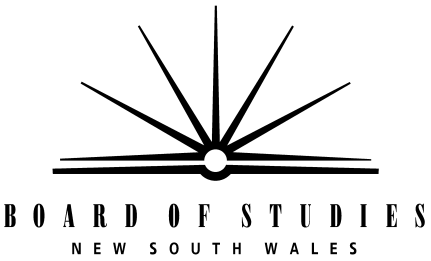

Marine and Aquaculture Technology

Content Endorsed Course
Years 7–10

Syllabus

September 2003

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1 Introduction

1.1 The K–10 Curriculum

This syllabus has been developed within the parameters set by the Board of Studies NSW in its *K–10 Curriculum Framework.* This framework ensures that K–10 syllabuses and curriculum requirements are designed to provide educational opportunities that:

- engage and challenge all students to maximise their individual talents and capabilities for lifelong learning
- enable all students to develop positive self-concepts and their capacity to establish and maintain safe, healthy and rewarding lives
- prepare all students for effective and responsible participation in their society, taking account of moral, ethical and spiritual considerations
- encourage and enable all students to enjoy learning, and to be self-motivated, reflective, competent learners who will be able to take part in further study, work or training
- promote a fair and just society that values diversity
- promote continuity and coherence of learning, and facilitate the transition between primary and secondary schooling.

The framework also provides a set of broad learning outcomes that summarise the knowledge, understanding, skills, values and attitudes essential for all students to succeed in and beyond their schooling. These broad learning outcomes indicate that students will:

- understand, develop and communicate ideas and information
- access, analyse, evaluate and use information from a variety of sources
- work collaboratively with others to achieve individual and collective goals
- possess the knowledge and skills necessary to maintain a safe and healthy lifestyle
- understand and appreciate the physical, biological and technological world and make responsible and informed decisions in relation to their world
- understand and appreciate social, cultural, geographical and historical contexts, and participate as active and informed citizens
- express themselves through creative activity and engage with the artistic, cultural and intellectual work of others
- understand and apply a variety of analytical and creative techniques to solve problems
- understand, interpret and apply concepts related to numerical and spatial patterns, structures and relationships
- be productive, creative and confident in the use of technology and understand the impact of technology on society
- understand the work environment and be equipped with the knowledge, understanding and skills to evaluate potential career options and pathways
- develop a system of personal values based on their understanding of moral, ethical and spiritual matters.

The ways in which learning in the *Marine and Aquaculture Technology Years 7–10 Syllabus* contributes to the curriculum and to the student's achievement of the broad learning outcomes are outlined in the syllabus rationale.

In accordance with the *K–10 Curriculum Framework*, the *Marine and Aquaculture Technology Years 7–10 Syllabus* takes into account the diverse needs of all students. It identifies essential knowledge, understanding, skills, values and attitudes. It enunciates clear standards of what students are expected to know and be able to do in Years 7–10. It provides

structures and processes by which teachers can provide continuity of study for all students, particularly to ensure successful transition through Years 5 to 8 and from Year 10 to Year 11.

The syllabus also assists students to maximise their achievement in Marine and Aquaculture Technology through the acquisition of additional knowledge, understanding, skills, values and attitudes. It contains advice to assist teachers to program learning for those students who have gone beyond achieving the outcomes through their study of the essential content.

1.2 Students with Special Education Needs

In the K–6 curriculum, students with special education needs are provided for in the following ways:

- through the inclusion of outcomes and content in syllabuses which provide for the full range of students
- through the development of additional advice and programming support for teachers to assist students to access the outcomes of the syllabus
- through the development of specific support documents for students with special education needs
- through teachers and parents planning together to ensure that syllabus outcomes and content reflect the learning needs and priorities of individual students.

Students with special education needs build on their achievements in K–6 as they progress through their secondary study and undertake courses to meet the requirements for the School Certificate.

It is necessary to continue focusing on the needs, interests and abilities of each student when planning a program for secondary schooling. The program will comprise the most appropriate combination of courses, outcomes and content available.

Life Skills
For most students with special education needs, the outcomes and content in sections 6 and 7 of this syllabus will be appropriate but for a small percentage of these students, particularly those with an intellectual disability, it may be determined that these outcomes and content are not appropriate. For these students the Life Skills outcomes and content in section 8 and the Life Skills assessment advice below can provide the basis for developing a relevant and meaningful program.

Access to Life Skills outcomes and content in Years 7–10
A decision to allow a student to access the Marine and Aquaculture Technology Years 7–10 Life Skills outcomes and content should include parents/carers and be based on careful consideration of the student's competencies and learning needs.

The decision should establish that the outcomes and content in sections 6 and 7 of the *Marine and Aquaculture Technology Years 7–10 Syllabus* are not appropriate to meet the needs of the student. Consideration should be given to whether modifications to programs and to teaching, including adjustments to learning activities and assessment, would enable the student to access the syllabus outcomes and content.

As part of the decision to allow a student to access the Marine and Aquaculture Technology Years 7–10 Life Skills outcomes and content, it is important to identify relevant settings, strategies and resource requirements that will assist the student in the learning process. Clear time frames and strategies for monitoring progress, relevant to the age of the student, need to be identified and collaborative plans should be made for future needs.

It is not necessary to seek permission of the Office of the Board of Studies for students to undertake the Marine and Aquaculture Technology Years 7–10 Life Skills outcomes and content, nor is it necessary to submit planning documentation.

Life Skills assessment

Each student undertaking the Marine and Aquaculture Technology Years 7–10 Life Skills course will have specified outcomes and content to be studied. The syllabus content listed for each outcome forms the basis of learning opportunities for students.

Assessment should provide opportunities for students to demonstrate achievement in relation to the outcomes and to generalise their knowledge, understanding and skills across a range of situations or environments including the school and the wider community.

Students may demonstrate achievement in relation to Marine and Aquaculture Technology Years 7–10 Life Skills outcomes independently or with support. The type of support will vary according to the particular needs of the student and the requirements of the activity. Examples of support may include:

- the provision of extra time
- physical and/or verbal assistance from others
- the provision of technological aids.

2 Rationale

The oceans, inland waterways and other bodies of water cover more than 70 percent of the earth's surface and influence all forms of life on this planet. Of the 33 animal phyla, 28 are found in water; 13 of these are exclusively marine.

Internationally, the oceans are viewed either as areas rich in minerals and marine life which can supply our needs virtually without limit, or else as repositories for agricultural, industrial and domestic waste. Nationally, the United Nations declaration of the Australian Exclusive Economic Zone in 1994 effectively doubled this country's size and responsibilities. Australia now controls an area of the oceans that is 1.3 times the size of its landmass.

Marine and Aquaculture Technology in Years 7–10 fits into an emerging field of study relating to sustainability of marine and related environments. At a time of pressure on the marine environment there is a recognised need to deliver sound marine educational programs through formal structures within state and national curricula. Australians must be aware of and understand this fragile environment, and consider how to effectively manage 69 630 kilometres of coastline, 14.8 million square kilometres of continental shelf, 12 000 islands, 783 major estuaries and the life they contain.

The development of environmentally or economically sustainable methods of farming fish, mollusks, crustaceans and aquatic plants is now recognised as essential for relieving the pressure on wild fish stocks as well as on the marine and aquatic environment.

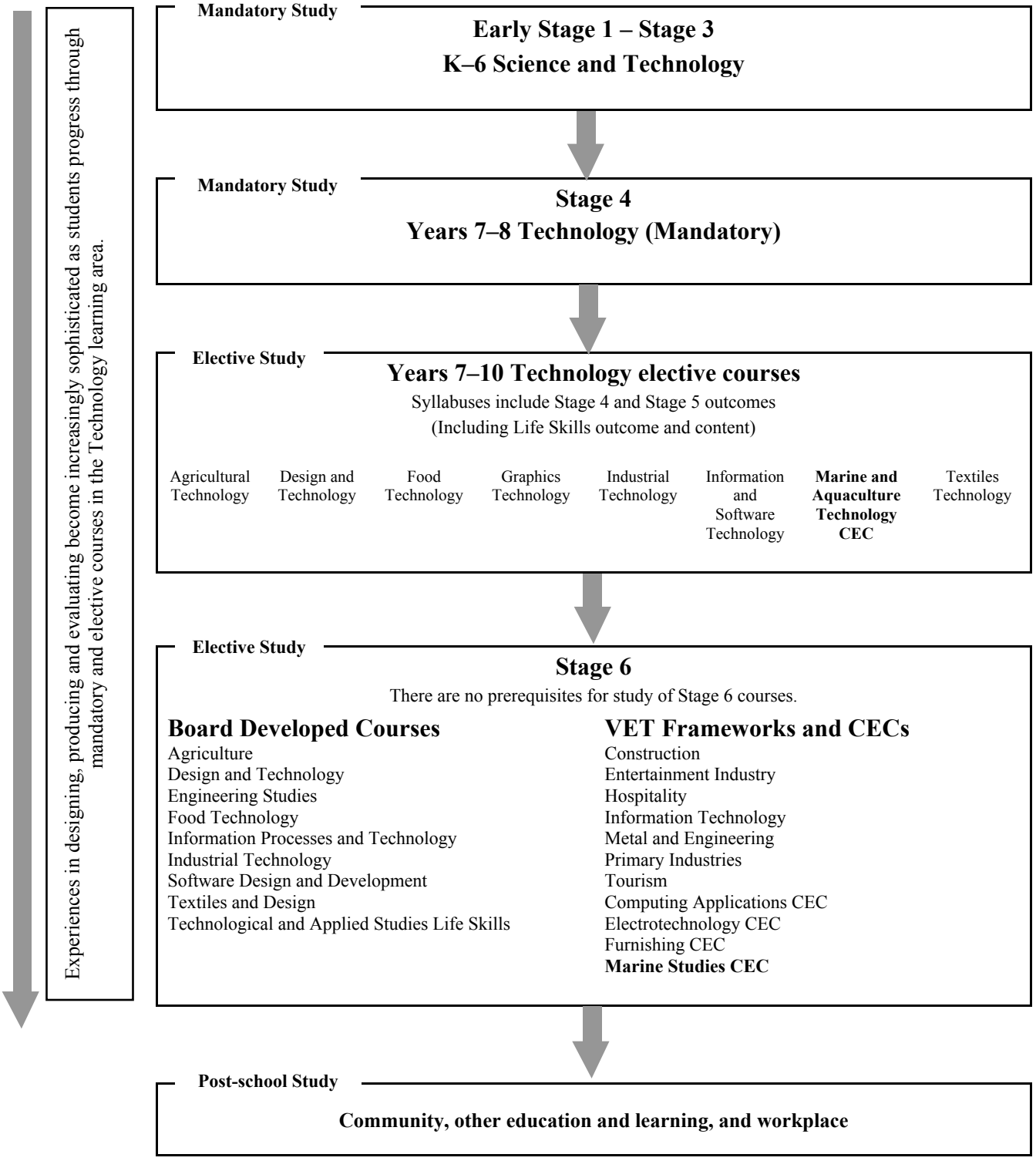
The study of Marine and Aquaculture Technology provides an opportunity for the future custodians of this environment to study it and to appreciate its value. It gives them the opportunity to develop the necessary knowledge and skills to use and protect its unique ecosystems, and at the same time communicate their appreciation to the community. It provides an opportunity to instil in students an acceptable ethical code towards the use of the marine environment, increasingly demanded by the community and governments.

The syllabus provides knowledge, understanding and skills that provide the opportunity for students to make informed arguments for the maintenance of biodiversity and the sustainable use of marine ecosystems. They will be involved in project development relating to coastal areas and other water-related environments, as well as water-related enterprises and leisure activities.

Marine and Aquaculture Technology provides an educational context linked to the needs of a population based very much on its coast and waterways and which fosters links to tertiary study and vocational pathways. Further, this syllabus brings a wide range of marine-based leisure experiences to students in a safe setting. Marine and Aquaculture Technology Studies provides for both practical and theoretical learning, honing students' acquired skills to solve real-life problems.

By studying Marine and Aquaculture Technology students develop technological and scientific literacy. They increase their capacity to think critically by calling upon a wide range of knowledge, procedures and approaches to analyse issues and develop solutions. They are required to examine the impact of technology and human activity on the marine environment.

3 The Place of the Marine and Aquaculture Technology Content Endorsed Course Years 7–10 Syllabus in the Technology K–12 Curriculum



4 Aim

The aim of the *Marine and Aquaculture Technology Years 7–10 Syllabus* is to develop in students a capacity to design, produce, evaluate, sustain, use and manage marine and water-related environments.

5 Objectives

Knowledge, understanding and skills
Students will develop:

1 knowledge, understanding and appreciation of marine and aquatic environments
2 knowledge, understanding and appreciation of the economical sustainability of aquaculture
3 knowledge, understanding and appreciation of the role of aquaculture in the preservation of wild seafood stocks and the marine environment
4 knowledge, understanding, skills and attitudes that promote ethical and sustainable practices in the use, management and protection of the marine environment
5 knowledge, understanding and skills in the responsible selection and safe use of materials, equipment and techniques used in aquaculture and marine and maritime activities
6 knowledge, understanding and appreciation of the industries and organisations using, managing and regulating aquaculture and the marine environment
7 knowledge and skills in researching, experimenting and communicating in marine and aquaculture contexts.

6 Outcomes

Objectives Students will develop:	**Stage 4 Outcomes** A student:	**Stage 5 Outcomes** A student:
1 knowledge, understanding and appreciation of marine and aquatic environments	4.1.1 identifies the nature and scope of the marine and aquatic environment	5.1.1 identifies and describes a range of marine and aquatic ecosystems and investigates their complex interrelationships
	4.1.2 identifies and describes the components of some marine ecosystems	5.1.2 identifies, describes and evaluates the social and economic importance of marine ecosystems
2 knowledge, understanding and appreciation of the economical sustainability of aquaculture	4.2.1 investigates attitudes towards the marine environment as a fisheries resource	5.2.1 identifies, describes and evaluates the effects humans have had on the marine environment
	4.2.2 investigates some of the effects human activity has had on the native fish stocks	5.2.2 explains why aquaculture provides an economically sustainable source of food
3 knowledge, understanding and appreciation of the role of aquaculture in the preservation of wild seafood stocks and the marine environment	4.3.1 identifies the nature and scope of aquaculture	5.3.1 assesses the potential of aquaculture to sustain wild fish stocks and the aquatic environment
	4.3.2 investigates plant and animal species suitable for aquaculture	5.3.2 evaluates the economic and environmental sustainability of aquacultural pursuits
4 knowledge, understanding, skills and attitudes that promote ethical and sustainable practices in the use, management and protection of the marine environment	4.4.1 relates to the ocean and its life forms with a respectful and caring attitude	5.4.1 identifies, describes and evaluates the ethical, social and sustainability issues related to the marine environment
	4.4.2 demonstrates sound and responsible judgement in their personal use of the marine environment	5.4.2 identifies, describes and evaluates policies for monitoring and conserving the marine environment

Objectives Students will develop:	**Stage 4 Outcomes** A student:	**Stage 5 Outcomes** A student:
5 knowledge, understanding and skills in the responsible selection and safe use of materials, equipment and techniques used in aquaculture and marine and maritime activities	4.5.1 selects, organises, assembles, uses, dismantles, cleans and stores equipment appropriately	5.5.1 selects and uses a broad range of contemporary materials, equipment and techniques with confidence in aquaculture and marine settings
	4.5.2 interprets and follows instructions with accuracy	5.5.2 demonstrates safe and responsible use of a range of materials, equipment and techniques in different aquaculture, marine and maritime situations
6 knowledge, understanding and appreciation of the industries and organisations using, managing and regulating aquaculture and the marine environment	4.6.1 identifies employment opportunities in aquaculture, marine and maritime industries	5.6.1 identifies and describes a range of aquaculture, marine and maritime vocations and leisure pursuits
	4.6.2 investigates the opportunities to join volunteer marine-based service organisations	5.6.2 identifies and describes the role of volunteer organisations that assist in the protection and management of the marine environment
7 knowledge and skills in researching, experimenting and communicating in marine and aquaculture contexts	4.7.1 selects and presents the results of appropriate research from a variety of sources	5.7.1 collects and organises data by experimenting and accurately reading instruments, signals and charts and communicates this information
	4.7.2 uses appropriate language, signals, signs and conventions to communicate in marine contexts	5.7.2 recalls aspects of the marine environment using relevant conventions, terminology and symbols

Stage 4 outcomes have been provided to assist the assessment and reporting of student achievement in those schools that choose to begin elective study before Year 9. Teachers are advised to select from the syllabus content to target the specific needs of students who commence study in Stage 4.

Life Skills

For some students with special education needs, particularly those students with an intellectual disability, it may be determined that the above outcomes are not appropriate. For these students, Life Skills outcomes and content can provide the basis for the development of a relevant and meaningful program – see section 8.

7 Content

7.1 Organisation of Content

Essential content
The *Marine and Aquaculture Technology Years 7–10 Syllabus* details the essential knowledge, understanding and skills necessary for students to achieve the syllabus outcomes to enable them to move to further learning or training, or employment, and to enjoy their leisure time during and after the compulsory years of schooling.

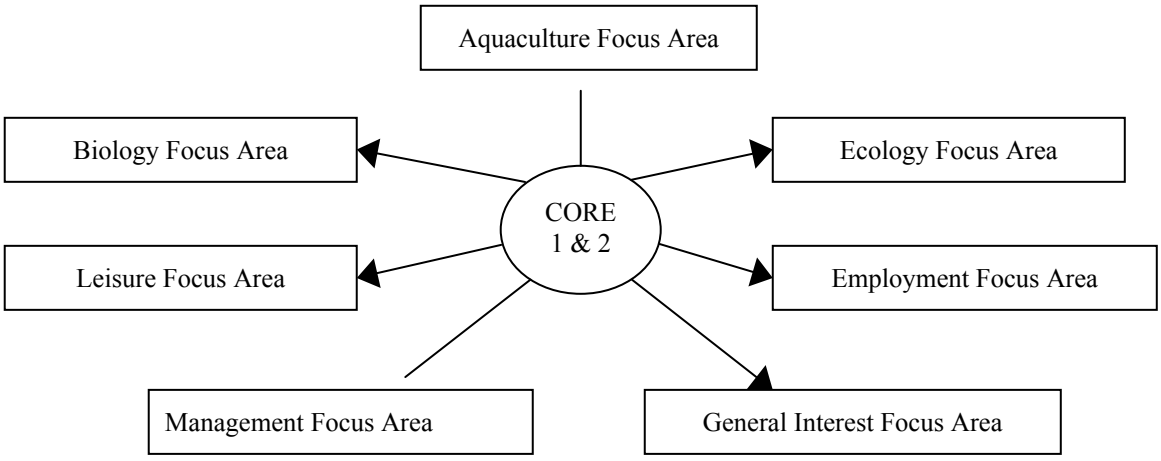
Core units are mandatory and contain essential content. Optional modules contain content that is essential within that specific context.

Additional content
Students can move beyond the essential content in order to broaden and deepen their understanding and skills and to extend their interest in particular aspects of marine and aquaculture technology. Some optional modules include additional content that can be integrated with essential content into units of work.

Marine and Aquaculture Technology can be studied as a 100-hour or 200-hour course in Years 7–10. The syllabus contains mandatory core 1 and 2 and a sufficiently broad range of optional modules to enable students to achieve the syllabus outcomes through a course of study reflecting their interests, location and resources.

Students may study 100-hour or 200-hour courses. In a 100-hour course, students complete Core 1 and any five option modules. In a 200-hour course, students complete Core 1, Core 2 and six option modules additional to those in the first 100 hours. Core 1 is to be studied at the beginning of the course and Core 2 is to be studied at the beginning of the second 100 hours.

A range of student needs can be met using this model and a variety of courses could operate within the one class or the one school. To assist course design the optional modules have been grouped into focus areas.



Modules may be selected from multiple focus areas or from one focus area. They may be delivered as discrete modules or delivered concurrently in an integrated or thematic structure.

Core

Core 1	Introduction to Marine and Aquaculture Technology	25 indicative hours
Core 2	Skills Management and Employment	10 indicative hours

Optional Modules

Content is provided for a range of optional modules in focus areas. Each module is designed for 15 hours indicative course time. Students can specialise by studying multiple modules from a focus area or can undertake a broad selection of modules from across focus areas.

Biology Focus Area

Module 1	Water Birds of NSW
Module 2	Mangroves
Module 3	Microscopic Aquatic Organisms
Module 4	Marine Plants
Module 5	Marine Mammals
Module 6	Dangerous Marine Creatures

Ecology Focus Area

Module 7	The Oceans
Module 8	Rock Platforms
Module 9	Introducing Estuaries
Module 10	Living Together in the Sea
Module 11	Marine Pests and Threats
Module 12	Temperate Marine Ecosystems
Module 13	Antarctica's Marine Ecology
Module 14	The Abyss

Leisure Focus Area

Module 15	Water Craft Design, Construction and Repair
Module 16	Basic Snorkelling
Module 17	Open Water Snorkelling
Module 18	Fish Harvesting
Module 19	Manufacturing Fishing Equipment
Module 20	Boat Building
Module 21	Sailing Theory and Practice

Aquaculture Focus Area

Module 22	Aquarium Design Construction and Maintenance
Module 23	Underwater Farming
Module 24	Designing Systems for Aquaculture
Module 25	Economics of Aquaculture
Module 26	Growing Stockfeed for Aquaculture
Module 27	Biology of Native Crayfish
Module 28	Growing Crustaceans
Module 29	Fish Biology
Module 30	Managing Fish Production
Module 31	Managing Water Quality
Module 32	Pests and Diseases of Aquatic Organisms

Employment Focus Area

Module 33	Small Motorboats
Module 34	Advanced Motor-boating
Module 35	Local Fishing Industries
Module 36	Food from the Sea
Module 37	Maritime Industries and Employment
Module 38	Tourism

Management Focus Area

Module 39	Coastal Management
Module 40	Tides and Currents
Module 41	Marine and Civil Engineering
Module 42	Saving Water Environments
Module 43	Recreational and Community Groups

General Interest Focus Area

Module 44	Shipwrecks and Salvage
Module 45	Basic Navigation
Module 46	Marine Disasters
Module 47	Personal Interest Project
Module 48	Local Area Study

Information for teaching and learning in Marine and Aquaculture Technology
To satisfy the requirements of the syllabus students must undertake a range of practical experiences that occupy the majority of course time. Practical experiences will be used to develop knowledge and understanding of, and skills in, designing, producing and evaluating. Student capability, confidence and expertise at their current stage of development are important considerations in determining the teaching and learning sequences in the course.

In developing and delivering teaching programs teachers should be aware of and adopt relevant guidelines and directives of their education authorities and/or schools. Teaching programs should recognise and reflect relevant state and Commonwealth legislation, regulations, conventions and standards including Occupational Health and Safety, Chemical Safety in Schools and Animal Welfare guidelines. Teachers need to be aware of activities that may require notification, certification, permission, permits and licences.

Programs developed from this syllabus will have an emphasis on first-hand experiences. The levels of student training, capabilities, confidence and expertise at their current stage of development are important considerations in determining the teaching sequence and choice of option modules. Programs will capitalise on the opportunities for skill development and the training of students in skills appropriate to their level of maturity and stage of physical and learning development.

Consideration of related school and systems policies, and accessing community knowledge and/or participation in the planning process, are important steps towards assuring the suitability of programs and teaching approaches.

Teachers are encouraged to use Australian examples and current technology including satellite technology and the internet wherever appropriate.

Life Skills
Life Skills outcomes and content are in section 8.

Cross-curriculum content
Cross-curriculum content assists students to achieve the broad learning outcomes defined in the Board of Studies *K–10 Curriculum Framework*. It is incorporated in the content of the *Marine and Aquaculture Technology Years 7–10 Syllabus* in the following ways:

Information and Communication Technologies (ICT)
Students in all focus areas will integrate a variety of ICT applications through the development, modification, production and evaluation of practical projects. These include the use of:

- databases and spreadsheets in the collection and recording of marine and aquaculture information
- electronic research methods including the internet to access, collect and interpret information
- electronic reports and presentations including word processing in relation to practical and research projects
- electronic and remote sensors in monitoring water quality and aquarium conditions.

Work, Employment and Enterprise

In all aspects of the course students will use appropriate industry terminology and work practices. They learn to identify and describe a range of marine and maritime vocations and volunteer organisations. Students develop an awareness of the range of vocational opportunities available through the study of focus areas. Optional study of the Marine Employment focus area can also be undertaken.

Problem-solving, workplace communication, cooperative work practices and Occupational Health and Safety are embedded in the syllabus.

Civics and Citizenship

Students will develop knowledge and understanding of the place of ethical considerations in scientific and technological practice relating to marine and aquaculture activities.

Difference and Diversity

Students are encouraged to develop skills in a variety of areas in which they are interested. By participating in cooperative work practices they learn to appreciate the various roles and contributions of all people in society.

Students develop the capacity to interact effectively with others individually and in groups. Through team and group tasks they develop an appreciation of individual difference, group dynamics and the benefits of working collaboratively. They demonstrate the ability to adopt a range of roles and to support others in group situations.

Environment

The aim of the syllabus is for students to gain a capacity to develop, sustain, use and manage marine and water-related environments. The core and optional focus areas integrate the studies of marine and water-based environments, enterprises, leisure activities and sustainability.

Gender

Marine and Aquaculture Technology Years 7–10 provides opportunities for students to engage with technological study through a range of focus areas. The diversity of the syllabus is designed to accommodate the interests and needs of all students regardless of gender.

Key Competencies

The course structure and pedagogy provide extensive opportunities to develop the key competencies. Experiences in the development of a variety of practical projects ensure that all the key competencies are addressed. During the course, students learn to:

- source, select and sequence information about issues in a selected focus area, developing competence in *collecting, analysing and organising information*
- debate, describe, discuss and explain ideas and issues in written, graphic and oral form, developing competence in *communicating ideas and information*
- plan, prepare and present project work to meet a range of needs within set time frames, developing competence in *planning and organising activities*
- cooperate with individuals and groups, developing competence in *working with others and in teams*
- design, implement and evaluate solutions to practical situations in a specific focus area, developing competence in *solving problems*

- plan, develop and modify projects including costing, quantities, measurement and time, developing competence in *using mathematical ideas and techniques*
- prepare practical projects using appropriate materials and equipment, developing competence in *using technology*.

Literacy

The use of marine and aquaculture terminology and technical language will be fostered and developed in all focus areas.

Students learn about effective communication using verbal and written techniques, including electronic media. They select and apply communication skills to resolve conflict and effectively respond to others. They demonstrate their communication skills in contexts such as formal presentations, informal interactions and social situations, and during interactions with the community during fieldwork.

Numeracy

Numeracy skills are integral to the development of marine and aquaculture-related projects through measurement, calculation and costing of resources, foods and growth rates.

Across the Years 7–10 curriculum there are other areas of cross-curriculum content that all students will experience through the mandatory curriculum. The additional areas of cross-curriculum content are:

- Aboriginal and Indigenous
- Multicultural.

7.2 Content for Years 7–10

Core 1: Introduction to Marine and Aquaculture Technology

Indicative hours: 25

Description
Core 1 outlines the structure of the course for students, including unit details, duration, equipment required and assessment procedures. It also revises the safety procedures for laboratory exercises and fieldwork. It is a practical unit developing students' water confidence thereby increasing their chance of survival should they ever get into difficulty in water.

Outcomes
A student:

5.1.1	identifies and describes a range of marine ecosystems and investigates their complex interrelationships
5.1.2	identifies, describes and evaluates the social and economic importance of marine ecosystems
5.2.1	identifies, describes and evaluates the effects humans have had on the marine environment
5.2.2	explains why aquaculture provides an economically sustainable source of food
5.4.1	identifies, describes and evaluates the ethical, social and sustainability issues related to the marine environment
5.4.2	identifies, describes and evaluates policies for monitoring and conserving the marine environment
5.5.1	selects and uses a broad range of contemporary materials, equipment and techniques with confidence in aquaculture and marine settings
5.5.2	demonstrates safe and responsible use of a range of materials, equipment and techniques in different aquaculture, marine and maritime situations
5.6.1	identifies and describes a range of aquaculture, marine and maritime vocations and leisure pursuits
5.6.2	identifies and describes the role of volunteer organisations that assist in the protection and management of the marine environment
5.7.1	collects and organises data by experimenting and accurately reading instruments, signals and charts and communicates this information
5.7.2	recalls aspects of the marine environment using relevant conventions, terminology and symbols

Students learn about:	**Students learn to:**
Introduction to Marine and Aquaculture Technology	
· the structure of the course, including unit details, duration, equipment required and assessment procedures	· discuss the structure of the course and understand the options available for specialisation or broad study · discuss the modules being studied, their purpose, duration and interrelationship · discuss requirements for folio/journal/ workbook
· the safety procedures for laboratory exercises and fieldwork	· discuss and understand assessment procedures
· the location of all marine equipment including safety equipment	
· the safety procedures for laboratory exercises and fieldwork	· recall safety procedures for laboratory and fieldwork
Water Safety	
· safety rules for young children around water · safe practices for swimmers · safe practices and behaviours at the beach and/or pool and/or · board-riding and/or · windsurfing and/or · the principles for boating safety and/or · waterskiers and/or canoeists	· swim 200 metres in still water · swim 25 metres fully clothed · swim 10 metres underwater · tread water for 3 minutes · remove clothing while treading water
· safe fishing practices from rocks, and/or the beach and/or boats	· identify dangerous local fishing spots and list the conditions that would make them dangerous
	Additional Content · remove clothing while treading water · make a trouser-float · correctly fit Personal Flotation Device (PFD) · jump into water wearing a PFD · simulate swimming out from under a capsised boat · identify rips at a beach · complete a recognised swimming award

Students learn about:	**Students learn to:**
General First Aid	
· emergency care and the Danger, Response, Send for help, Airway, Breathing, CPR, Defibrillator (if available) (DRSABCD) plan of action	· recognise the causes and treatment of breathing difficulties
· Cardiopulmonary Resuscitation (CPR)	· treat simulated bleeding
· first aid	· treat simulated soft tissue injuries, including sprains and bruises · recognise the causes and treatment of shock · treat or remove foreign bodies · treat simulated envenomation
· local venomous organisms and their treatments	
Maintaining Equipment Used in Water	
· destructive forces found in the marine environment	· clean, dry and store personal equipment such as swimwear and snorkelling equipment
· the effects of salt, water, sunlight and living things on common equipment	· investigate the effects of sunscreen, outboard fuel and solvents on swimwear
· the procedures for maintaining personal swimming gear	· dismantle, clean and oil a fishing reel
· the procedures for maintaining personal snorkelling gear	
· the procedures for maintaining fishing equipment	
· the procedures for maintaining aluminium dinghies	· clean, dry and store large equipment, eg aluminium boats and surfboards
· the procedures for maintaining outboard motors	**Additional Content**
· the procedures for maintaining surf craft	· swab and culture organisms from inside dirty snorkels
The Marine Environment	
· the physical features of the marine environment	· examine life adaptations, eg fish scales
· the effects these have on marine life	· compare and contrast life on land and life in water
· comparison between marine and terrestrial environments	· access, collect and interpret electronic information from the internet when comparing marine and terrestrial environments
· the importance of the marine environment	
· some of the problems facing the marine environment	**Additional Content**
· Aboriginal use of the marine environment pre-1770 and Australian usage post-1770	· extract salt from sea water · examine sand grains under a microscope

Notes for teachers

Course Introduction
Core 1 is foundational for the first 100 hours of study.

Water Safety
Refer to the relevant safety guidelines of school authorities when conducting sport, physical or water-related activities.

Core 1 should be taught in a 50-metre swimming pool.

It is recommended that the Royal Life Saving Society (RLSS) swimming award corresponding to the student's age be considered for incorporation into the module. Completion of such an award would satisfy all outcomes for the water saftey section of Core 1.

General First Aid
Core 1 is designed to provide a basic understanding of the theory behind the practical first aid that may be needed by these students as they use the surf and river for recreational activity. It is designed to assist them should they progress to a St John or equivalent First Aid Certificate.

Experience has shown that sunburn, cuts and abrasions and marine coelenterate stings are the main injuries needing field treatment.

Maintaining Equipment Used in Water
This study should be limited to the equipment the students will be using at school and at home:

- personal equipment such as swimwear, snorkelling equipment
- metal equipment such as boats, tools, fittings
- composite materials in bodyboards and surfboards.

Students should be made aware of the effects of salt water on vehicles such as cars, bikes and marine equipment. Hence the innappropriatness of taking wet equipment or wet people in vehicles should be reinforced.

The Marine Environment
This module aims to make students think about the 'differences' between life in salt water and that on land.

Core 2: Skills, Management and Employment

Indicative hours: 10

Description

Core 2 is a practical unit designed to re-accredit students in water safety and first aid for their water work in the second half of the 200-hour course. It also introduces students to the statutory bodies and the volunteer organisations that combine to manage the use of the marine environment in a safe and responsible manner. It makes them aware of the roles played by each organisation and encourages them to join a volunteer body.

Outcomes

A student:

5.1.1 identifies and describes a range of marine ecosystems and investigates their complex interrelationships

5.2.1 identifies, describes and evaluates the effects humans have had on the marine environment

5.4.1 identifies, describes and evaluates the ethical, social and sustainability issues related to the marine environment

5.6.1 identifies and describes a range of aquaculture, marine and maritime vocations and leisure pursuits

5.6.2 identifies and describes the role of volunteer organisations that assist in the protection and management of the marine environment

5.7.1 collects and organises data by experimenting and accurately reading instruments, signals and charts and communicates this information

Students learn about:	**Students learn to:**
Water Safety Re-accreditation	
· safe practices for swimmers · safe practices and behaviours at the beach and/or · board-riding and/or windsurfing · the principles for boating safety and/or · waterskiers and/or canoeists · safe fishing practices from rocks and/or the beach and/or boats	· swim 200 metres in still water · swim 25 metres fully clothed · swim 10 metres underwater · tread water for 3 minutes · identify dangerous local fishing spots and list the conditions that would make them dangerous **Additional Content** · remove clothing while treading water · make a trouser-float · correctly fit a Personal Flotation Device (PFD) · jump into water wearing a PFD · simulate swimming out from under a capsised boat · identify rips at a beach

Students learn about:	**Students learn to:**
General First Aid · emergency care and the Danger, Response, Send for help, Airway, Breathing, CPR, Defibrillator (if available) (DRSABCD) plan of action · Cardiopulmonary Resuscitation (CPR) · marine first aid	· pass practical resuscitation tests using mannekins · apply first aid to common injuries
Management and Employment · statutory bodies and volunteer organisations that regulate and manage aquatic habitats · statutory bodies and volunteer organisations that regulate and manage fish stocks · statutory bodies and volunteer organisations that regulate and protect marine mammals and reptiles · statutory bodies and volunteer organisations that regulate aquaculture · employment opportunities for both females and males within these organsiations, and recruitment procedures	· research the roles and responsibilities of NSW Fisheries, NSW National Parks and Wildlife Service, NSW Department of Land and Water Conservation, Fishwatch, OceanWatch, Dune Care, Coast Care · research the local volunteer groups that accept school students as members · identify and discuss the cooperative nature of volunteer groups · investigate the daily routine of a volunteer marine operations centre

Notes for teachers

Skills re-accreditation

Teachers should refer to the relevant safety guidelines of school authorities when conducting sport, physical or water-related activities.

Core 2 should be taught in a 50-metre swimming pool.

Gaining the Royal Life Saving Society (RLSS) swimming award corresponding to the student's age would satisfy the outcomes for Core 2.

Students should be capable of dealing with sunburn, cuts and abrasions in the field.

Focus Area: Biology

Indicative hours: 90 indicative hours of content are provided for this focus area in six optional modules. Each module is designed for 15 hours indicative course time. Students can specialise by studying multiple modules from this focus area or can undertake a selection of modules from across focus areas. Modules can be studied individually or integrated.

Description

Module 1 – Water Birds of NSW, introduces the variety and abundance of seabirds found along the NSW coastline. This module provides an ideal opportunity to highlight those species that migrate to the NSW coastline each year as well as native Australian species.

Module 2 – Mangroves, develops an awareness of the scope and importance of mangrove communities in NSW. Students should consider the vulnerability of these communities and threats to them as the population increases in coastal areas.

Module 3 – Microscopic Aquatic Organisms, introduces the variety, abundance and importance of the microscopic aquatic organisms that make up plankton. Students will be made aware of the huge numbers of these organisms that are too small to be seen with the human eye and their importance to the organisms that depend on them.

Module 4 – Marine Plants, introduces the variety and importance of plants found in water. Many aquatic plants are very different from terrestrial plants – all are important as producers in aquatic food webs.

Module 5 – Marine Mammals, introduces the biology of marine mammals, with the opportunity to complete a 'case study' of a mammal of interest to them.

Module 6 – Dangerous Marine Creatures, develops an awareness of the dangerous marine creatures they may encounter during their course and the behaviour of these creatures, to assist students to avoid contact with them.

Outcomes

A student:

5.1.1	identifies and describes a range of marine ecosystems and investigates their complex interrelationships
5.1.2	identifies, describes and evaluates the social and economic importance of marine ecosystems
5.2.1	identifies, describes and evaluates the effects humans have had on the marine environment
5.2.2	explains why aquaculture provides an economically sustainable source of food
5.4.1	identifies, describes and evaluates the ethical, social and sustainability issues related to the marine environment
5.4.2	identifies, describes and evaluates policies for monitoring and conserving the marine environment
5.5.1	selects and uses a broad range of contemporary materials, equipment and techniques with confidence in aquaculture and marine settings
5.5.2	demonstrates safe and responsible use of a range of materials, equipment and techniques in different aquaculture, marine and maritime situations

5.6.1 identifies and describes a range of aquaculture, marine and maritime vocations and leisure pursuits 5.7.2 recalls aspects of the marine environment using relevant conventions, terminology and symbols	
Students learn about:	**Students learn to:**
Module 1 – Water Birds of NSW · the main species of water birds (both migratory and non-migratory) in NSW using observations and photographs · mapping the migratory paths of three birds · adaptations of water birds that make them different from land birds · interaction between humans and water birds in NSW and the resultant effect on water bird numbers	· identify common water birds · identify, discuss and demonstrate adaptations of birds, eg through the use of plaster and latex casts of bird footprints · observe and record the behaviour of water birds in a feeding group · identify and represent the characteristics of water birds such as making models or mobiles · identify and record, in a database, the species present in water bird communities sighted from the feathers collected
Module 2 – Mangroves · physical features of a mangrove environment · the distribution of mangroves in NSW · the features of four mangrove species found in NSW · the adaptations of these mangrove species for salt water, aeration, seed dispersal · the importance of mangroves to the life cycles of fish, crustaceans, molluscs · animals found among mangroves · the threats to mangrove communities in NSW	· identify common marine animals found in a mangrove environment · construct a food chain for a mangrove community · identify organisms in mangrove communities · debate the importance of mangroves · identify areas from which mangroves have been removed
Module 3 – Microscopic Aquatic Organisms · plankton · the difference between permanent and temporary plankton · distinguishing between phytoplankton and zooplankton · phytoplankton as a photosynthetic plant · phytoplankton as the major source of oxygen in our atmosphere	· examine and identify features of plankton under the microscope · design and construct a food pyramid for the ocean · investigate the effect of oil on plankton **Additional Content** · design, produce and evaluate a plankton net

Students learn about:	**Students learn to:**
· the role of plankton in the marine food chain	· trawl for plankton using a plankton net to obtain specimens · stain plankton to observe internal structure
Module 4 – Aquatic Plants · the role of plants as producers in an ecosystem · the main types of plants found in the sea · the difference between cyanobacteria, diatoms and dinoflagellates · the characteristics of algae · the types and importance of seagrasses · the contrast between dune plants and aquatic plants	· make a dried algae collection · collect foods made from or containing marine algae · draw life cycle diagrams for *Ulva* or *Zostera* **Additional Content** · grow seagrass from rhizomes · trawl for phytoplankton · extract agar from seaweed
Module 5 – Marine Mammals · the general characteristics of marine mammals · the basic anatomical parts of marine mammals · the basic physiology of marine mammals · the physiology of marine mammals compared to humans · the use of marine mammals for human food, especially in Aboriginal communities	· research a selected marine mammal: general description basic anatomy and physiology, life cycle and diet, adaptations, distribution, economic importance · prepare a written, audio, video or digital presentation report of this research project **Additional Content** · examine and record the external features of a common marine mammal · examine a skeleton or a model of the anatomy of a marine mammal
Module 6 – Dangerous Marine Creatures · the psychology behind our fear of dangerous marine creatures, including the role of movies and journalism in creating myths and phobias · dangerous marine creatures as either aggressors or retaliators · the warning signs of aggression in sharks · the territorial nature of saltwater crocodiles related to attacks on humans	· debate the statement – 'What we don't understand we fear and what we fear we fight' · identify dangerous marine creatures from photographs or preserved specimens · investigate the treatment for some of the following: – stingray slash – jellyfish sting – bullrout or stonefish sting – old maid wound

Students learn about:	**Students learn to:**
· stingrays, jellyfish, cone shells, stonefish, bullrouts, old maids, sea snakes and blue-ringed octopus as retaliators · first aid procedures for injuries caused by stingrays, jellyfish, bullrouts, cone shells, stonefish, old maids, sea snakes and blue-ringed octopus	· treat a sea snake bite · use a first aid kit to treat a simulated marine bite sting or puncture wound

Notes for teachers

Local wildlife carers and rescue groups may be good source of practical assistance for Module 1.

It is recommended that students keep a sighting log during Module 2.

Relevant government departments and tertiary institutions may have useful resource materials relating to mangroves.

An excursion to a mangrove community could be considered during this focus area.

A number of marine and biology texts have a range of simple experiments for the collection, staining and observation of plankton.

Collection of human foods made from or containing seaweed is a recommended exercise for this focus area and can be done as a class project.

Many of the marine anatomy and physiology books have been written at tertiary level but do contain good source material and diagrams.

Organs common to humans and marine creatures, and differences in organs, should be mentioned as part of this study. Similarities or differences compared to human biology.

Marine mammals, dead or alive, are protected by NSW law. NSW National Parks and Wildlife Service (NPWS) licences are required to collect, preserve and display material from dead marine mammals. No marine mammal or its remains should be taken without NSW NPWS permission.

There is a wide range of websites, texts and manuals on the effects and treatment of injuries caused by dangerous marine creatures.

Teachers should be aware of current information on the treatment of marine injuries.

The importance of danger avoidance is to be stressed in this focus area. It also provides a good opportunity to make students aware that many animals are not dangerous if left alone and that seemingly docile and harmless animals, when irritated, may become aggressive.

Focus Area: Ecology

Indicative hours: 120 indicative hours of content are provided for this focus area in eight optional modules. Each module is designed for 15 hours indicative course time. Students can specialise by studying multiple modules from this focus area or can undertake a selection of modules from across focus areas. Modules can be studied individually or integrated.

Description

Module 7 – The Oceans, introduces students to the formation, size and nature of the world's oceans.

Module 8 – Rock Platforms, introduces rock platforms and the animals and plants that commonly live there. Students are made aware of the harshness of the rock platform habitat and the adaptations that organisms living on it need for survival.

Module 9 – Introducing Estuaries, introduces the complexities and fragility of estuarine ecosystems. Students will be made aware of the importance of estuaries to the whole marine ecosystem. They will learn to appreciate the need to monitor and conserve estuaries.

Module 10 – Living Together in the Sea, introduces an awareness of the relationships between organisms living together in the sea. It provides an ideal context to examine a range of relationships, both beneficial and harmful, between marine creatures.

Module 11 – Marine Pests and Threats, introduces an awareness of the pests and threats that can affect the NSW marine environment, and the steps that can be taken to minimise the impact on the environment and economy.

Module 12 – Temperate Marine Ecosystems, introduces marine ecosystems found in temperate waters, which is the marine ecosystem most NSW schools have access to.

Module 13 – Antarcica's Marine Ecology, introduces the marine ecosystems around the frozen continent of Antarctica. Students are made aware of the effects of the Antarctic convergence or high oxygen levels on marine life in the region.

Module 14 – The Abyss, introduces the conditions and life forms found in the ocean depths.

Outcomes
A student:

5.1.1 identifies and describes a range of marine ecosystems and investigates their complex interrelationships

5.1.2 identifies, describes and evaluates the social and economic importance of marine ecosystems

5.2.2 explains why aquaculture provides an economically sustainable source of food

5.4.1 identifies, describes and evaluates the ethical, social and sustainability issues related to the marine environment

5.4.2 identifies, describes and evaluates policies for monitoring and conserving the marine environment

5.5.1 selects and uses a broad range of contemporary materials, equipment and techniques with confidence in aquaculture and marine settings

5.5.2 demonstrates safe and responsible use of a range of materials, equipment and techniques in different aquaculture, marine and maritime situations

5.7.1 collects and organises data by experimenting and accurately reading instruments, signals and charts and communicates this information

5.7.2 recalls aspects of the marine environment using relevant conventions, terminology and symbols

Students learn about:	**Students learn to:**
Module 7 – The Oceans · major oceans and seas of the world · how the oceans were formed and why they are salty · terms used in the study of oceans: sea, bay, gulf, strait · the continental shelf, continental slope and abyssal plain · the water cycle · the greenhouse effect and how it may affect the oceans · the importance of the oceans to humans	· label major oceans and seas on a world map · draw and label a scale diagram of an ocean bottom profile · use graphs to compare ocean depths to mountain heights · research the physical conditions at various ocean depths and animals and plants that live at those depths
Module 8 – Rock Platforms · rock platform cross-sections · the physical factors affecting organisms on the rock platform: temperature, light, wave action, wind speed and direction, salinity of water in rock pools · plants and animals commonly found on the rock platform · adaptations that help these plants and animals survive on a rock platform · the importance of rock platforms · human and natural factors that can disrupt a rock platform ecosystem	· recognise animals on a rock platform that feed as: browsers, carnivores, scavengers, detrital feeders, filter feeders · recognise examples of different rock platform plants · construct food chains and a food web for the organisms on the rock platform · investigate the various ways humans affect the rock platform · profile a rock platform

Students learn about:	**Students learn to:**
Module 9 – Introducing Estuaries · what an estuary is · different types of estuaries · the physical features of an estuary · human uses of estuaries · the importance of seagrasses to the estuarine food web · the importance of estuaries as the interface between land and sea as well as sources of shelter and food for marine organisms · the importance of estuaries in the life cycles of many marine species	· locate and label natural and introduced features on a map of a local estuary (eg mangroves, seagrass beds, sandbars, bridges, wharves, channels, islands etc) · brainstorm commercial and non-commercial uses made of estuaries · design, produce and evaluate posters advertising the need to protect our estuary · research local estuary fish varieties **Additional Content** · snorkel over seagrass beds · examine seagrass specimens
Module 10 – Living Together in the Sea · habitats and ecosystems in the sea · structural, functional and behavioural adaptations of marine organisms · relationships between organisms in the sea including examples of predation, competition, mutualism, commensalism and parasitism · food chains and food webs for different regions of the ocean	· research modern techniques used to study the oceans · identify the adaptations of kelp, chitons and fish · observe territorial behaviour of fish in an aquarium · classify organisms as producers, consumers and decomposers · classify organisms as herbivores, carnivores and omnivores · identify detrital feeders · draw a food chain for the ocean
Module 11 – Marine Pests and Threats · different marine pests · the different effects these pests may have, including: competition for food, competition for space, production of toxins, predation · important examples of natural and introduced marine pests · the difference between pests and a threat · ballast water and how it can be a threat · the transportation of fouling organisms · the role played by government authorities in protecting the marine environment, eg Customs, Department of Health	· use a variety of sources including the internet to research the major threats to our marine environment · map the major outbreaks of crown-of-thorns starfish · research the problem effect of one introduced pest species on a marine ecosystem · research methods used to reduce the risk of introducing pests in ballast water **Additional Content** · investigate historical ballast dumps in NSW waterways

Students learn about:	**Students learn to:**
Module 12 – Temperate Marine Ecosystems · physical characteristics of temperate marine ecosystems · climate impacts on these systems · marine plant life in temperate waters · marine animal life in temperate waters · human activity and its effects on these ecosystems	· compare and contrast the features of temperate and tropical sea water · compare and contrast the features of temperate and tropical marine ecosystems · research the types of thermal protection needed in temperate and cold water · construct temperate water food chains · use the internet to track water movements around Australia
Module 13 – Antarctica's Marine Ecology · the Antarctic continent · the climate and weather conditions that impact on the marine environment · Antarctic convergence and the richness of Antarctic waters · Antarctic marine life including the importance of krill, birds, mammals and fish · significance of Antarctica and some of the problems created by human exploration	· use the internet to view remote sensors located in Antarctica · research the work of early Antarctic explorers such as Sir Douglas Mawson · examine krill specimens or photos or videos from Antarctica
Module 14 – The Abyss · the areas of the world's oceans that are abyssal · the physical features of the abyssal zone: light, temperature, dissolved oxygen, pressure · the life forms that live in this zone · the adaptations life forms use to survive in the abyss	· research the methods used by scientists to examine the ocean depths · research the nature of life forms found in the abyss · compare and contrast life forms on the continental shelf with those in the abyss

Notes for teachers

NSW State Fisheries permits and licences may be required if:
(i) undersized fish are caught or displayed
(ii) endangered species are held.

Module 8 – Rock Platforms could involve a field trip to a rock platform.

NSW Fisheries has extensive maps of NSW estuaries as well as publications on the nature, scope and importance of estuaries.

Statutory bodies including NSW Department of Public Works and Services, NSW Department of Land and Water Conservation, NSW National Parks and Wildlife Services, NSW Department of Agriculture, Waterways Authority of NSW, as well as flood mitigation authorities and local shire councils are excellent sources of information on estuaries in general and local estuaries in particular.

NSW Environmental Protection Authority, Ocean Watch Australia, and the Australian Marine Conservation Society are other good sources of information for Module 11 – Marine Pests and Threats.

Australian examples should be used in this focus area.

Focus Area: Leisure

Indicative hours: 105 indicative hours of content are provided for this focus area in seven optional modules. Each module is designed for 15 hours indicative course time. Students can specialise by studying multiple modules from this focus area or can undertake a selection of modules from across focus areas. Modules can be studied individually or integrated.

Description

Module 15 – Water Craft Design, Construction and Repair, develops an insight into the materials and processes used in the construction and maintenance of water craft. Students will also be introduced to elementary design and materials used in construction that dictate the performance of craft.

Module 16 – Basic Snorkelling, introduces the theory and practice of snorkelling. This module aims to give lifelong skills that will enable students to safely enjoy viewing marine life in shallow water.

Module 17 – Open Water Snorkelling, develops skills and confidence in snorkelling in open water. On completion of this module, students should have developed the skills and confidence to snorkel in a range of open waters.

Module 18 – Fish Harvesting, introduces the methods used to catch fish. Students will be required to relate each method to the behaviour and physiology of the animals being caught.

Module 19 – Manufacturing Fishing Equipment, introduces assembly techniques for basic fishing tackle made from readily available components and construction of simple items such as sinkers and spinners from common materials.

Module 20 – Boat Building, introduces the features of small boat hulls through the construction of models.

Module 21 – Sailing Theory and Practice, introduces the theory and practice of sailing small craft.

Outcomes

A student:

5.2.1	identifies, describes and evaluates the effects humans have had on the marine environment
5.2.2	explains why aquaculture provides an economically sustainable source of food
5.4.1	identifies, describes and evaluates the ethical, social and sustainability issues related to the marine environment
5.4.2	identifies, describes and evaluates policies for monitoring and conserving the marine environment
5.5.1	selects and uses a broad range of contemporary materials, equipment and techniques with confidence in aquaculture and marine settings
5.5.2	demonstrates safe and responsible use of a range of materials, equipment and techniques in different aquaculture, marine and maritime situations

5.6.1 identifies and describes a range of aquaculture, marine and maritime vocations and leisure pursuits 5.7.1 collects and organises data by experimenting and accurately reading instruments, signals and charts and communicates this information 5.7.2 recalls aspects of the marine environment using relevant conventions, terminology and symbols	
Students learn about:	**Students learn to:**
Module 15 – Water Craft Design, Construction and Repair · design features of a surfboard, including: size, rocker, plan shape, fins, fin placement, bottom shape, rail shape, thickness · design features relating to the performance of a surfboard · materials and construction techniques used in the manufacture of surfboards · fabrication sequence for a conventional surfboard · stages in the repair of fibreglass craft · employment opportunities in watercraft industries	· investigate the latest technology and future directions in surfboard, waterski or kayak construction such as epoxy, carbon fibre, wood laminates, vacuum bagging **Additional Content** · interpret the identify and describe the specific roles of a surfboard manufacturer · repair a fibreglass sea craft for one or more of the following: a simple shatter, a rail or penetration ding, fin cracks or fin replacement, stress marks, creases, application of textured deck to strengthen a depressed board, a snapped board · patch an inflatable surf craft
Module 16 – Basic Snorkelling · methods that humans have used throughout history to swim underwater · reasons for snorkelling · effects of water and water pressure on various parts of our body and the methods we use to overcome these effects · basic snorkelling equipment · features that should be considered when purchasing basic snorkelling equipment · safety rules for snorkelling, including the importance of the buddy system, 'diver below' flag etc · standard hand signals used when snorkelling	· scull 50 metres · duck dive to 2 metres depth · defog a mask · fit mask and fins correctly · fin 400 metres · clear mask underwater · recover a coin in 2 metres of water · swim 50 metres with snorkel but no mask · treat a leg cramp in a buddy · use a tired snorkeller tow for 50 metres · support an unconscious buddy for 5 minutes in deep water · snorkel in enclosed water
Module 17 – Open Water Snorkelling · snorkelling rules · safety procedures for open water snorkelling	· make a 'diver below' flag · predict possible dangers at diver sites

Students learn about:	**Students learn to:**
· equipment needed for open water snorkelling · employment opportunities associated with snorkelling	· research contents for and pack a first aid kit · check equipment used on a snorkelling trip · assess fitness of self and buddy to undertake the dive · complete a dive log sheet **Additional Content** · observe the operation of a commercial diving organisation that takes snorkel charters · notify relevant authorities, including relatives, prior to the dive
Module 18 – Fish Harvesting · procedures relating to obtaining an amateur fishing licence · requirements for a professional fishing licence · various methods used to catch fish including Aboriginal methods · relationships between the method of capture to the physiology of the fish · different lines used to catch fish, including: hand lines, pole line, rod and reel, long lines, drop lines and set lines · differences between and uses of trawl nets, gill nets and seine nets · spears and their fish-catching functions · fish traps and how they work · features of the fish species caught in the local area · employment opportunities associated with amateur and professional fishing	· tie different strength knots in fishing lines · select the correct hook for the type of fish being sought · select the correct bait for the type of fish being sought · catch bait · rig a handline or rod and reel · catch fish using a line · rig a bait net **Additional Content** · use a hand net (scoop or seine) · make a simple fish trap · identify fish species caught in the local area
Module 19 – Manufacturing Fishing Equipment · techniques used to prepare and set up hand spools · fishing rod manufacture from a blank · sinker manufacture · spinner manufacture	· tie line on a hand spool · make spinners from a spoon · rig lines for beach and estuary fishing

Students learn about:	**Students learn to:**
· rigging techniques for estuary and beach fishing · employment opportunities in fishing equipment manufacturing industries	**Additional Content** · produce a fishing rod from a blank · make sinkers using a mould · design and produce fish traps and crab traps
Module 20 – Boat Building · parts of a hull · hull design · model hull construction · techniques used to test hull efficiency · employment opportunities in boatbuilding industries	· research the development of hulls from the coracle to the modern aluminium dinghy · design and construct model hulls and/or boats · investigate boatbuilding materials and enter anticipated costs for a project into a spreadsheet · investigate early boatbuilding techniques **Additional Content** · test model hulls in a drag tank · observe large-scale ship construction at a local shipyard
Module 21 – Sailing Theory and Practice · parts of a small boat, windsurfer or sailboard · functions of these parts in propelling and controlling the craft · wind and its effects on sailing craft · the points of sail · employment opportunities associated with sailing	· rig a sailing craft · launch a sailing craft · sail with the wind · tack and gybe · recover a capsised craft · research early sail design · investigate the sailing techniques used by early mariners

Notes for teachers

OHS requirements of school authorities must be observed for all work, including working with fibreglass and epoxy resins.

Regulations of school authorities applying to snorkelling, water sports and activities must be followed.

Module 16 – Basic Snorkelling is a prerequisite unit for Module 17 – Open Water Snorkelling. This focus area must only be undertaken by students who have successfully completed Module 16 – Basic Snorkelling and who are confident and proficient snorkellers.

Relevant government departments may provide advice on the delivery of Module 18 – Fish Harvesting.

Commercially available boatbuilding kits have been used in some schools for Module 20 – Boat Building. Construction of a dinghy from plans or from a commercial kit satisfies all outcomes for Module 20 – Boat Building.

Completion of Australian Yachting Federation (AYF) sailing accreditation course will satisfy the content of Module 21 – Sailing Theory and Practice.

Focus Area: Aquaculture

Indicative hours: 165 indicative hours of content are provided for this focus area in 11 optional modules. Each module is designed for 15 hours indicative course time. Students can specialise by studying multiple modules from this focus area or can undertake a selection of modules from across focus areas. Modules can be studied individually or integrated.

Description

Module 22 – Aquarium Design, Construction and Repair, introduces students to the principles involved in the construction and maintenance of an aquarium. It gives students an appreciation of the different requirements of marine and terrestrial animals and some of the special needs of fish when kept as pets.

Module 23 – Underwater Farming, introduces the concepts in and basic practices involved in aquaculture. The module raises students' awareness of the finite nature of marine resources and the pressure placed on marine species used for human food. It shows aquaculture as a feasible supplementation and alternative to large-scale wild capture.

Module 24 – Designing Systems for Aquaculture, introduces systems used in intensive and extensive aquaculture. They will be required to analyse and evaluate the systems currently used in both systems.

Module 25 – Economics of Aquaculture, provides the opportunity for students to complete a case study of an existing or hypothetical aquaculture facility to determine its economic viability and profitability.

Module 26 – Growing Stockfeed for Aquaculture, introduces methods of growing food for animals used in aquaculture concentrating on feeding the early stages of stock adjustment.

Module 27 – Biology of Native Crayfish, introduces students to the basic anatomy and physiology of native crayfish and their reproduction.

Module 28 – Growing Crustaceans, introduces the relationship between basic anatomy, physiology and behaviour of crustaceans to growing these animals for human food.

Module 29 – Fish Biology, introduces the anatomy and physiology of fish.

Module 30– Managing Fish Production, introduces the general principles of animal husbandry, specifically those required by fish farmers.

Module 31 –Managing Water Quality, develops an awareness of the importance of water quality, the factors affecting it and the methods used to monitor water quality. Students are made aware of the effects of poor water quality on aquatic and marine plants and animals.

Module 32 – Pests and Diseases of Aquatic Organisms, introduces the common pests and diseases which may limit aquaculture production.

Outcomes
A student:

5.1.2 identifies, describes and evaluates the social and economic importance of marine ecosystems

5.2.2 explains why aquaculture provides an economically sustainable source of food

5.3.1 assesses the potential of aquaculture to sustain wild fish stocks and the aquatic environment

5.3.2 evaluates the economic and environmental sustainability of aquacultural pursuits

5.4.1 identifies, describes and evaluates the ethical, social and sustainability issues related to the marine environment

5.4.2 identifies, describes and evaluates policies for monitoring and conserving the marine environment

5.5.1 selects and uses a broad range of contemporary materials, equipment and techniques with confidence in aquaculture and marine settings

5.5.2 demonstrates safe and responsible use of a range of materials, equipment and techniques in different aquaculture, marine and maritime situations

5.6.1 identifies and describes a range of aquaculture, marine and maritime vocations and leisure pursuits

5.7.1 collects and organises data by experimenting and accurately reading instruments, signals and charts and communicates this information

5.7.2 recalls aspects of the marine environment using relevant conventions, terminology and symbols

Students learn about:	**Students learn to:**
Module 22 – Aquarium Design, Construction and Maintenance · aquariums as a balanced community · comparing and contrasting an aquarium to the natural environment it simulates · aquarium-keeping as a widespread recreational and educational activity · information gained from aquarium-keeping helps in the establishment of aquaculture practices · aquariums as freshwater, marine, tropical, temperate environments · equipment needed to make a viable aquarium · animals and plants that could be kept in a marine aquarium	· construct a working aquarium involving the following principles: filtration of solids, removal of wastes, control of algae, dissolved oxygen supply, balanced community relationships · recognise and rectify problems that may arise in aquarium maintenance · construct a biofilter **Additional Content** · collect aquarium fish · monitor water quality using remote sensors and digital recording techniques
Module 23 – Underwater Farming · the variety of resources found in the ocean which humans are able to use	· maintain aquatic organisms in an aquarium · raise aquatic organisms from eggs or juveniles

Students learn about:	**Students learn to:**
· harvest rates, and the need to take into account the growth/replenishment rate · effects of improved fishing technology and newly exploited resources (eg krill, kelp) on the quality and quantity of harvested seafoods · aquaculture and its origins · aquaculture involving farming · types of underwater farms · the role of hatcheries in aquaculture · methods used to grow seaweed · methods used to farm various invertebrates · major problems facing aquaculturalists · employment opportunities in aquaculture	· test the effects of diet on growth rates in aquatic organisms **Additional Content** · wild catch a common estuary fish and grow it out · measure the growth rates of fish · assess operational procedures on an aquaculture farm
Module 24 – Designing Systems for Aquaculture · differences between intensive and extensive aquaculture · low-cost traditional intensive aquaculture in Asian countries · modern extensive aquaculture farm designs · intensive aquaculture design · artificial wetlands and biofilter design	· research the economic and environmental costs of flow-through and recirculating aquaculture systems · design an intensive aquaculture system on a sloping site · construct a biofilter · debate the advantages and disadvantages of sea cages · design a crayfish pond
Module 25 – Economics of Aquaculture · fixed costs associated with a selected intensive or extensive aquaculture enterprise · variable costs associated with a selected intensive or extensive aquaculture enterprise · the gross income of a selected intensive or extensive aquaculture enterprise · the level of profit of a selected intensive or extensive aquaculture enterprise	· use first or second-hand investigations to determine the total operating costs of a selected intensive or extensive aquaculture enterprise · discuss the ethics of intensive and extensive aquaculture enterprises · use first or second-hand investigations to determine the gross income of a selected intensive or extensive aquaculture enterprise · use first or second-hand investigations to calculate the level of profit of a selected intensive or extensive aquaculture enterprise

Students learn about:	**Students learn to:**
Module 26 – Growing Stockfeed for Aquaculture · problems associated with feeding newly hatched animal species used in aquaculture · relationship of mouth size and gut structure to food type · importance of phytoplankton and zooplankton in aquaculture · some methods used to grow aquaculture food in commercial operations · the costs of manufactured and imported foods	· grow a variety of microalgal species · grow rotifers · examine microalgae under the microscope · examine rotifers under the microscope **Additional Content** · hatch atremia from cysts · cultivate and grow atremia · cultivate and grow daphnia · establish and maintain stock cultures of algae
Module 27 – Biology of Native Crayfish · the types of crayfish native to NSW waters · the general characteristics of crayfish · external features of crayfish · crayfish anatomy · the life cycle of a native crayfish	· identify crayfish from live or preserved specimens and/or photographs · determine the sex of crayfish from live or preserved specimens and/or photographs · research the function of specific organs in a crayfish body **Additional Content** · raise crayfish in an aquarium or aquaculture facility · mate crayfish · conduct nutritional trials on crayfish
Module 28 – Growing Crustaceans · different types of crustaceans · the basic anatomy and physiology of crustaceans · life cycles of crustaceans including reproduction in prawns, and/or blue claw and/or red claw · environmental requirements of prawns, and/or blue claw and/or red claw · difficulties in farming some crustaceans due to life cycle variations · nutritional requirements of prawns, and/or blue claw and/or red claw · employment opportunities in aquaculture	· make an aquarium suitable for housing crustaceans · hatch and raise brine shrimp · grow one species of crustacean **Additional Content** · mate crustaceans · raise and fatten juvenile crustaceans

Module 29 – Fish Biology · the two classes of fish – cartilaginous and bony · fish as cartilaginous or bony · the general characteristics of fish · the internal organs of bony fish · the basic physiology of bony fish	· examine and record the external features of a bony fish in a database · dissect a bony fish and identify its internal organs · research the following features of a selected marine fish: general description, basic anatomy and physiology, life cycle and diet, adaptation, distribution, economic importance · prepare a word-processed, audio or video report of their research project
Module 30 – Managing Fish Production · environmental requirements of fish · limiting factors for fish growth · importance of management, genetics, nutrition, disease and environmental factors in measuring fish growth · type of equipment needed to grow fish	· make simple structures to hold fish for prolonged periods · identify common fish diseases · select suitable species of fish to grow out · select food to optimise growth · grow out fish from the fingerling stage
Module 31 – Managing Water Quality in Aquaculture · differences between sea water, brackish water and fresh water · the causes of change in temperature, pH, total dissolved solids, ammonia, phosphorus, nitrates and nitrites in water · water changes and how these changes affect aquatic animals and plants · the water quality requirements of various organisms (eg marine versus fresh water, animal versus plant) · local catchment/storage area for domestic water supply · water sample sites for the collection of water samples for analysis	· make a Secchi Disc for turbidity study · perform a turbidity test · collect water samples from various sites for analysis · analyse water samples for: temperature, pH, total dissolved solids, ammonia, total phosphorus, total nitrates, total nitrites · identify water sample sites for water analysis **Additional Content** · compile water analysis records to monitor changes over a period of time
Module 32 – Pests and Diseases in Aquatic Organisms · the difference between a pest and a disease	· identifiy the measures needed to protect species from disease

Students learn about:	**Students learn to:**
· common pests facing pond-cultured fish or crayfish · common pests facing shellfish production or fish in seacages · common diseases of fish and/or crayfish and/or shellfish · procedures to prevent and isolate disease in aquaculture · procedures used to control some pests in specific aquaculture production	· identify from photographs shell disease and whitetail disease in crayfish · identify form photographs white spot and skin fungus disease in fish **Additional Content** · treat fish and/or crayfish diseases in an aquarium

Notes for teachers

This focus area does not require expensive equipment.

Complicated or expensive equipment is not necessary for the delivery of Module 22 – Aquarium Design, Construction and Maintenance.

Australian Standards relating to glass thickness and types must be adhered to if glass is used to make aquaria.

Statutory water bodies, local shire councils and many environmental organisations have extensive resources on water treatment and maintaining water quality.

Department of Land and Water Conservation operates water quality monitoring stations throughout NSW, many using remote sensors and dataloggers.

Most equipment for Module 31 – Managing Water Quality in Aquaculture is available in school science laboratories. Simple ammonia, phosphorus, nitrate and nitrite kits are available from aquarium shops and wholesalers. Many schools and local shire councils have Streamwatch kits suitable for this module.

A NSW Fisheries permit is needed to house red claw crayfish.

Common hardy fish such as poddy mullet can be substituted for commercial aquacultural species if these are not available.

Animal Welfare regulations apply to this focus area.

Focus Area: Employment

Indicative hours: 90 indicative hours of content are provided for this focus area in six optional modules. Each module is designed for 15 hours indicative course time. Students can specialise by studying multiple modules from this focus area or can undertake a selection of modules from across focus areas. Modules can be studied individually or integrated.

Description

Module 33 – Small Motor Boats, introduces the theory and skills involved in the care and handling of small motor boats. This module gives students the opportunity to gain a NSW Waterways boat licence.

Module 34 – Advanced Motor-boating, provides the opportunity to become familiar with some of the requirements for higher boating qualifications, and gain practice in advanced small boat handling. The module is a practical skills module designed to build confidence and skills in handling small motor boats.

Module 35 – Local Fishing Industries, provides the opportunity to study local fisheries and their importance to the local economy. Students should be made aware of the difference between wild capture and aquaculture, with examples of cultured marine animals (eg oysters) that are important sources of human food.

Module 36 – Food from the Sea, introduces the range of edible seafood and cultural differences associated with its preparation and consumption. Students are made aware of the nutritional value of seafood, particularly its value as a source of protein and omega 3 fatty acids.

Module 37 – Maritime Industries Employment, develops an awareness of the marine careers available. The nature and range of maritime and associated industries are examined in this module as a potential source of employment for students. The opportunities provided by the increasing marine leisure and tourism industries are highlighted in this module.

Module 38 – Tourism, introduces tourism as an economic and culturally important activity. This module examines tourism from the perspectives of value to the community as well as negative impacts, and the role of ecotourism in the future.

Outcomes

A student:

5.1.2	identifies, describes and evaluates the social and economic importance of marine ecosystems
5.2.2	explains why aquaculture provides an economically sustainable source of food
5.4.1	identifies, describes and evaluates the ethical, social and sustainability issues related to the marine environment
5.4.2	identifies, describes and evaluates policies for monitoring and conserving the marine environment
5.5.1	selects and uses a broad range of contemporary materials, equipment and techniques with confidence in aquaculture and marine settings

5.5.2 demonstrates safe and responsible use of a range of materials, equipment and techniques in different aquaculture, marine and maritime situations 5.6.1 identifies and describes a range of aquaculture, marine and maritime vocations and leisure pursuits 5.6.2 identifies and describes the role of volunteer organisations that assist in the protection and management of the marine environment 5.7.1 collects and organises data by experimenting and accurately reading instruments, signals and charts and communicates this information 5.7.2 recalls aspects of the marine environment using relevant conventions, terminology and symbols	
Students learn about:	**Students learn to:**
Module 33 – Small Motorboats · parts of a small boat · Waterways Authority requirements for a young adult boat licence · navigation rules applicable to small craft · boating laws and reguations including buoys, beacons and lights and their meaning · internationally recognised boating signals · boating safety and relevant safety equipment · impact of boats on the marine environment	· safely board a small boat · distribute a load to maximise stability in a small boat · handle a small boat, including rowing, steering, navigation and mooring · start, operate, trim and maintain an outboard motor · approach a mooring buoy in a current · approach a mooring buoy in wind · anchor on a sandy bottom · secure the boat to a wharf and a beach · clean and stow a boat that has been in salt water
Module 34 – Advanced Motor-boating · boating rules for NSW waters · theory and practical course requirements for a coxswain's certificate · impact of large motor boats on the marine environment · employment opportunities provided by the boating and support industries	· clean and adjust or change the spark plug in an outboard motor · clean the water ports in an outboard motor · bring a boat to the plane · approach different shores correctly · moor to a jetty, buoy and rocky shore · cross a wash · complete a figure of eight · recover an object from the water · complete a man-overboard drill · tow another boat · refloat a swamped boat

Students learn about:	**Students learn to:**
Module 35 – Local Fishing Industries · the term 'fishery' and its meaning · the importance of Australia's national fisheries · important local fisheries · the importance of these fisheries to the local economy · the legal requirements for establishing a fishery · the methods used to catch seafood in NSW · the sale and distribution of local fisheries produce	· analyse the relative importance of Australian fisheries **Additional Content** · research all aspects of a local Fishermen's Cooperative · inspect and identify trawl 'rubbish' from a sorting tray · catch crabs · fatten or examine oysters grown from spat
Module 36 – Food from the Sea · cultural relationships between seafood and its consumption · cultural reliance on seafood for protein · preventing seafood from deteriorating · the steps involved in preparing seafood for eating · how the type of seafood determines its cooking time · methods and styles of seafood cookery in different cultures · seafoods that are eaten raw · employment opportunities in seafood handling and catering	· scale, gut, fillet and cook fish · cook prawn, in shell and peeled · prepare and cook crabs · demonstrate etiquette when eating seafoods · research the seafood preparation methods and eating habits of different cultures **Additional Content** · identify and describe the range of activities and roles that occur within a local seafood handling plant
Module 37 – Industries and Employment · major maritime industries in Australia · types of jobs in these industries: land-based and sea-based · prerequisites for all types of employment · prerequisites for employment in specific maritime careers · the growing importance of marine tourism	· research a specific marine career identifying: what the job involves, prerequisite school credentials, the training involved, where training takes place, the training period, rates of pay and working conditions · communicate findings of this research to the class · investigate all the sites of marine employment in this area and the jobs offered

Students learn about:	**Students learn to:**
· specific marine industries of the local region · marine research as a specific career · marine traineeships available	· produce a personal résumé including marine qualifications
Module 38 – Tourism · local tourist destinations · features of popular tourist destinations · types of marine tourist activities · tourist/dollar links – the trickle-down effect · ecotourism and its importance in the maintenance of marine area integrity · impacts of tourism including environmental, social and economic effects · marketing methods in marine tourism	· investigate marketing methods used to promote tourist destinations · recognise the value of tourism to the local economy · investigate marine tourism as a wide-ranging employment field · discuss why zoning is necessary on coral reefs **Additional Content** · conduct a local area survey based on marine tourism themes · manage a small-scale aquarium and compare to a tourist aquarium · calculate the value of tourist tax dollars in the upkeep of national parks, marine sanctuaries and boat ramps

Notes for teachers

MSB Waterways requirements and advice may be useful for the delivery of Module 33 – Small Motorboats, and Module 34 – Advanced Motor-boating.

Module 36 – Food from the Sea provides an opportunity for across-curriculum collaboration, particularly in the Technological and Applied Studies key learning area and in Vocational Education and Training courses.

Focus Area: Management

Indicative hours: 75 indicative hours of content are provided for this focus area in five optional modules. Each module is designed for 15 hours indicative course time. Students can specialise by studying multiple modules from this focus area or can undertake a selection of modules from across focus areas. Modules can be studied individually or integrated.

Description

Module 39 – Coastal Management, introduces the effective management of coastal areas. Students are made aware that many of the ecological problems in coastal regions have been caused by poor planning and management.

Module 40 – Tides and Currents, introduces the major forces that move water on earth. The module looks at the various types of water movement and effects these have on climate, marine organisms and humans.

Module 41 – Marine and Civil Engineering, links the reasons for the engineering structures found along the coastline and in waterways to those aspects of the aquatic environment that conflict with human usage.

Module 42 – Saving Water Environments, introduces the ways that humans pollute the sea and the legislation and procedures that can be used to minimise damage and rehabilitate those areas that have been degraded.

Module 43 – Recreational and Community Groups, introduces water-based clubs involved in recreational activities in the aquatic enviroment. This module examines these groups, their interrelationships and the spin-off volunteer groups that enhance community development.

Outcomes

A student:

5.1.1	identifies and describes a range of marine ecosystems and investigates their complex interrelationships
5.1.2	identifies, describes and evaluates the social and economic importance of marine ecosystems
5.2.1	identifies, describes and evaluates the effects humans have had on the marine environment
5.2.2	explains why aquaculture provides an economically sustainable source of food
5.4.1	identifies, describes and evaluates the ethical, social and sustainability issues related to the marine environment
5.4.2	identifies, describes and evaluates policies for monitoring and conserving the marine environment
5.6.1	identifies and describes a range of aquaculture, marine and maritime vocations and leisure pursuits
5.6.2	identifies and describes the role of volunteer organisations that assist in the protection and management of the marine environment
5.7.1	collects and organises data by experimenting and accurately reading instruments, signals and charts and communicates this information
5.7.2	recalls aspects of the marine environment using relevant conventions, terminology and symbols

Students learn about:	**Students learn to:**
Module 39 – Coastal Management · early human inhabitants of our coast · Australia's population and its density along the coastline · renewable resources (eg fisheries, estuarine communities, water) and the non-renewable resources (eg land, soil, minerals) that are found along our coast · the major problems affecting our coast, eg pollution, sewage outfall, sedimentation, coastal wetland degradation, agricultural practices, depletion of estuaries, over-exploitation of resources, introduction of exotic species, reclamation of swamps and mangroves · industries that rely either directly or indirectly on the local coast · waste disposal methods in the area · rules for river and ocean use that balance care for the environment with human needs	· map a sand dune formation and identify areas prone to blow-outs · collect data to monitor a specific local problem, eg growth of bitou bush · research the impact of dredging operations on NSW river systems · discuss the ethical considerations of the access to and the use of both renewable and non-renewable resources **Additional Content** · collect and germinate seeds of dune-stabilising plants · attend a Dune Care meeting · visit a canal development to check water quality and circulation · visit the sewage treatment works to study processing methods
Module 40 – Tides and Currents · major forces that move water in the oceans · ocean, coastal, local and tidal currents · causes and features of each current · causes and effects of tides · factors that may affect the height and time of tides · spring and neap tides · water movement around the local coastline · movement of water in a local sewer system	· plot El Niño current on a world map · plot the coastal currents on a map of Australia · use the internet to trace ocean currents · investigate species, eg tuna and their association with Australian currents **Additional Content** · measure the rise and fall of tides · measure tidal flow rate in a river · investigate the directed water flow around a training wall · use bottle paper to check water movement
Module 41 – Marine and Civil Engineering · training walls · groynes · wharfs · ramps	· discuss the reasons for constructing training walls, groynes, dams and weirs · research the methods used to construct early rockwalls

Students learn about:	**Students learn to:**
· boat harbours · dams and weirs	· examine the methods used to place piles · discuss the need for boat harbours **Additional Content** · observe local marine engineering structures on field trips · model the action of a groyne using a ripple tank
Module 42 – Saving Water Environments · pollution · major causes of marine pollution · impact of technology on waste production · human attitudes to waste disposal · point and non-point pollution sources · combating pollution · the role of education in the fight against pollution · the effects of salinity on the environment · philosophies, eg 'think globally, act locally', that can be used in a community · repairing the damage done by pollution	· research the main sources of pollution in the local area · investigate the causes and effects of Minamata Disease · investigate the action plan for a major oil spill off the NSW coast or the Great Barrier Reef · debate major pollution issues, eg nuclear testing in the Pacific, oil spills, sewage outfalls · investigate strategies for overcoming salinity around inland waterways · investigate reconstitution of the riparian zone as a means of combating agricultural pollution **Additional Content** · conduct an analysis of beach rubbish
Module 43 – Recreational and Community Groups · benefits of being involved in a recreational community group · objectives and purposes of different community groups · how these objectives and purposes are achieved · membership of recreational/community groups · Surf Life Saving Australia, club life and activities · meritorious and community awards	· complete a case study on an organisation, Surf Life Saving Australia (SLSA) · investigate surf life saving activities and their role in the community · discuss the benefits of being actively involved in recreational and community groups · complete contact and non-contact rescues using a variety of resources **Additional Content** · list names, addresses (all forms) of local service groups with the intended purpose of building their own directory

Note for teachers

Management plans developed by local councils may be relevant for this focus area.

Focus Area: General Interest

Indicative hours: 75 indicative hours of content are provided for this focus area in five optional modules. Each module is designed for 15 hours indicative course time. Students can specialise by studying multiple modules from this focus area or can undertake a selection of modules from across focus areas. Modules can be studied individually or integrated.

Description

Module 44 – Shipwrecks and Salvage, develops and awareness of hardships faced by early mariners, their skill and the often fatal results of miscalculations, poor instrumentation and the forces of nature.

Module 45 – Basic Navigation, introduces the basics of pilotage and navigation. Students develop an awarenessof dangers associated with passage in congested shipping lanes and the need for international conventions to avoid collisions and shipwrecks.

Module 46 – Marine Disasters, introduces the types and effects of natural and man-made disasters on the marine environment.

Module 47 – Personal Interest Project, provides the opportunity to undertake an in-depth study of any marine related topic which interests them.

Module 48 – Local Area Study, introduces students to the local marine and aquatic ecosystems in their local area and effects of human activity on them.

Outcomes

A student:

5.1.1	identifies and describes a range of marine ecosystems and investigates their complex interrelationships
5.2.2	explains why aquaculture provides an economically sustainable source of food
5.4.1	identifies, describes and evaluates the ethical, social and sustainability issues related to the marine environment
5.5.2	demonstrates safe and responsible use of a range of materials, equipment and techniques in different aquaculture, marine and maritime situations
5.6.2	identifies and describes the role of volunteer organisations that assist in the protection and management of the marine environment
5.7.1	collects and organises data by experimenting and accurately reading instruments, signals and charts and communicates this information
5.7.2	recalls aspects of the marine environment using relevant conventions, terminology and symbols

Students learn about:	**Students learn to:**
Module 44 – Shipwrecks and Salvage · the dangers facing early mariners · the limitations of equipment used by early mariners · the major trade routes of the Indian and Pacific oceans · shipwrecks around the Australian coast and their frequency · the instruments, charts and navigation aids used to prevent shipwrecks	· research a famous shipwreck · locate on a map of Australia the known shipwreck treasures that have never been found
Module 45 – Basic Navigation · ancient navigation techniques · points of the compass · features of a chart · setting a course · markers used in pilotage · the need for rules and international conventions to avoid collisions at sea and wrecks on shore	· research the techniques used by ancient navigators · read a compass · take a bearing · read a chart · plot a course · pilot a small craft through a series of markers
Module 46 – Marine Disasters · natural disasters affecting the marine environment · human-influenced disasters affecting the marine environment · predicting and preventing marine disasters · state and national planning for disasters · Search and Rescue (SAR) and its operations · safety procedures and their importance when dealing with marine disasters	· classify marine disasters into specific groups · investigate organisations and planning for marine disasters · identify different weather types and their affects on the sea · investigate a specific action plan for a possible disaster
Module 47 – Personal Interest Project · a marine-related topic of interest to them · methods of research · information technology	· research and acquire information · assess and verify information · collate information and use word processing to present it in a report
Module 48 – Local Area Study · a local river catchment and drainage system · types of marine ecosystems found in the local area	· locate their local area on a map of NSW · identify, preferably by field trip, the major ecosystems of their area

Students learn about:	**Students learn to:**
· the importance of local ecosystems · human impacts on local ecosystems · introduced modifications to local ecosystems	· map major aquatic and terrestrial ecosystems in this area · identify, preferably by field trip, the major sources and ethical considerations of human impact on these ecosystems · discuss at least one major modification man has made to one of these ecosystems and assess its impact on the system

Notes for teachers

The wrecking of the whaling ship *Essex*, the wrecks of the *Batavia* and *Yongala*, and Matthew Flinders' expedition are inspirational stories that may be incorporated into programs of study.

The *Australian Geographic* magazine has a map of the shipwreck treasures not recovered as yet.

8 Life Skills Outcomes and Content

The Board of Studies recognises that a small percentage of students with special education needs may best fulfil the mandatory curriculum requirements for Marine and Aquaculture Technology Years 7–10 by undertaking Life Skills outcomes and content. (Requirements for access to Life Skills outcomes and content are detailed in section 1.2.)

Life Skills outcomes will be selected on the basis that they meet the particular needs, goals and priorities of each student. Students are not required to complete all outcomes. Outcomes may be demonstrated independently or with support.

In order to provide a relevant and meaningful program of study that reflects the needs, interests and abilities of each student, schools may integrate Marine and Aquaculture Technology Life Skills outcomes and content across a variety of school and community contexts.

In developing and delivering teaching programs teachers should be aware of and adopt relevant guidelines and directives of their education authorities and/or schools. Teaching programs should recognise and reflect relevant state and Commonwealth legislation, regulations, conventions and standards including Occupational Health and Safety, Chemical Safety in Schools and Animal Welfare guidelines. Teachers need to be aware of activities that may require notification, certification, permission, permits and licences.

Programs developed from this syllabus will have an emphasis on first-hand experiences. The levels of student training, capabilities, confidence and expertise at their current stage of development are important considerations in determining the teaching sequence and choice of modules. Programs will capitalise on the opportunities for skill development and the training of students in skills appropriate to their level of maturity and stage of physical and learning development.

Consideration of related school and systems policies, and accessing community knowledge and/or their participation in the planning process, are important steps towards assuring the suitability of programs and teaching approaches.

It is essential that, prior to implementing Life Skills outcomes and content, teachers refer to the relevant ‘Notes for teachers’ at the end of each focus area in section 7.2 of the syllabus, for details on specific regulations and resources that relate to particular activities. In particular, information relating to requirements for water safety, snorkelling and the operation of motor boats should be noted and observed.

Teachers are encouraged to use Australian examples and modern, up-to-date technology including satellite technology and the internet wherever appropriate.

8.1 Outcomes

Objectives Students will develop:	**Outcomes** A student:
knowledge, understanding and appreciation of marine and aquatic environments	LS.1 recognises features of marine and aquatic environments and life LS.2 explores some of the factors that affect marine and aquaculture environments
knowledge, understanding and appreciation of the economical sustainability of aquaculture	LS.3 explores the effects of people's activities on marine and aquaculture environments
knowledge, understanding and appreciation of the role of aquaculture in the preservation of wild seafood stocks and the marine environment	LS.4 recognises a range of marine and aquaculture plants and animals that can be grown to provide food LS.5 investigates ways in which marine and aquaculture environments impact on our daily lives
knowledge, understanding, skills and attitudes that promote ethical and sustainable practices in the use, management and protection of the marine environment	LS.6 ensures safe treatment of and care for plants and animals in their personal use of marine and aquatic environments
knowledge, understanding and skills in the responsible selection and safe use of materials, equipment and techniques used in aquaculture and marine and maritime activities	LS.7 demonstrates safe practices in the care and use of materials, tools and equipment and in relation to personal safety
knowledge, understanding and appreciation of the industries and organisations using, managing and regulating aquaculture and the marine environment	LS.8 recognises the need for marine and aquaculture environments to be managed and cared for LS.9 explores the opportunities provided within marine and aquaculture environments for leisure, community work and employment
knowledge and skills in researching, experimenting and communicating in marine and aquaculture contexts	LS.10 uses a variety of strategies to locate and select information LS.11 uses a variety of strategies to organise and communicate information

Life Skills modules

Modules for Life Skills students are designed to provide links to a range of the modules provided in section 7.1 of the syllabus. Content is provided for a range of Life Skills modules including:

- Water Safety
- General First Aid
- Maintaining Equipment Used in Water
- The Marine Environment
- Management and Employment
- Underwater Farming
- Marine Mammals
- Dangerous Marine Creatures
- The Oceans
- Rock Platforms
- Introducing Rivers and Estuaries
- Basic Snorkelling
- Open Water Snorkelling
- Fish Harvesting
- Manufacturing Fishing Equipment
- Aquarium Design, Construction and Repair
- Growing Crustaceans
- Small Motor Boats
- Advanced Motor-boating
- Local Fishing Industries
- Food from the Sea
- Industries and Employment
- Tourism
- Saving Water Environments
- Recreational and Community Environmental Groups
- Shipwrecks and Salvage
- Personal Interest Project
- Local Area Study.

8.2 Content

Module: Water Safety

LS.1, LS.5, LS.6, LS.7	
Students learn about:	**Students learn to:**
· safety rules for young children around water · safe practices for swimmers · safe practices and behaviours at the beach and/or pool and/or when: – board-riding and/or – windsurfing and/or – sailing · safe fishing practices from rocks, and/or the beach and/or boats	· swim 200 metres in still water · swim 25 metres fully clothed · swim 10 metres underwater · tread water for 3 minutes · remove clothing while treading water · recognise dangerous local fishing spots and the conditions that would make them dangerous · make a trouser-float · correctly fit a Personal Flotation Device (PFD) · jump into water wearing a PFD · recognise rips at a beach

Module: General First Aid

LS.7, LS.10	
Students learn about:	**Students learn to:**
· the need for sun protection · basic first aid procedures · Danger, Response, Send for help, Airway, Breathing, CPR, Defibrillator (if available) (DRSABCD) plan of action · Cardiopulmonary Resuscitation (CPR) · local venomous organisms and their treatments · when to seek help	· correctly apply sunscreen · treat simulated bleeding · locate and apply information about basic first aid procedures · treat simulated sprains and bruises · treat simulated asthma attack · treat simulated snake bite · treat simulated shock · cooperate with people providing treatment

Module: Maintaining Equipment Used in Water

LS.7, LS.10	
Students learn about:	**Students learn to:**
· the effects of salt, water, sunlight and living things on equipment · the procedures for maintaining personal equipment used in water	· clean, dry and store personal equipment such as swimwear and snorkelling equipment · locate and follow instructions relating to the maintenance and storage of specialised equipment · dismantle, clean and oil a fishing reel · clean, dry and store large equipment, eg aluminium boats and surfboards

Module: The Marine Environment

LS.1, LS.2, LS.3, LS.6, LS.8, LS.10, LS.11	
Students learn about:	**Students learn to:**
· some aspects of the marine environment · some differences between marine and land environments · the importance of the marine environment · some of the problems facing the marine environment including examples induced by human activity · the effect of people's activities on fish stocks	· explore some of the ways animals adapt to life in water · measure – water temperature – salinity – turbidity · examine sand grains under a microscope and sketch and comment on findings

Module: Management and Employment

LS.1, LS.5, LS.6, LS.8, LS.9, LS.10	
Students learn about:	**Students learn to:**
· organisations that regulate or manage aquatic areas and the animals/plants they contain · employment opportunities for both females and males within these organisations, and recruitment procedures	· explore some of the management and care-related roles and responsibilities of NSW Fisheries, NSW National Parks and Wildlife Service, NSW Department of Land and Water Conservation, Fishwatch, OceanWatch, Dune Care, Coast Care · investigate local environmental volunteer groups that accept school students as members

Module: Underwater Farming

LS.2, LS.3, LS.4, LS.5, LS.7, LS.8, LS.9	
Students learn about:	**Students learn to:**
· aquaculture and its beginnings · aquaculture involving farming · types of underwater farms · the role of hatcheries in aquaculture and their impact for humans and the environment · employment opportunities in aquaculture	· use correct and safe procedures to manage aquatic organisms in an aquarium · raise aquatic organisms from eggs or juveniles · feed aquatic organisms correctly · use correct equipment and techniques to catch a common estuary fish and grow it out · measure the growth rates of fish or crustaceans

Module: Marine Mammals

LS.1, LS.2, LS.3, LS.10	
Students learn about:	**Students learn to:**
· the general features of marine mammals · the ways in which marine mammals breathe, move, digest food and care for their young	· locate information and develop a presentation on a selected marine mammal and factors that effect their environment using a variety of multimedia · examine a skeleton or a model of the anatomy of a marine mammal

Module: Dangerous Marine Creatures

LS.5, LS.8, LS.10, LS.11	
Students learn about:	**Students learn to:**
· what makes a marine creature dangerous · examples of dangerous marine creatures and how they can impact on human activity · the warning signs of aggression in sharks or other marine creatures · the need for dangerous marine creatures to be managed and cared for · first aid procedures for injuries caused by local marine organisms	· recognise dangerous marine creatures from films, photographs, pictures or preserved specimens · research, using technology, and draw pictures to indicate the dangerous parts of selected dangerous marine creatures · use a first aid kit to treat a simulated marine bite, sting or puncture wound

Module: The Oceans

LS.1, LS.2, LS.3, LS.4, LS.5, LS.6, LS.10, LS.11	
Students learn about:	**Students learn to:**
· major oceans and seas of the world · why the oceans are salty · the water cycle · how people's activities can affect the oceans · the importance of the oceans to the daily lives of humans	· recognise major oceans and seas on a world map · use computer technology to locate and view images of the ocean's bottom · use technology to locate or draw a diagram of an ocean bottom profile

Module: Rock Platforms

LS.1, LS.2, LS.3, LS.10, LS.11	
Students learn about:	**Students learn to:**
· rock platforms as a habitat · plants and animals commonly found on a rock platform · adaptations that help these plants and animals survive on a rock platform	· recognise animals on a rock platform · recognise different plants on a rock platform · investigate the ways that humans affect the rock platform · use technology to construct and represent a food chain of living things on a rock platform

Module: Introducing Rivers and Estuaries

LS.1, LS.2, LS.3, LS.5, LS.6, LS.8, LS.11	
Students learn about:	**Students learn to:**
· defining an estuary · features of rivers and estuaries and factors, including human activities, that can affect them · the importance of rivers and estuaries to our daily lives	· draw, or use technology to locate and print, a map of a local river or estuary · develop a presentation or poster about the need to protect rivers and estuaries · categorise human needs related to rivers and estuaries including food provision and leisure activities

Module: Basic Snorkelling

LS.1, LS.6, LS.7, LS.10, LS.11	
Students learn about:	**Students learn to:**
· methods that people have used throughout history to swim underwater · features of marine and aquatic environments that can require caution when swimming and snorkelling · effects of water and water pressure on various parts of our body · the correct ways to use basic snorkelling equipment · features that should be considered when purchasing basic snorkelling equipment · safety rules for snorkelling including the importance of the buddy system, 'diver below' flag etc. · standard hand signals used when snorkelling	· scull 50 metres · duck dive to 2 metres depth · swim and snorkel with safety and an awareness of the possible effect on the environment · defog a mask · fit mask and fins correctly · fin 400 metres · clear mask underwater · recover a coin in 2 metres of water · swim 50 metres with snorkel but no mask · treat a leg cramp in a buddy · use a tired snorkeller tow for 50 metres · support an unconscious buddy for 5 minutes in deep water · snorkel in enclosed water

Module: Open Water Snorkelling

LS.7, LS.10	
Students learn about:	**Students learn to:**
· snorkelling rules and safety · equipment needed for open water snorkelling · employment opportunities associated with snorkelling	· make a 'diver below' flag · investigate possible dangers at diver sites · check the contents of a first aid kit · check equipment used on a snorkelling trip · be aware of their own fitness and that of their buddy before undertaking a dive · complete a dive log sheet

Module: Fish Harvesting

LS.3, LS.7, LS.8, LS.9	
Students learn about:	**Students learn to:**
· the various methods used to catch fish and their effects on the environment · employment opportunities associated with amateur and professional fishing	· tie different strength knots in fishing lines and select the correct hook and bait for the type of fish being sought · use safe practices and correctly care for fishing equipment · catch bait · rig a handline or rod and reel · catch fish using a line · rig a bait net · use a hand net (scoop or seine) · make a simple fish trap · identify fish species caught in the local area and the protection requirements for them

Module: Manufacturing Fishing Equipment

LS.7	
Students learn about:	**Students learn to:**
· techniques used to prepare and set up hand spools · fishing rod manufacture from a blank · sinker manufacture · spinner manufacture	· tie line on a hand spool · rig lines for beach and/or estuary fishing · make sinkers using a mould · make spinners from a spoon · demonstrate safe practices in the manufacture of equipment

Module: Aquarium Design, Construction and Maintenance

LS.1, LS.2, LS.4, LS.6, LS.7, LS.8	
Students learn about:	**Students learn to:**
· animals and plants that could be kept in a marine aquarium · aquariums as a living and balanced community including important features and factors that affect them · aquarium-keeping as a widespread recreational and educational activity · equipment needed to make a viable aquarium	· safely maintain a working aquarium and perform functions such as cleaning, feeding, testing water temperature and clarity · select and place appropriate plants and animals for the aquarium environment · make a biofilter · make an aquarium using correct and safe procedures

Module: Growing Crustaceans

LS.1, LS.4, LS.7	
Students learn about:	**Students learn to:**
· different types of crustaceans, their features and suitability for consumption · life cycle of a selected crustacean · environmental requirements of a selected crustacean, eg prawns	· hatch and raise brine shrimp using correct and safe procedures · grow one species of crustacean · mate crustaceans · raise and fatten juvenile crustaceans

Module: Small Motorboats

LS.2, LS.3, LS.7	
Students learn about:	**Students learn to:**
· parts of a small boat · boating laws and reguations including buoys, beacons and lights and their meaning · boating safety and relevant safety equipment · Waterways Authority requirements for a young adult boat licence	· safely board a small boat · distribute a load to maximise stability in a small boat · safely handle a small boat, including rowing, steering, navigation and mooring · trim, start and operate an outboard motor · anchor on a sandy bottom · secure the boat to a wharf and a beach · clean and stow a boat that has been in salt water

Module: Advanced Motor-boating

LS.3, LS.6, LS.7, LS.9	
Students learn about:	**Students learn to:**
· simple maintenance requirements for outboard motors · some of the impacts of boats on the marine environment · the impact of large motorboats on the marine environment · employment opportunities provided by the boating and support industries	· clean and adjust or change the spark plug in an outboard motor · clean the water ports in an outboard motor · demonstrate an awareness of possible damage to the environment when using a motor boat · safely use a motor boat including: – bring a boat to the plane – approach different shores correctly – moor to a jetty, buoy and rocky shore – cross a wash – complete a figure of eight – recover an object from the water – complete a man-overboard drill – tow another boat

Module: Local Fishing Industries

LS.3, LS.5, LS.6, LS.8, LS.9	
Students learn about:	**Students learn to:**
· the methods used to catch seafood in NSW and their effects on the environment · important local fisheries · the sale and distribution of local fisheries' produce · environmental considerations in local fishing industries including the effects on plants and animals in a marine environment	· explore the significance of Australian fisheries for people's lives · visit a local Fishermen's Cooperative and recognise employment opportunities and roles · inspect trawl 'rubbish' from a sorting tray · catch crabs · fatten or examine oysters grown from spat

Module: Food from the Sea

LS.4, LS.5, LS.9	
Students learn about:	**Students learn to:**
· a range of sources of food from the sea · the impact of seafoods on human diet · preventing seafood from deteriorating · the steps involved in preparing seafood for eating · the eating habits of different cultures · methods and styles of seafood cookery in different cultures · employment opportunities in seafood handling and catering	· safely scale, gut, fillet and cook fish · cook prawn, in shell and peeled · prepare and cook crabs · demonstrate etiquette when eating seafoods

Module: Industries and Employment

LS.3, LS.8, LS.9, LS.10, LS.11	
Students learn about:	**Students learn to:**
· major maritime industries in Australia · types of jobs in these industries · the growing importance of marine tourism and the need for marine and aquaculture environments to be managed and cared for · specific marine industries of the local region	· explore the opportunities for marine employment in this area and the jobs offered · develop a project on a specific marine career

Module: Tourism

LS.1, LS.2, LS.3, LS.6, LS.8, LS.9, LS.11	
Students learn about:	**Students learn to:**
· local tourist destinations · marine and aquatic features of popular tourist destinations · types of marine tourist activities and related factors that effect the environment · ecotourism and its importance in the maintenance of marine area integrity	· make a poster and/or a pamphlet to promote a local tourist destination · promote natural features of the local area · recognise the value of tourism to the local economy and people's lives · identify some of the problems that may be caused by too many tourists

Module: Saving Water Environments

LS.2, LS.3, LS.6, LS.8, LS.11	
Students learn about:	**Students learn to:**
· recognising types of pollution in the local area · the need for people to manage waste disposal responsibly · the role of education in reducing pollution · repairing the damage done by pollution	· explore the main sources of pollution in the local area · indicate appropriate ways to dispose of a variety of waste material · identify ways to reduce pollution in the local area · identify ways to repair the damage done by pollution · make a poster using a slogan to encourage effective waste disposal

Module: Recreational and Community Environmental Groups

LS.2, LS.3, LS.6, LS.8, LS.9, LS.11	
Students learn about:	**Students learn to:**
· the activities of different community environmental groups · the benefits of being involved in a recreational community group · becoming a member of a recreational/ community environmental group	· recognise the function of a range of community environmental groups · indicate the benefits of being actively involved in recreational and community environmental groups · make a presentation about the work of a community environmental group

Module: Shipwrecks and Salvage

LS.1, LS.2, LS.8, LS.10, LS.11	
Students learn about:	**Students learn to:**
· the reasons why there were many shipwrecks in the past, including relevant features of the marine environment · the changes to equipment which now help to prevent shipwrecks · the dangers to the environment from shipwrecks	· retell the story of a famous shipwreck · locate on a map of Australia areas where shipwrecks have occurred · identify the dangers to the environment when ships run aground or are wrecked

Module: Personal Interest Project

LS.10, LS.11. Also may include a range of outcomes that relate to specific topics studied	
Students learn about:	**Students learn to:**
· a marine-related topic of interest to them · locating information · methods of presenting information	· use strategies to locate and select information · use strategies to organise and share information

Module: Local Area Study

LS.1, LS.10, LS.11. Also may include a range of outcomes that relate to specific topics studied	
Students learn about:	**Students learn to:**
· the features of ecosystems found in the local area	· locate ecosystems in their local area on a map · explore through a field trip aspects of major ecosystems of the local area

9 Continuum of Learning in Marine and Aquaculture Technology K–10

9.1 Stage Statements

Stage statements illustrate the continuum of learning in the *Marine and Aquaculture Technology Years 7–10 Syllabus* and are summaries of the knowledge, understanding, skills, values and attitudes that have been developed by students as a consequence of achieving the outcomes for the relevant stage of learning.

Early Stage 1 – Science and Technology

Students who have achieved Early Stage 1 show a growing awareness of, and interest in, the natural and made environment. They demonstrate confidence in proposing ideas for designs they develop through play and modeling. They demonstrate curiosity about artefacts, events, phenomena, places and living things around them.

Early Stage 1 students use play to explore ideas, manipulate materials and trial solutions. They develop and begin to refine their understanding of environments, materials, equipment and other resources through trial and error. They ask questions, suggest ideas, propose their own explanations and are able to report verbally and graphically on their actions and observations.

Students in this stage use their senses to observe features of their immediate environment and to explore the properties of a range of common materials. They identify and group living and non-living things according to some common characteristics.

Students explore and identify the needs of people and other living things. They recognise the use of some forms of energy and their ideas about it are beginning to develop as they experience energy in different contexts.

Students generate their own ideas, using make-believe, and express these verbally, pictorially and through modeling. They are unlikely to perceive the steps in a designing and making process as they often work in situations where these aspects occur at the same time. They identify what they like or dislike about their designs or explorations.

Students in Early Stage 1 recognise that information can come from a variety of sources, including other people, and from different media, for example, books and videos. They demonstrate an awareness of a range of uses for computer-based technology as well as showing an emerging confidence in their ability to explore and use computer-based technologies, with assistance, to create text, images and play games.

Students show growing awareness of the appropriate use and maintenance of a range of classroom equipment. They give reasons for safe working practices and organisational procedures related to the use of equipment, resources and materials. Students develop ideas through the use and manipulation of concrete materials as a means of progressing towards abstract thought.

Stage 1 – Science and Technology

Students who have achieved Stage 1 are developing an awareness of the wider world and are applying their scientific and technological understanding to new and different situations. They are starting to develop the social skills required to investigate, design and make products and services.

Students are starting to appreciate the interdependence of living things and their environments. They recognise that people create products, services and environments to meet their own needs. They build on their existing understanding of some of the forms of energy.

Students are able to interpret information and make predictions based on their own observations. They are better able to accept that the result of a test may be different from what was originally expected.

Students are able to recognise the purpose of an investigation and seek further information as a result of their own curiosity. They begin to see that an investigation is a series of orderly steps. They use their senses to identify similarities and differences. Students show curiosity about natural and made environments and seek explanations that allow them to interpret their observations.

Using plans, drawings and models, Stage 1 students begin to generate and select ideas to best meet design task objectives, and give simple explanations of why they have chosen a certain idea. Students in this stage can draw plans for a design and can explain some of the features and materials to be used. They can write labels and simple explanations when creating images.

Students recognise and discuss with others some of the strengths and limitations of what they have done and identify some changes that could be made to improve plans or models, for example, in appearance. They make comparisons about what they like and dislike about familiar products, systems or environments.

Students effectively manipulate materials that are available in the classroom environment, and show a growing awareness of the different properties of such materials and how they affect the way in which the materials are used. They recognise that some materials occur naturally, while others are made.

Students have a developing awareness of a range of media and information products. They are able to use computer technology to start and open files or applications, save and shut down. They are able to use computer-based technologies where appropriate for a given task.

They are able to identify the different forms of technology in their immediate environments and explain how they help us. They safely use, maintain and store equipment such as scissors, magnifying glasses, computers and disks.

Stage 2 – Science and Technology

Students who have achieved Stage 2 are able to initiate their own investigations as a result of something that has aroused their curiosity. They ask perceptive questions and respond to design tasks in innovative ways. They identify ways of improving their own scientific and technological activities by considering issues such as how well something works, its appearance and how it might affect the environment.

Students develop the capacity to ask questions to clarify understanding. They predict outcomes by proposing explanations and testing to see if their predicted outcomes eventuate. As students develop skills in predicting, testing, recording results and drawing conclusions, they begin to form understanding about 'fair testing' that takes into account the need for consistent conditions combined with one variable, in order to ensure accurate results.

Students who have achieved Stage 2 are able to explore ideas for investigations and their design proposals in order to identify where decisions still need to be made, and to suggest possible courses of action. Students may suggest modifications to improve their initial proposals, including the selection of different solutions to arrive at a suitable outcome.

Students are able to explore the properties, capabilities and working characteristics of both natural and manufactured materials and components. They recognise that materials are varied and have different properties that affect their use. They can select, maintain and safely use classroom tools and equipment, hardware and software, and justify their selection for particular tasks.

Students give consideration to issues such as function and aesthetics when designing and evaluating products, services and environments. They can identify some limitations when carrying out a design task. Students develop plans that show some consideration of the types and quantities of materials required and an awareness of the need for accuracy in a plan for production purposes.

Students recognise the function of some hardware and software and are able to select and use these to meet the requirements of a task. They can discuss the possibilities and limitations of using a range of technology including computer-based technology.

Students are developing a capacity to understand relationships in the natural world. They can identify and describe some aspects of the structure and function of living things and some of the ways living things interact. They can also identify and describe some of the interactions of the Earth with other parts of the solar system. Students in this stage devise systems that inform or utilise their understanding of some forms of energy.

Students also demonstrate a greater understanding of and control over a design process. They recognise the importance of evaluation throughout a design cycle.

Stage 3 – Science and Technology

Students who have achieved Stage 3 are able to undertake investigations independently in order to satisfy their own curiosity. They demonstrate a willingness to initiate their own investigations; this might include designing appropriate fair tests to evaluate a range of possible explanations for the results of their investigations.

Students select and use appropriate language, structures and media and demonstrate skills in critically examining and communicating scientific and technological ideas and issues. Students can relate their scientific and technological understanding to new tasks or different situations.

Students research and investigate to identify phenomena and processes that have influenced Earth over time. They build on their existing understanding of forms of energy.

Students are aware of the skills and processes involved in designing and making, investigating and using technology. They manage the design process including aspects of time management, design constraints and needs of the target audience. At this stage, they can make decisions involving some conflicting interests or issues, for example, ethical, aesthetic, environmental and cultural.

Students use two-dimensional and three-dimensional drawings and models to develop and modify their design ideas and to communicate details to others. They recognise and use some conventions and symbols related to developing plans and diagrams, such as measurements and some use of scale. They can observe the form and detail of objects carefully in order to produce accurate drawings from different views and they reflect on their drawings, sketches or computer models.

Students are aware of a range of issues related to scientific and technological achievements. They are capable of acquiring information from a variety of sources and are able to experiment with new techniques and skills as technologies change. Students identify emerging trends by using data, diagrams and a range of tools and equipment to assist with observations.

Students recognise that computer-based technologies have a wide range of applications in society and can identify and describe some of the effects of such technologies on individuals and communities. Students who have achieved Stage 3 can confidently and competently use a range of computer-based hardware and applications. Students at this stage can identify alternative uses and can be creative in adapting available software to the requirements of a task.

Students reflect on the methods used and positive and negative results of technological and scientific activity both throughout their own projects and in personal, local and global contexts.

Stage 4 – Technology (Mandatory)

Students at Stage 4 are able to independently initiate design projects and investigations that reflect an understanding of needs and opportunities. They demonstrate the ability to research and extract information from a variety of sources and a willingness to use experiments and tests to enhance the development of a design project. They describe factors that influence design.

Students select and use a broad range of media and method and appropriate language and structures to accurately communicate design ideas to a diverse audience. This may include recounting the process of designing, producing and evaluating used when developing design projects. Students are aware of the skills and processes involved in designing and are able to generate and communicate design ideas and solutions. They develop knowledge and understanding of a range of design processes, roles of designers and associated work opportunities. They can identify what makes good design and are able to creatively develop quality design projects.

Students responsibly, safely, confidently and accurately apply a range of contemporary and appropriate tools, materials and techniques and understand the implications and applications of these in the wider community. Students demonstrate competence when using a range of ICTs and have the ability to select and use them appropriately in developing design projects.

Students recognise the importance of safety, quality and management in the design and production of design projects. They learn to manage their own time by sequencing processes of designing, producing and evaluating to plan ahead. They work collaboratively and learn to work safely with others in technological environments.

Throughout the design process students reflect on and evaluate their design projects. They consider the impact of innovation and emerging technology on society and the environment and identify and explain ethical, social, sustainability and environmental considerations related to design projects.

Design projects that integrate marine and aquaculture-related content can be undertaken.

Stage 4 – Marine and Aquaculture Technology

Students have the opportunity to further develop higher-order understandings and skills in the context of more specialised technological applications through the study of Marine and Aquaculture Technology.

They undertake practical design and technological activity that develops their understanding of marine environments and the economical sustainability of aquaculture. They develop knowledge, understanding and skills in the selection and safe use of materials, equipment and techniques used in aquaculture and marine activities.

Stage 5 – Marine and Aquaculture Technology

The knowledge, skills and attitudes developed in the Technology and the Science Years 7–10 syllabuses are further enhanced through the study of Marine and Aquaculture Technology CEC Years 7–10 through applied practical experiences in one or more particular focus areas.

Students are able to recognise and make an assessment of the risks and OHS issues that are associated with marine activities.

Students are able to competently apply design processes to modify, develop and produce original design solutions for a range of practical and research projects relevant to marine and related environments, enterprises and leisure activities.

Students understand the relationship between the physical and mechanical properties of a range of relevant and associated materials and marine resources and their functional applications. They are able to select the most appropriate resources for the successful completion of practical projects and activities.

Through experiences in a range of practical activities, students develop an appreciation of the value of working cooperatively with others in the achievement of common goals, gaining personal satisfaction and enjoyment. These skills form the basis that enables students to continue their learning experiences in many lifestyle and leisure activities.

Students are able to identify and critically evaluate marine and aquaculture products and environmental solutions that have been well designed and produced, and which fulfil their intended function. They are able to effectively apply design criteria to the planning, development and evaluation of their projects.

Students are aware of the impact of current and emerging technologies on society and the marine and related environments. They are able to describe the effect of these technologies on the local and global environment and to envisage future directions and possible applications of technology.

10 Assessment

10.1 Standards

The Board of Studies *K–10 Curriculum Framework* is a standards-referenced framework that describes, through syllabuses and other documents, the expected learning outcomes for students.

Standards in the framework consist of two interrelated elements:
- outcomes and content in syllabuses showing what is to be learnt
- descriptions of levels of achievement of that learning.

Exemplar tasks and student work samples help to elaborate standards.

Syllabus outcomes in Marine and Aquaculture Technology contribute to a developmental sequence in which students are challenged to acquire new knowledge, understanding and skills.

The standards are typically written for two years of schooling and set high, but realistic, expectations of the quality of learning to be achieved by the end of Years 2, 4, 6, 8, 10 and 12.

Using standards to improve learning
Teachers will be able to use standards in Marine and Aquaculture Technology as a reference point for planning teaching and learning programs, and for assessing and reporting student progress. Standards in Marine and Aquaculture Technology will help teachers and students to set targets, monitor achievement, and, as a result, make changes to programs and strategies to support and improve each student's progress.

10.2 Assessment for Learning

Assessment for learning in Marine and Aquaculture Technology is designed to enhance teaching and improve learning. It is assessment that gives students opportunities to produce the work that leads to development of their knowledge, understanding and skills. *Assessment for learning* involves teachers in deciding how and when to assess student achievement, as they plan the work students will do, using a range of appropriate assessment strategies including self-assessment and peer assessment.

Teachers of Marine and Aquaculture Technology will provide students with opportunities in the context of everyday classroom activities, as well as planned assessment events, to demonstrate their learning.

In summary, *assessment for learning*:
- is an essential and integrated part of teaching and learning
- reflects a belief that all students can improve
- involves setting learning goals with students
- helps students know and recognise the standards they are aiming for
- involves students in self-assessment and peer assessment
- provides feedback that helps students understand the next steps in learning and plan how to achieve them
- involves teachers, students and parents in reflecting on assessment data.

Quality Assessment Practices
The following *Assessment for Learning Principles* provide the criteria for judging the quality of assessment materials and practices.

Assessment for learning:
- **emphasises the interactions between learning and manageable assessment strategies that promote learning**
  In practice, this means:
  – teachers reflect on the purposes of assessment and on their assessment strategies
  – assessment activities allow for demonstration of learning outcomes
  – assessment is embedded in learning activities and informs the planning of future learning activities
  – teachers use assessment to identify what a student can already do.

- **clearly expresses for the student and teacher the goals of the learning activity**
  In practice, this means:
  – students understand the learning goals and the criteria that will be applied to judge the quality of their achievement
  – students receive feedback that helps them make further progress.

- **reflects a view of learning in which assessment helps students learn better, rather than just achieve a better mark**
  In practice, this means:
  – teachers use tasks that assess, and therefore encourage, deeper learning
  – feedback is given in a way that motivates the learner and helps students to understand that mistakes are a part of learning and can lead to improvement
  – assessment is an integral component of the teaching-learning process rather than being a separate activity.

- **provides ways for students to use feedback from assessment**
  In practice, this means:
  – feedback is directed to the achievement of standards and away from comparisons with peers
  – feedback is clear and constructive about strengths and weaknesses
  – feedback is individualised and linked to opportunities for improvement.

- **helps students take responsibility for their own learning**
  In practice, this means:
  – assessment includes strategies for self-assessment and peer assessment emphasising the next steps needed for further learning.

- **is inclusive of all learners**
  In practice, this means:
  – assessment against standards provides opportunities for all learners to achieve their best
  – assessment activities are free of bias.

10.3 Reporting

Reporting is the process of providing feedback to students, parents and other teachers about students' progress.

Teachers can use evidence gathered from assessment to extend the process of *assessment for learning* into their *assessment of learning*. In a standards-referenced framework this involves teachers in making professional judgments about student achievement at key points in the learning cycle. These may be at the end of a year or stage, when schools may wish to report differentially on the levels of knowledge, understanding and skills demonstrated by students.

A general set of Descriptions of Levels of Achievement has been developed for use in Content Endorsed Courses and Board Endorsed School Developed Courses. These provide schools with a useful tool to report consistent information about student achievement to students and parents, and to the next teacher to help to plan the next steps in the learning process. They describe observable and measurable features of student achievement at the end of a stage, within the indicative hours of study. Descriptions of levels of achievement provide a common language for reporting.

At Stage 5 there are six levels of achievement. Level 6 describes a very high level of achievement in relation to course objectives and outcomes. Level 2 describes satisfactory achievement, while the level 1 description will help identify students who are progressing towards the outcomes for the stage.

At Stage 4 there are four levels of achievement. Level 4 describes a very high level of achievement; levels 2 and 3 describe satisfactory and high achievement that should provide a solid foundation for the next stage of learning. The level 1 description will help identify students who are progressing towards the outcomes for the stage.

For students undertaking Life Skills outcomes and content in Years 7–10, the content listed for each identified Life Skills outcome forms the basis of the learning opportunities for these students. It also provides examples of activities on which teachers can base judgements to report student progress in relation to individual learning goals.

10.4 Choosing Assessment Strategies

Planning for assessment is integral to programming for teaching and learning. In a standards-referenced framework, teachers assess student performance on tasks in relation to syllabus outcomes and make on-balance judgements about student achievement. Assessment relies on the professional judgement of the teacher and is based on reliable data acquired in a fair and challenging environment, from multiple performances in a variety of contexts. Assessment is fundamental for furthering student learning.

In planning programs, teachers, individually and collaboratively, review the syllabus and standards materials. They use these materials to describe for themselves what students should know and be able to do at a particular stage, and they consider the kinds of evidence their students could produce to show they have learnt what they needed to learn.

Students are provided with a description of the learning expected to be accomplished, opportunities to discuss the criteria on which judgements will be based, time to learn, and where possible, examples of what that learning looks like.

Assessment is used to determine the students' initial knowledge, understanding and skills, to monitor student progress and to collect information to report student achievement. The assessment cycle is continuous; students receive and give themselves feedback on what they have learnt, and what needs to be done to continue their learning. Students gain information about their learning through feedback from teachers and from self-assessment and peer assessment. The challenge and complexity of assessment tasks increase to enable students to develop evaluative independence as they assess their own knowledge, understanding and skills, and determine ways to improve their learning.

Teachers of Marine and Aquaculture Technology should employ a range of assessment strategies to ensure that information is being gathered regarding the knowledge and understanding that are being acquired, and the skills that are being developed. Strategies should be appropriate to the outcomes being addressed, be manageable in number and be supportive of the learning process. Teachers could work collaboratively in planning appropriate assessment strategies. Working collaboratively leads teachers to develop a shared understanding of the syllabus standards and also supports teachers in making consistent and comparable judgements of student achievement in relation to these standards.

In planning for assessment in Marine and Aquaculture Technology it is important for teachers to consider:

- the requirements of the syllabus
- the accessibility of the proposed activity in terms of language requirements
- the appropriateness of the challenge presented to individual students
- resource availability
- how the task will be administered
- the way in which feedback will be provided.

In planning for assessment, teachers of Marine and Aquaculture Technology need to consider how results will be recorded, with a view to ensuring that there is sufficient and appropriate information collected for making an on-balance holistic judgement of the standard achieved by the student at the end of the stage. The evidence collected should enable teachers of

Marine and Aquaculture Technology to make consistent judgements to meet the various reporting requirements that the system, school and community may have.

Practical experiences should occupy much of the allocated course time for students of Marine and Aquaculture Technology. The selection of assessment strategies and tasks should reflect the practical intent of the course. Marine and Aquaculture Technology particularly lends itself to the following assessment techniques:

Practical experiences
Marine and Aquaculture Technology students undertake project work throughout the course. They move from undertaking teacher-guided work to a more independent mode. Assessment of these projects should reflect the change in nature and demands at different stages. When students are working on practical work in class, the teacher has the opportunity to observe and note aspects of student learning. When students undertake practical experiences, they could be assessed on their ability to:

- conduct hands-on investigations
- report on and apply the results of investigations
- select appropriate techniques, equipment or material(s) for a project
- justify their use of a particular technique or material
- use appropriate tools and methods
- set goals, prioritise tasks and manage time effectively
- use equipment safely and efficiently for an appropriate purpose.

Research projects
Research projects can be used to develop in students analytical, organisational and problem-solving skills and may include case studies and internet research projects. When students undertake research projects, they could be assessed on their ability to:

- conduct appropriate research using a variety of methods
- select and interpret relevant information
- address the chosen issues with clarity
- present information in a logical manner.

Written reports
These may include surveys, project reports, field trip reports, interviews and essays. When students produce a written report, they could be assessed on their ability to:

- show appropriate depth of analysis
- summarise key findings in a concise manner
- use appropriate detail
- use terminology consistent with the focus area of study.

Presentations
Presentations allow students to develop skills in communicating their ideas in oral, graphic and written forms using a variety of subject-specific concepts and content. They provide opportunities for students to develop and demonstrate their skills and reflect upon the performances of others. Assessment strategies may include prepared and impromptu oral presentations, graphical presentation of project ideas and concepts, and various forms of display techniques. When presentations are used for assessment purposes, students could be assessed on their ability to:

- select and apply appropriate information
- present information in a creative and logical manner.

Diaries and journals
Diaries and journals provide opportunities for students to write personal reflections. They allow students to develop knowledge, skills and abilities to make informed, responsible choices. They also develop in students, self-awareness and critical thinking skills.
When using diaries and journals as an assessment technique, students could be assessed on their ability to:

- identify key indicators and evidence of their own learning
- show appropriate depth of analysis
- effectively describe the development and production of projects
- record employment-related skills and discuss training and career pathways.

Written and practical tests
Written and practical tests (or a combination of these) can assess the ability of students to:

- recall, interpret, comprehend and apply knowledge
- perform skills with appropriate tools and methods.

Peer assessment
Marine and Aquaculture Technology encourages the active involvement of students in the learning process. Opportunities exist for individual and collaborative work. Activities involving peer assessment might include evaluating the contribution of individuals to a group task, and reflecting on a peer project or presentation.

Self-assessment
In Marine and Aquaculture Technology students are encouraged to acquire basic skills to become self-directed learners. Opportunities exist for students to reflect upon their progress towards the achievement of the syllabus outcomes through the progressive and ongoing evaluation of practical projects and processes. This reflection provides the basis for improving their learning. Developing self-assessment skills is an ongoing process, becoming increasingly more sophisticated and self-initiated as a student progresses.