Economic Zone (AEEZ): description and location

### **Maritime**

#### **Design**

- common craft design features, including:
  - efficiency
  - comfort
  - safety
  - cost effectiveness

- design features of specific hull designs, including:
  - hard chine
  - catamaran
  - trimaran
  - hydrofoil
  - small water-plane-area twin hull (SWATH)
  - wave piercer

### **History and archaeology**

- impact of world trade patterns and historic sea routes, including Brouwer's route, on Western Australian coastal exploration
- importance of exploration and mapping of the Western Australian coastline, including that carried out by de Vlamingh and Hartog

### **Concepts and skills**

#### **Nautical 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, including bureau of meteorology and other models
- weather map and forecast interpretation: local weather effects, wind against tide or current, wind strength/frontal squalls
- log on, log off
- charts symbols, chart types, scale chart work in local waters 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 of a man overboard, collision, capsize, abandon ship, grab bags, survival in water, passengers'/crew's duties, code of conduct, reporting of accidents and rules
- registration of vessels
- port authority, licensing, recognition of operational areas and commercial regulations, including certificates of operation and certificates of competency

##### Safety equipment

- required safety equipment (including unprotected waters, protected waters, and registrable vessels and non-registrable vessels): lifejacket, visual distress signals (flares, electronic visual distress signal (EVDS), parachute flares), GPS enabled Emergency Positioning Indicator Radio Beacon (EPIRB)/GPS enabled Personal Locator Beacon (PLB), and marine radio (VHF, 27 MHz)

- safety equipment expiry dates, care and maintenance, stowage and accessibility, safety equipment transition period (period of time to phase out old safety equipment)
- recommended safety equipment (including unprotected waters, protected waters, and registrable vessels and non-registrable vessels): bailer or bilge pump, fire extinguishers, anchors
- additional safety equipment: tool kit, first aid kit, fire blanket, life buoy, torch, life raft, replacement spark plugs, chart, knife, mask and snorkel, 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

#### Emergency situations

- safety briefing: first aid, seasickness, sunburn, safety equipment, code of behaviour, alcohol, movement about vessel, emergency signalling, and fitting a life jacket
- fire causes: engine, LPG, bilge and engine room cleanliness and refuelling

#### 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 2

### Unit description

This unit focuses on the cycling of matter through the marine ecosystem, the interdependence of organisms, global ocean currents and global atmospheric circulation systems. Students investigate issues and strategies involved in the management of local Western Australian fisheries.

Maritime history and archaeology understanding is developed further through the investigation of laws protecting wreck sites, local shipwrecks, and the historical information gathered from shipwrecks.

Students have the opportunity to develop additional seamanship skills relating to power boating and charting. Students further develop the skills associated with scientific inquiry.

### Unit content

This unit builds on the content covered in Unit 1.

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

#### Science Inquiry Skills

- identify, research and construct questions for investigation; propose hypotheses; and predict possible outcomes
- design investigations, including the procedure(s) to be followed, the materials required, and the type and amount of primary and/or secondary data to be collected; conduct risk assessments; and consider research ethics, including animal ethics
- conduct investigations, including using ecosystem surveying techniques, safely, competently and methodically for the collection of valid and 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 uncertainty and limitations in data; and select, synthesise and use evidence to make and justify conclusions
- interpret a range of scientific and media texts, and evaluate processes, claims and conclusions by considering the quality of available evidence; and use reasoning to construct scientific arguments
- select, construct and use appropriate representations, including food webs to communicate conceptual understanding, solve problems and make predictions
- communicate to specific audiences, and for specific purposes, using appropriate language, nomenclature, genres and modes, including scientific reports

#### Science as a Human Endeavour

- an increase in the number of recreational fishers, together with an increased use of technology, (global positioning system [GPS], colour echo sounders) have impacted on the stocks of offshore demersal scalefish. Regulatory measures are used to protect stocks, and long-term sampling programs are undertaken, so that predictions can be made about fish numbers in the future

- modern fish marking, including tagging with increasingly sophisticated tracking devices, together with the parallel development of software to process the data gathered, has meant advances in the knowledge of fish behaviour and management
- 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
- historical significance, value, aesthetics, and impact of removal, are determining factors used to influence decisions on conservation and display of maritime artefacts
- technological advances in conjunction with historical records and practices influence the methodologies of safe navigation and seamanship

## **Science Understanding**

### **Marine**

#### **Oceanography**

- cycling of nitrogen, carbon and water through a marine ecosystem
- interdependence of organisms within a marine ecosystem, including food webs
- factors that create ocean currents, including:
  - wind
  - Earth's rotation – Coriolis force
  - water temperature differences
  - water density differences
- global surface ocean currents: names, locations, and role in energy transfer
- global atmospheric circulation systems, including:
  - Southern Oscillation Index and Walker Circulation
  - El Niño and La Niña

#### **Environmental and resource management**

- current issues affecting Western Australia's fisheries (select local examples only), including:
  - management practices
  - fish population dynamics
  - sustainable yields
- aquaculture solutions to declining fish stocks
  - types of aquaculture
  - examples and locations
  - environmental issues associated with aquaculture

## Maritime

### Design

- characteristics (cost, environmental, aesthetics, functionality) of maritime construction materials, including wood, metal, fibreglass and plastic
- variation in vessel design according to specific use, including:
  - commercial fishing boats
  - dive boats
  - yachts
  - rigid inflatable boats

### History and archaeology

- background and location of Western Australian shipwrecks, including:
  - Zuytdorp
  - Vergulde Draeck
- historical information found within a shipwreck
- Western Australian law protecting wreck sites
- the factors that influence the selection of artefacts for conservation and display

## Concepts and skills

### Nautical concepts and skills

#### Seamanship skills

- operating a vessel safely
- using berthing and mooring equipment
- tying knots and appropriate use, including: 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
- skippers logging on and logging off
- departing the berth
- performing a man overboard
- driving a transit
- performing a controlled stop
- returning to the berth (secures vessel)

**Charting skills**

- estimating a position
- position fixing: single bearing fix, and triangulations to locate position
- performing distance, speed, time calculations
- plotting latitude and longitude
- reading tide charts, calculating tide heights, calculating tide charts (rule of 12<sup>ths</sup>)
- calculating depth of water under boat
- plotting a course
- calculating magnetic variation and bearing conversions

## 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 ATAR Year 11 syllabus and the weighting for each assessment type.

**Assessment table – Year 11**

Type of assessment	Weighting
<b>Science inquiry</b> Science inquiry involves identifying and posing questions; planning, conducting and reflecting on investigations; processing, analysing and interpreting data; and communicating findings. Science inquiry can involve scientific skills or investigations which are more extensive activities. <b>Scientific skills</b> Scientific skills can include: classification exercises, design and construction of scientific testing/collecting equipment or models and microscope work. <b>Investigation</b> Investigations can include experimental testing; environmental and field work; conducting surveys; scientific research into specific marine and maritime issues and/or comprehensive scientific reports.	15%
<b>Practical</b> Practical tasks assess how students perform in a practical activity where they demonstrate specific skills or strategies. Practical tasks can include: boating; knot tying; navigation and charting; radio operation; delivering a safety briefing; performance of maintenance tests. Assessment can take the form of direct observation and judgement of student's performance as they demonstrate a skill.	20%
<b>Extended response</b> Tasks requiring an extended response can 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 can 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%
<b>Test</b> Tests typically consist of multiple choice questions and questions requiring short and extended answers. Tests should be designed so that students can apply their understanding and skills in the Marine and Maritime Studies ATAR course to analyse, interpret, solve problems and construct scientific arguments.	15%
<b>Examination</b> Typically conducted at the end of each semester and/or unit. In preparation for Unit 3 and Unit 4, the examination should reflect the examination design brief included in the ATAR Year 12 syllabus for this course.	40%

Teachers are required to use the assessment table to develop an assessment outline for the pair of units (or for a single unit where only one is being studied).

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).

In the assessment outline for the pair of units, each assessment type must be included at least twice. In the assessment outline where a single unit is being studied, each assessment type must be included at least once.

The set of assessment tasks must provide a representative sampling of the content for Unit 1 and Unit 2.

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

## Grading

Schools report student achievement in terms of the following grades:

Grade	Interpretation
<b>A</b>	Excellent achievement
<b>B</b>	High achievement
<b>C</b>	Satisfactory achievement
<b>D</b>	Limited achievement
<b>E</b>	Very low achievement

The teacher prepares a ranked list and assigns the student a grade for the pair of units (or for a unit where only one unit is being studied). 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 ATAR Year 11 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](http://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 11

A

### Understanding and applying concepts

Applies scientific principles to accurately explain complex phenomena in detail.

Clearly links multiple concepts to explain relationships in detail.

Applies models to explain cycles and processes in detail, using supporting examples and diagrams where appropriate.

Accurately applies knowledge to unfamiliar contexts or examples.

Selects, evaluates and uses information from a variety of sources to solve problems and to support a point of view.

### Science Inquiry Skills

Formulates a testable hypothesis that states the relationship between dependent and independent variables.

Designs investigations to identify and control appropriate variables, describes the experimental method in detail and accurately collects data.

Processes data accurately and provides relevant suggestions to improve its validity and reliability.

Organises data logically and presents it in a range of forms, including graphs, tables and charts to reveal patterns and relationships.

Comprehensively explains trends using numerical data and uses evidence to draw conclusions that relate to the hypothesis.

Communicates detailed information and concepts logically and coherently, using correct terminology and appropriate conventions.

### Practical

Independently uses a variety of resources and equipment to achieve results that meet most design or performance requirements.

Consistently manages aspects of the work and/or leisure environment through hazard recognition, 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**

Applies scientific principles to accurately explain simple, and some complex, phenomena.  
 Presents explanations of concepts logically and/or sequentially, with some provision of supporting examples.  
 Applies models to explain cycles and processes using supporting examples and diagrams where appropriate.  
 Applies knowledge to unfamiliar contexts or examples, sometimes lacking detail.  
 Selects, evaluates and uses information to solve problems and to support a point of view.

**Science Inquiry Skills**

Formulates a testable hypothesis that states the relationship between dependent and independent variables.  
 Designs investigations to identify and control appropriate variables, describes the experimental method and accurately collects data.  
 Processes data and suggests ways to improve its validity and reliability.  
 Presents data in a range of forms, including graphs, tables and charts to reveal patterns and relationships.  
 Explains trends and uses evidence to draw conclusions that relate to the hypothesis.  
 Communicates information and concepts logically, using correct terminology and appropriate conventions.

**Practical**

Uses resources as directed and achieves results that meet some design or performance requirements.  
 Sometimes manages the work and/or leisure environment through hazard recognition, demonstration of safety and selection of appropriate operational procedures for working with selected equipment.  
 Performs tasks with a number of obvious skill faults which are not always self-corrected within the allocated time.



C

**Understanding and applying concepts**

Inconsistently applies scientific principles to describe phenomena.

Presents arguments or statements supported by some evidence. Responses lack detail and may include irrelevant information.

Describes trends or relationships.

Applies models to explain some cycles and processes. Diagrams sometimes lack detail and insufficient annotation.

Applies knowledge to familiar and some unfamiliar contexts or examples.

Selects some information to support a point of view.

**Science Inquiry Skills**

Formulates a testable hypothesis that links dependent and independent variables.

Designs investigations to identify and control some variables, briefly outlines the experimental method and collects data.

Processes data and makes general suggestions for improving the investigation. Presents data using basic tables and graphs.

Describes trends in the data and draws simple conclusions that may not be linked back to the hypothesis.

Communicates information and concepts, without detail, using some correct terminology and appropriate conventions.

**Practical**

With guidance and direction, makes use of resources and achieves results that meet some design or performance requirements.

With direction, meets safety standards, including the management of the work and/or leisure environment.

Performs tasks with a substantial number of obvious skills, faults and substandard performance, and requires additional guidance and time to reach minimum standards.

D

**Understanding and applying concepts**

Incorrectly applies scientific principles to describe properties and phenomena.

Presents statements of ideas with limited development of an argument and little use of evidence.

Provides limited cause and effect examples.

Inconsistently recalls facts and includes some irrelevant or confused information.

Inconsistently applies principles to unfamiliar contexts.

Makes little use of information to support a point of view.

**Science Inquiry Skills**

Identifies one or more relevant variables without making links between them.

Identifies a limited number of controlled variables. Does not distinguish between the dependent, independent and controlled variables. Method lacks detail.

Presents data that is unclear, insufficient and lacks appropriate processing. Includes anomalous results in the data without identifying them as anomalous.

Identifies trends in the data incorrectly or overlooks trends. Offers simple conclusions that are not supported by the data or are not related to the hypothesis.

Communicates information using everyday language with frequent errors in the use of conventions.

**Practical**

With guidance and direction makes limited use of resources and achieves limited results that meet some design or performance requirements.

With direction meets minimal 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 skills faults, unsafe practices 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.

<b>Accuracy</b>	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.
<b>Animal ethics</b>	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).
<b>Biosecurity</b>	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.
<b>Data</b>	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.
<b>Ecological survey techniques</b>	Techniques used to survey, measure, quantify, assess and monitor biodiversity and ecosystems in the field; techniques used depend on the subject and purpose of the study. Techniques may include random quadrats, transects, capture - recapture, nest survey, netting, trapping, flight interception, beating trays, dry extraction from leaf litter samples, 3-minute habitat-proportional sampling of aquatic habitats, aerial surveys, and soil, air and water sampling.
<b>Evidence</b>	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.
<b>Genre</b>	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).
<b>Hypothesis</b>	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.
<b>Investigation</b>	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.
<b>Law</b>	A statement describing invariable relationships between phenomena in specified conditions, frequently expressed mathematically.
<b>Measurement error</b>	The difference between the measurement result and a currently accepted or standard value of a quantity.
<b>Media texts</b>	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.

<b>Mode</b>	The various processes of communication – listening, speaking, reading/viewing and writing/creating.
<b>Model</b>	A representation that describes, simplifies, clarifies or provides an explanation of the workings, structure or relationships within an object, system or idea.
<b>Primary data</b>	Data collected directly by a person or group.
<b>Primary source</b>	Report of data created by the person or persons directly involved in observations of one or more events, experiments, investigations or projects.
<b>Reliable data</b>	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.
<b>Reliability</b>	The degree to which an assessment instrument or protocol consistently and repeatedly measures an attribute, achieving similar results for the same population.
<b>Representation</b>	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.
<b>Research</b>	To locate, gather, record, attribute and analyse information in order to develop understanding.
<b>Research ethics</b>	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.
<b>Risk assessment (in the school/agricultural college context)</b>	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.
<b>Secondary data</b>	Data collected by a person or group other than the person or group using the data.
<b>Secondary source</b>	Information that has been compiled from records of primary sources by a person or persons not directly involved in the primary event.
<b>Simulation</b>	A representation of a process, event or system which imitates a real or idealised situation.
<b>System</b>	A group of interacting objects, materials or processes that form an integrated whole. Systems can be open or closed.
<b>Theory</b>	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.
<b>Uncertainty</b>	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.
<b>Validity</b>	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.