



MCAST

MQF/EQF Level 4

AG4-02-22

Advanced Diploma in Fish Management

Course Specification

Course Description

This programme of study offers learners a wide perspective of different aspects of fish management and will provide them with a broad knowledge and aptitude related to the fish husbandry sector and industry. Learners will acquire knowledge, skills and competences in both the farmed and ornamental fish husbandry industries. This programme of study also exposes learners to key concepts related to wild stock fisheries management. The programme will give an opportunity to learners to gain experience while learning new skills. They are constantly encouraged to relate theory to practice at all stages through assignments, projects, practical work and work placements. Scheduled fish husbandry duties form an integral part of the curriculum.

Programme Learning Outcomes

At the end of the programme the learner will be able to:

- 1. Understand a number of scientific and technical aspects in the fish husbandry area.*
- 2. Understand the anatomy, physiology, behaviour and health of fish.*
- 3. Undertake work-related experience in the land-based sector (Aquaculture).*
- 4. Develop business ideas and carry out investigative projects in the land-based sector (Aquaculture).*

Entry Requirements

Any MCAST Level 3 Diploma

OR

4 SEC/O-Level/SSC&P (Level 3) passes

Key Information

Awarding Body - MCAST

Accreditation Status - Accredited via MCAST's Self Accreditation Process (MCAST holds Self-Accrediting Status as per 1st schedule of Legal Notice 296/2012)

Type of Programme: Qualification

MQF Level	Examples of Qualifications	'Qualification' Minimum Credits Required	'Award' Credits Required
Level 8	Doctoral Degree Third Cycle Bologna Process	NA	NA
Level 7	Masters Second Cycle Bologna Process	90-120	Less than 30
	Post-Graduate Diploma	60	
	Post-Graduate Certificate	30	
Level 6	Bachelor ²³ /Bachelor (Hons.) ²⁴ First Cycle Bologna Process	180-240	Less than 180
Level 5	Short Cycle Qualification	120	Less than 60
	Undergraduate Higher Diploma	90	
	Undergraduate Diploma	60	
	Undergraduate Certificate	30	
	VET Level 5 Programme ²⁵	60-120	
Level 4	Pre-Tertiary Certificate	30	Less than 120
	VET Level 4 Programme ²⁶	120	
	MATSEC Certificate	NA	
Level 3	VET Level 3 Programme ²⁷	60	Less than 60
	General and Subject Certificate	NA	
Level 2	VET Level 2 Programme ²⁸	60	Less than 60
	General and Subject Certificate	NA	
Level 1	VET Level 1 Programme ²⁹	40	Less than 40
	General and Subject Certificate	NA	
Introductory Level A	Preparatory Programme	30	Less than 30
Introductory Level B	Pre-entry Basic Skills Course	30	Less than 30

Table 1: Minimum number of credits for 'Qualifications' and parameters for 'Awards'

Fig.1: p56, Ministry for Education and Employment & National Commission for Further and Higher Education Malta (2016). *Referencing Report*, 4th Edition. NCFHE.

Total number of Hours: 3000

Mode of attendance: Full Time

Duration: 2 Years

Target audience for MCAST full-time courses is 16 to 65+

The official language of instruction at MCAST is English. All notes and textbooks are in English (except for language courses which will be in the respective language being instructed). International candidates will be requested to meet English language certification requirements for access to the course.

This course will be offered at

MCAST has four campuses as follows:

MCAST Main Campus

Triq Kordin, Paola, Malta

All courses except for the Institute for the Creative Arts, Centre of Agriculture, Aquatics and Animal Sciences are offered here.

Institute for the Creative Arts

Mosta Campus

Misraħ Ġhonoq Targa Gap,

Mosta

**Institute of Applied Sciences,
Centre of Agriculture, Aquatics and Animal Sciences,
Luqa Road, Qormi**

Gozo Campus

J.F. De Chambray Street

MCAST, Ġhajnsielem

Gozo

Teaching, Learning and Assessment

The programmes offered are vocational in nature and entail both theoretical lectures delivered in classes as well as practical elements that are delivered in laboratories, workshops, salons, simulators as the module requirements dictate.

Each module or unit entails a number of in person and/or online contact learning hours that are delivered by the lecturer or tutor directly (See also section 'Total Learning Hours').

Access to all resources is provided to all registered students. These include study resources in paper or electronic format through the Library and Resource Centre as well as tools, software, equipment and machinery that are provided by the respective institutes depending on the requirements of the course or module.

Students may however be required to provide consumable material for use during practical sessions and projects unless these are explicitly provided by the College.

All Units of study are assessed throughout the academic year through continuous assessment using a variety of assessment tools. Coursework tasks are exclusively based on the Learning Outcomes and Grading Criteria as prescribed in the course specification. The Learning Outcomes and Grading Criteria are communicated to the Student via the coursework documentation.

The method of assessment shall reflect the Level, credit points (ECTS) and the schedule of time-tabled/non-timetabled hours of learning of each study unit. A variety of assessment instruments, not solely Time Constrained Assignments/Exams, are used to gather and interpret evidence of Student competence toward pre-established grading criteria that are aligned to the learning outcomes of each unit of the programme of study.

Grading criteria are assessed through a number of tasks, each task being assigned a number of marks. The number of grading criteria is included in the respective Programme Specification.

The distribution of marks and assessment mode depends on the nature and objectives of the unit in question.

Coursework shall normally be completed during the semester in which the Unit is delivered.

Time-constrained assignments may be held between 8 am and 8 pm during the delivery period of a Unit, or at the end of the semester in which the Unit is completed. The dates are notified and published on the Institute notice boards or through other means of communication.

Certain circumstances (such as but not limited to the Covid 19 pandemic) may lead Institutes and Centres to hold teaching and assessment remotely (online) as per MCAST QA Policy and Standard for Online Teaching, Learning and Assessment (Doc 020) available via link <https://www.mcast.edu.mt/college-documents/>

The Programme Regulations referenced below apply. (DOC 004 available at: link <https://www.mcast.edu.mt/college-documents/>)

Total Learning Hours

The total learning hours required for each unit or module are determined as follows:

Credits (ECTS)	Indicative contact hours	Total Student workload (hrs)	Self-Learning and Assessment Hours
1	5 - 10 hrs	25 hrs	20-15 hrs*
2	10 - 20 hrs	50 hrs	40-30 hrs*
3	15 - 30 hrs	75 hrs	60-45 hrs*
4	20 - 40 hrs	100 hrs	80-60 hrs*
6	30 - 60 hrs	150 Hrs	120-90 hrs*
9	45 - 90 hrs	225 hrs	180-135 hrs*
12	60 - 120 hrs	300 hrs	240-180 hrs*

* The 'Self-Learning and Assessment Hours' amount to the difference between the contact hours and total student workload.

Grading system

All MCAST programmes adopt a learner centred approach through the focus on Learning Outcomes. The assessment of MCAST programmes is criterion-referenced and thus assessors are required to assess learners' evidence against a pre-determined set of Learning Outcomes and assessment criteria.

For a student to be deemed to have successfully passed a unit, a minimum of 50% (grade D) must be achieved. In case of part time programmes, the student must achieve a minimum of 45% to successfully pass the unit.

All units are individually graded as follows:

A* (90-100)

A (80-89)

B (70-79)

C (60-69)

D (50-59)

Unsatisfactory work is graded as 'U'.

Work-based learning units are graded on a Pass/Fail basis only.

Detailed information regarding the grading system may be found in the following document: DOC 004 available at: link <https://www.mcast.edu.mt/college-documents/>

Intake Dates

- MCAST opens calls for application once a year between July and August of each year for prospective applicants residing in MALTA.
- Applications to full-time courses from international students not residing in MALTA are accepted between April and Mid-August.
- For exact dates re calls for applications please follow this link <https://www.mcast.edu.mt/online-applications-2/>

Course Fees

MCAST course are free for Maltese and EU candidates. International candidates coming from outside the EU need to pay fees for the respective course. Course fees are set on a per-level and course duration basis. For access to course fee structure and payment methods please visit <https://www.mcast.edu.mt/fee-payments-for-non-eu-candidates/>.

Method of Application

Applications to full-time courses are received online via the College Management Information System. Candidates can log in using Maltese Electronic ID (eID) or European eIDAS (electronic identification and trust services) to access the system directly and create an account as the identity is verified electronically via these secure services.

Non-EU candidates need to request account creation though an online form by providing proof of identification and basic data. Once the identity is verified and the account is

created the candidate may proceed with the online application according to the same instructions applicable to all other candidates.

Non-EU candidates require a study visa in order to travel to Malta and joint the course applied for. For further information re study-visa please access <https://www.identitymalta.com/unit/central-visa-unit/>.

For access to instructions on how to apply online please visit <https://www.mcast.edu.mt/online-applications-2/>

Contact details for requesting further information about future learning opportunities:

MCAST Career Guidance

Tel: 2398 7135/6

Email: career.guidance@mcast.edu.mt

Current Approved Programme Structure

Unit Code	Unit Title	ECTS	Year	Semester
ASFSH-406-1508	An Introduction to Fisheries Studies	6	1	YEAR
ASFSH-406-1503	Global Aquaculture, Fisheries and Trade	6	A	YEAR
ASFSH-406-2204	Fish Biology and Behaviour	6	A	YEAR
ASENV-406-1506	Understanding Water Quality	6	A	YEAR
ASFSH-406-1506	Farming of Sea bream, Sea Bass and Meagre	6	A	YEAR
ASFSH-406-1509	Understanding Fisheries Management	6	A	YEAR
ASFSH-406-1513	Introduction to Oceanography	6	A	YEAR
ASFSH-406-1514	Freshwater Ornamental Aquaria	6	A	YEAR
CDKSK-406-2001	English	6	A	YEAR
CDKSK-406-2109	Information Technology	6	A	YEAR
ASWBL-406-2201	Work Related Experience	6	2	YEAR
ASFSH-403-2205	Fish Behaviour and Genetics	3	B	YEAR
ASFSH-406-1505	Fish Health and Welfare	6	B	YEAR
ASANM-406-2210	Environmental Science	6	B	YEAR
ASPRJ-409-1803	Undertake an Extended Investigative Project in the Land and Sea Based Sectors	9	B	YEAR
ASFSH-406-1507	Farming of Tuna and Amberjack	6	B	YEAR
ASFSH-406-1510	Marine Ornamental Aquaria	6	B	YEAR
ASFSH-406-1511	Aquascaping and Ornamental Invertebrates	6	B	YEAR
ASFSH-406-1512	Navigation	6	B	YEAR
CDKSK-404-1915	Employability and Entrepreneurial Skills	4	B	YEAR
CDKSK-402-2104	Community Social Responsibility	2	B	YEAR
Total ECTS		120	/	/

This course will be delivered on a back-to-back system

ASF5H-406-1508: An Introduction to Fisheries Studies

Unit level (MQF/EQF): 4

Credits: 6

Delivery Mode: Face to Face

Total Learning Hours: 150

Unit description

This unit is designed for centre-based delivery to meet the needs of learners looking to enter the fish capture sector, or progress to higher education. The knowledge gained relating to the principles of fisheries biology that underpin the assessment and management of wild fish populations will provide a platform for understanding fisheries management.

Outcome 1 introduces learners to the central purpose of fisheries science, determining the fishing effort required for sustainable yields. A distinction will be drawn between MSY (Maximum Sustainable Yield) and MEY (Maximum Economic Yield) in the context of the history of a typical fishery as it moves from the 'prospective' stage, to being developed and ultimately over exploited. The methods of conserving fish stocks through controlling and limiting fishing effort will be discussed in general practical terms.

The standard methods of measuring individual finfish, shellfish and crustaceans will be revealed in Outcome 2, and consolidated through practical activities. The aging of fin fish from scale and otolith reading will be demonstrated and practiced by learners, and the information used to establish the age structure of a given fish population.

Once competent in the measurement of fish lengths and aging fish by scale or otolith reading, the processes and challenges of fish population assessment can be considered more fully by learners, as required by Outcome 3. Sampling strategies will be introduced, with the emphasis on ensuring 'representative samples', overcoming the influence of random sampling error and sampling bias that can undermine the supply of reliable management information, to the detriment of fishery science and capture fisheries.

Parallel to their knowledge development, learners will develop practical skills in the standardised measurement of fish length, shell fish and crustacean dimensions, and the aging of fish through scale reading, using the data to determine fish population structures. The results of a qualitative analysis of fish stomach contents can be correlated to fish age, determining changes in feeding behaviour over time. Learners will collect record and analyse fish data, learning how appropriate sample sizes and sampling regimes are established, thereby satisfying Outcome 4.

Learning Outcomes

On completion of this unit the student will be able to

1. *Explain how fish stocks can be managed to provide a sustainable yield whilst being protected from over exploitation.*
2. *Describe the standardised methods of measuring individual finfish, shellfish and crustaceans with reference to data extrapolation.*
3. *Describe fish population assessment methodologies with reference to sampling regimes and fish catch data.*
4. *Assess a fish population through applied field work and data analysis, informed by supplementary information.*

ASFSH-406-1503: Global Aquaculture, Fisheries and Trade

Unit level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face to Face
Total Learning Hours: 150

Unit description

The unit is designed for centre based delivery for learners planning to enter the fish management sector (aquaculture or fisheries) or progress to higher education.

Outcome 1 will develop the learner's understanding of the production and supply of fish and fish products from capture based fisheries and aquaculture traded globally, and factors influencing consumer demand.

The challenges facing fishery management will be revealed, providing a global context that will help learners to better understand the management of the Maltese and Mediterranean fishery. The concept of sustainability and 'sustainable yield' will be introduced and exemplified through a range of case studies illustrating sustainable and unsustainable fisheries and aquaculture enterprises, satisfying Outcome 2.

Learners will develop an understanding of the principles and evolution of aquaculture as an alternative and potentially more sustainable aquatic food supply, capable of resolving the global 'protein deficit' looming in the 21st Century. The range of aquaculture practices within temperate and tropical regions, utilising freshwater and marine environments, will be revealed, from extensive through to intensive systems, exploring the factors influencing their development.

On completion of the unit, learners will have grasped that the full scope of aquaculture includes the culture of plants, crustaceans, shellfish and fin fish. The pros and cons of 'low input' extensive aquaculture systems will be highlighted and compared to the intensive monoculture of high value carnivorous species reliant on aquaculture technology and dietary protein derived from finite marine fish stocks, satisfying Outcome 3. An awareness of the socio-economic importance of aquaculture to rural communities will be developed, acknowledging the potential detrimental impacts and the preventive and remedial measures that can safeguard the natural environment.

Outcome 4 requires learners to devise and conduct a consumer survey to investigate the nature of demand for aquatic food and consumer resistance towards unfamiliar products. The difficulty suppliers can have in gaining consumer acceptance of new aquatic food products in order to successfully diversify will be demonstrated, and marketing solutions considered.

Learning Outcomes

On completion of this unit the student will be able to

1. *Categorise global fishery and aquaculture production and trade, with reference to the main fish producing countries and the species that they provide and/or produce.*
2. *Identify the main drivers for change in modern aquaculture/ fisheries systems globally, and the need to consider greater intensification.*
3. *Describe the development of aquaculture systems, from extensive to intensive regimes, with reference to sustainability and socioeconomic benefits.*
4. *Conduct a consumer survey to establish those factors influencing attitudes towards aquatic food products.*

ASFSH-406-2204: Fish Biology and Behaviour

Unit level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face to Face
Total Learning Hours: 150

Unit Description

This unit is designed for centre based delivery, preparing learners for entry to the aquaculture, fisheries, or ornamental sector at an operative level, or progression to higher education.

Fish populations need to be managed effectively in order to satisfy a range of aims, whether found in capture based fisheries, fish farms or aquaria. Fish propagation and growth, whilst achieving high standards of animal welfare and safeguarding the environment, are applicable to all industry sectors. Equipped with an underpinning knowledge of fish biology, learners will appreciate how environmental conditions can influence fish behaviour and the importance of minimising fish stress in order to sustain fish health and productivity. By heightening their animal welfare and environmental awareness, learners will develop the necessary legal, moral and ethical responsibility to ensure that fish under their care are provided the correct conditions to thrive and exhibit normal behaviour.

Initially, learners will familiarise themselves with the concepts of taxonomy, meristics, morphometrics and internal and external fish anatomy, relating the normal anatomical features of healthy fish to important physiological processes.

Although Teleost fin fish of commercial significance to either aquaculture, fish capture or the ornamentals sector in the Mediterranean region provide the short list, the unit does allow learners the freedom to study specific fish species of personal interest in more depth.

Learning Outcomes

On completion of this unit the student will be able to

1. *Apply fish taxonomy, meristics and morphometrics in different settings.*
2. *Describe the external and internal anatomy of specific fish species with reference to the visual signs of poor health.*
3. *Dissect fish specimen to observe various features and record observations.*
4. *Evaluate the functions of the major organs of specific fish species with reference to their physiological role.*

ASENV-406-1506: Understanding Water Quality

Unit level (MQF/EQF): 4

Credits: 6

Delivery Mode: Face to Face

Total Learning Hours: 150

Unit Description

A good standard of water quality is essential for every living thing on our planet to survive. Water pollution can have devastating effects on aquatic life and humans. Recording, monitoring and controlling water quality is vital to ensuring standards are maintained.

This unit aims to equip learners with the skills and knowledge associated with water quality analysis. Learners will gain an understanding of the factors that impact on water quality including human activity. Physical, biological and chemical factors will be investigated and a thorough understanding of their influence on water quality will be gained. The principles of water treatment will be covered to ensure learners have an understanding of the processes involved and the management of water quality in a work based setting.

Scientific techniques will be experienced by learners to allow them to confidently progress into industry. Skills including recording results, interpreting data and drawing conclusions from analytical data will be practiced.

Learning Outcomes

On completion of this unit the student will be able to

- 1. Describe factors that impact on water quality*
- 2. Measure basic water quality factors*
- 3. Record and interpret water quality data*
- 4. Explain the principles of water treatment*

ASFSH-406-1506: Farming of Sea bream, Sea Bass and Meagre

Unit level (MQF/EQF): 4

Credits: 6

Delivery Mode: Face to Face

Total Learning Hours: 150

Unit Description

This unit is designed for centre-based delivery to suit those aiming to enter the fish management sector (aquaculture, fisheries or ornamentals), or planning to progress to higher education. It introduces learners to the knowledge and skills that relate to the farming of Sea bream, Sea bass and Meagre, and includes on farm practical skills development.

Outcome 1 introduces the farming of Sea bream and Sea bass, the established backbone of Mediterranean aquaculture, more recently complemented by Meagre production, as the industry diversifies. Following an initial overview of the evolution of Mediterranean farming methods, learners will study intensive 'closed' production cycles for current and emerging farmed species from ova production through to harvest.

Learners will discover how the main farmed species are propagated, including the management of brood-stock, ova production, incubation and early rearing up to a typical transfer target weights of 2-4 grams. By developing an overarching understanding of hatchery phase operations, Outcome 2 will be satisfied.

An understanding of fish husbandry requirements during hatchery and on-growing phases will be developed through a combination of study and periods of on farm practical experience. Learner's will select equipment and technology needed to ensure a high quality rearing environment, optimal feed intake, and minimal fish stress during grading and harvesting operations to satisfy Outcome 3. Concurrently, through completing a period of work experience on an on-growing site, learners will demonstrate defined practical fish husbandry competences to satisfy Outcome 4.

Towards the end of the unit the learners familiarity with farm site selection criteria and factors determining the fish holding capacity, economic viability and environmental impact of on-growing will have grown. Consideration of the governance and regulatory framework for Mediterranean aquaculture, and its impact on and the development of

farming practices for Sea bream, Sea bass and Meagre, and the growth of the sector, will lead to the completion of Outcome 5, concluding the unit.

Learning Outcomes

On completion of this unit the student will be able to

- 1. Describe the production cycle of farmed Sea bream, Sea bass and Meagre including the hatchery, nursery and on-growing phases.*
- 2. Explain the hatchery, nursery and on-growing phases including the husbandry requirements, for Sea bream, Sea bass and Meagre.*
- 3. Select the equipment and technology required for fish production operations during hatchery and on-growing phases for Sea bream, Sea bass and Meagre.*
- 4. Conduct routine fish husbandry on-growing operations for Sea bream, Sea bass or Meagre, conforming to standard operating procedures.*
- 5. Outline the principles of aquaculture governance and licensing with reference to the criteria applied to ensure responsible farm site selection in the Mediterranean region.*

ASF5H-406-1509: Understanding Fisheries Management

Unit level (MQF/EQF): 4

Credits: 6

Delivery Mode: Face to Face

Total Learning Hours: 150

Unit Description

This unit is designed for centre-based delivery to meet the needs of learners looking to enter the fish capture sector, or progress to higher education. The understanding of a range of commercial fishing and fishery management practices is consolidated through the examination of a local fishery operation.

Outcome 1 introduces learners to the wide range of fishing methods and gear deployed to capture commercially significant species within industrial, semi industrial and artisanal fisheries important to Malta and the Mediterranean region. The different gear types for finfish, shellfish and crustaceans are considered, developing the learner's appreciation of the rationale for selecting particular methods and gear configurations to suit the environmental conditions and target species.

With some knowledge of fishing previously established, Outcome 2 provides learners the opportunity to relate commonly deployed fishing methods to fishery management practices, in particular the control of fishing effort and the use of different fishing gear to influence species and size selectivity helping to redress the frequent high 'bycatch' discard rates which concern environmentalists, the public and industry. The imposition of marine reserves and management zones is considered with reference to the Maltese Fisheries Management Zone (FMZ) recently established. Outcome 3 exposes learners to the equipment and technology used to prepare and store fish post capture, ensuring fish products of the highest quality reach market and satisfy consumer needs. The Maltese fish supply licensing and distribution system is studied in some detail to illustrate fish supply regulation from a predominantly artisanal fishery.

Learners can study and experience the operation of a specific fishery of interest to them, to satisfy Outcome 4, learning how the fishing gear is prepared, operated and maintained, fouling and snagging avoided, and the 'catch per unit effort' optimised. The safety regulations governing commercial fishing will be integrated and emphasised throughout, and some basic commercial fishing skills gained through completing Outcome 5.

Learning Outcomes

On completion of this unit the student will be able to

1. *Describe how finfish, shellfish and crustaceans are captured and the range of fishing methods and gear used.*
2. *Explain the fishery management practices applied locally and regionally across a range of fisheries.*
3. *Describe the fish supply process from capture to market and the measures taken to safeguard product quality.*
4. *Explain fishery operations for a given fishery, with reference to the preparation, handling and maintenance of fishing equipment.*
5. *Participate in commercial fishing operations complying with standard operating procedures and health and safety requirements.*

ASFSH-406-1513: Introduction to Oceanography

Unit level (MQF/EQF): 4

Credits: 6

Delivery Mode: Face to Face

Total Learning Hours: 150

Unit Description

This unit is designed for centre-based delivery to meet the needs of learners looking to enter the fish management sector (aquaculture, fisheries or ornamentals), or progress to higher education. The knowledge gained in Oceanography is complemented by the skills developed in the identification of marine life and the analysis of water characteristics.

The biodiversity, productivity and spoliation of marine ecosystems, is explored fully, supporting the development of emergent thinking in Fisheries Management. Conventional, single species stock management approaches which have led to the overexploitation of fish stocks are being questioned, and calls for a more ecologically sound holistic 'multi- species' approach to fishery management are growing. Therefore, the central thrust of the unit - understanding the ecology of the marine environment, provides a basis for better management of marine resources in the future, locally, and globally.

Outcome 1 introduces important water characteristics in the context of the hydrological cycle, including the freshwater phase, before the emphasis shifts towards a full exploration of the marine environment. This is exemplified by studying the nature of the freshwater and marine resource in Malta and the Mediterranean region. Initially, learners will develop their knowledge of how water characteristics can change during waters' journey through the hydrological cycle due to natural and human influences. The physical and chemical properties of water are explored through class based activity and practical field work, as required by Outcome 2, and the key parameters measured. This can be integrated with water quality monitoring in fish holding facilities, re-enforcing the dynamic nature of the biotic influences on water and potential impact on captive and natural fish stocks.

In Outcome 3, learners will develop a basic knowledge of physical oceanography, emphasising the physical forces that drive water movement and exchange between oceans, including wind generated currents and waves, water density differentials and tidal action. This knowledge underpins the development of learners full understanding of how key requirements to the growth of marine life, including oxygen and nutrients, are transported, boosting the productivity of the oceans.

Outcomes 4 and 5 are a major component of delivery, providing learners the opportunity to develop a detailed knowledge of Mediterranean flora, fauna and ecology, including the identification of typical members of the main taxa through qualitative surveys of a range of marine habitats. Once the holistic and cyclical nature of marine food webs and trophic systems are understood, consideration of current environmental issues, including spoliation, overfishing and the impact of invasive exotic species, can follow. The unit will conclude on a positive note, with an evaluation of marine conservation plans in place and under development for the Mediterranean region.

Learning Outcomes

On completion of this unit the student will be able to

- 1. Describe the typical variations in the physical and chemical characteristics of water at different stages of the hydrological cycle*
- 2. Measure the physical and chemical characteristics of water in the field using basic chemical tests and monitoring equipment*
- 3. Describe the physical zones of the marine environment and the forces driving water circulation in the oceans*
- 4. Explain the ecology and biodiversity of the Mediterranean marine environment with reference to factors determining productivity*
- 5. Identify Mediterranean marine flora and fauna using simple identification keys and through conducting qualitative surveys*

ASF5H-406-1514: Freshwater Ornamental Aquaria

Unit level (MQF/EQF): 4

Credits: 6

Delivery Mode: Face to Face

Total Learning Hours: 150

Unit description

This unit is designed for centre-based delivery to meet the needs of learners looking to enter the ornamental sector, or progress to higher education. Skills relating to freshwater the establishment and maintenance of freshwater aquarium systems will be developed.

Outcome 1 introduces to the learner to freshwater flora and fauna of commercial interest. Learners will research the habitat requirements and optimal conditions for fish, aquatic invertebrates and plants commonly kept in freshwater aquaria, and the operating procedures required, ensuring a healthy aquatic environment.

The sources of fish, aquatic invertebrates and plants for the ornamental trade will be revealed and sustainability issues facing the ornamental sector considered. Learners will progress to the establishment of mixed fish populations and themed displays subsequently, satisfying Outcome 2.

Outcome 3 encourages the exploration of the technology, equipment and materials used in the aquatics industry, including the components of single and multi-tank systems deployed by hobbyists and the ornamental trade.

Outcome 4 develops the learner's knowledge of the animal health and welfare legislation with jurisdiction over the ornamental sector, exemplified through case studies. Learners will be made aware that the welfare of animals is taken seriously by society, and that the moral, ethical and legal considerations applied to terrestrial animals, also apply to fish when kept in captivity.

Through practical demonstration, instruction and practise, freshwater aquatic husbandry skills will be nurtured and consolidated. Learners will be equipped to establish and maintain an aquarium environment for compatible species of freshwater fish, aquatic invertebrates and plants, thereby satisfying Outcome 5.

Learning Outcomes

On completion of this unit the student will be able to

1. *Describe the habitat and environmental requirements of freshwater aquatic organisms with reference to their tolerance limits and optimal conditions.*
2. *Evaluate the suitability of aquatic flora and fauna to be kept in freshwater aquaria with reference to their compatibility.*
3. *Explain environmental control principles with reference to the function of the equipment used in freshwater aquaria to support aquatic life.*
4. *Explain the implications of the major legislation governing the aquatics industry with reference to codes of practice.*
5. *Establish freshwater aquaria environments and their inhabitants, monitoring the aquatic environment to ensure that suitable conditions are maintained.*

ASF5H-403-2205: Fish Behaviour and Genetics

Unit level (MQF/EQF): 4

Credits: 3

Delivery Mode: Face to Face

Total Learning Hours: 75

Unit description

This unit builds on the 'Fish Biology and Behaviour' unit and continues to provide the learners with a thorough comprehension of the various aspects of fish life. This unit will focus on the behaviour and genetics of fish. Initially, learners will familiarise themselves with the normal and abnormal fish behaviour, with reference to physiological processes which can influence behaviour and indicate the condition of their environment. The interrelationships between fish and their environment will be explored more comprehensively with reference to their feeding behaviour, nutritional requirements and metabolism. Finally, an overview of genetics will be provided and which will start from the basics of genetics up to their implications on fish breeding. This will be followed with a discussion on sex reversal in the aquaculture industry and its implications.

Learning Outcomes

On completion of this unit the student will be able to

1. Describe the normal and abnormal behaviour of specific fish species with reference to their tolerance limits.
2. Describe the feeding behaviour for specific fish species with reference to their metabolism.
3. Analyse general principles of genetics and inheritance in fish
4. Evaluate the importance of sex reversal in aquaculture.

ASF5H-406-1505: Fish Health and Welfare

Unit level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face to Face
Total Learning Hours: 150

Unit Description

This unit is designed to suit centre-based delivery and learners seeking to enter the fish management sector (aquaculture, fisheries or ornamentals) or planning to progress to higher education. It aims to introduce the skills and knowledge that relate to fish health and welfare and fish husbandry within a range of fish holding facilities.

Maintaining fish health is fundamental to keeping fish in captivity, whether they are being farmed, or held and traded within the ornamental sector. As similar fish welfare considerations apply, regardless of sector, it is important that learners understand how health problems can arise, aware of the limitations of conventional chemical treatments which are becoming increasingly ineffective and restricted, shifting the emphasis towards disease prevention.

Learners will investigate a range of pathogens that can cause disease, from viruses and bacteria, to parasites and fungi, to satisfy Outcomes 1 and 2. This will include studying the aetiology and possible symptoms of a disease outbreak, and developing their knowledge of preventative measures and, for when prevention has failed, disease treatments. Based on an understanding of the pathogens requirements, learners will relate various techniques available to prevent and treat disease to 'standard operating procedures' found in the fish management industry. Ultimately, this should reduce the risk of local disease outbreaks escalating to become pandemics, to the benefit of the industry globally.

To satisfy Outcome 3, learners will investigate health problems that have environmental and nutritional causes, learning how to identify symptoms and differentiate them from pathogenic diseases. Reference will be made to mitigation through good fish husbandry, including optimising the rearing environment and feed management. An exploration of the relevant EU legislation and codes of practice relating to fish welfare and fish health management at national level completes Outcome 4.

Learning Outcomes

On completion of this unit the student will be able to

- 1. Explain the management of viral and bacterial fish diseases with reference to their causes and symptoms.*
- 2. Explain the management of parasitic and fungal fish diseases with reference to their causes and symptoms.*
- 3. Describe the management of nutritional, environmental and genetic fish health problems with reference to their causes and symptoms.*
- 4. Explain the legislative control of fish health management in the EU, with reference to relevant codes of practice and the implications to fish husbandry practices.*

ASANM-406-2210: Environmental Science

Unit level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face to Face
Total Learning Hours: 150

Unit Description

The aim of this unit is to stimulate analytical thinking and develop skills for scientific inquiry that will provide the learner with a good understanding of the environment. Learners will understand the importance of how the different environmental systems interact and the implications of the environment on human society. The Environmental Science Unit is to be approached with the learner exercising problem solving and developing their investigation skills.

The Environmental Science Unit covers the main environmental topics of ecology, climate change, nutrient cycles and biodiversity. Learners are encouraged to research environmental issues and so develop their scientific literacy. Furthermore, learners need to practice communicating their research findings and thus develop their presentation skills.

Learners who complete the Environmental Science Unit will be able to utilise their understanding of the main principles of environmental science and apply the scientific skills learnt. In addition, learners will be able to draw on their environmental knowledge to develop and undertake practical investigations.

In this unit, learners are to apply the environmental principles learnt to selected local contexts in order to complete the assessment tasks. In the Climate area of study, learners choose a particular greenhouse gas to research further and compile a mini presentation, narrating how their local climate is, or could, be affected. Likewise, with the Nutrient Cycle area, learners are to choose one cycle from which to research a particular aspect. Learners must demonstrate their knowledge of biodiversity threats by selecting a threatened animal in the region they live and present the underlying principles behind the threat and solutions to prevent the loss of this animal.

Learning Outcomes

On completion of this unit the student will be able to

1. *Explain general ecological principles showing how organisms interact with their environment.*
2. *Show how climate change is affected by mankind in order to prevent further harm.*
3. *Explain how nutrient cycles function and their impact on the environment.*
4. *Appreciate the complexities of biodiversity for managing ecosystems.*

ASPRJ-409-1803: Undertake an Extended Investigative Project in the Land and Sea Based Sectors

Unit level (MQF/EQF): 4

Credits: 9

Delivery Mode: Face to Face

Total Learning Hours: 225

Unit Description

“Anyone who has ever worked on a project will agree that making a project succeed is no simple task. The difficulties manifest themselves in delays, budget over-runs, inadequate results, dissatisfied customers, high stress among the project team and other undesirable outcomes. What is the cause of all of these problems? Projects are characterised by four features: a group of people, a goal, limited time and money, and a certain level of uncertainty regarding whether the goals will be achieved. Project managers are involved with all of these aspects. Supervising and directing a project is thus anything but an easy task.”

[1] The aim of this study unit is to train learners in all the processes involved in proposing and undertaking an extended investigative project in the land-or sea-based sector. The learners should be able to conduct a literature review, compile a proposal, identify, plan, carry out an investigative project, and evaluate and present the results of the project. The project will help the learners to develop project management and communication skills by investigating a topic of their choice. It is suggested that the learners explore a topic area that interests them and is relevant to their field of study. Learners will develop this skill of taking responsibility of their own learning by choosing independently their own research problem to be solved. They should produce a breakdown of resources and a project action plan including intermediate deadlines.

Learning Outcomes

On completion of this unit the student will be able to

- 1. Conduct a literature review related to the land-or sea-based sector.*
- 2. Write a proposal for an investigative project in the land-or sea-based sector.*
- 3. Design and produce a detailed plan for an investigative project in the land-or sea-based sector.*
- 4. Construct an investigative project in the land-or sea-based sector and monitor all the phases involved.*
- 5. Review and evaluate an investigative project in the land-or sea-based sector.*

ASFSH-406-1507: Farming of Tuna and Amberjack

Unit level (MQF/EQF): 4
Credits: 6
Delivery Mode: Face to Face
Total Learning Hours: 150

Unit Description

This unit is designed to suit centre-based delivery and will help to prepare learners planning to enter the fish management sector (aquaculture, fisheries or ornamentals) or progress to higher education. It aims to introduce learners to the knowledge underpinning the farming of Tuna and Amberjack in the Mediterranean region, and provides insights to progress with the development and commercialisation of ‘controlled’ propagation, essential to the future of the sector. Within Unit assessments learners are provided a degree of choice, and can focus on either Tuna or Amberjack production.

As a scene setter, Learning Outcome 1 introduces learners to Tuna farming, a relatively new and profitable addition to Mediterranean aquaculture. The enterprise’s dependency on the capture of adult wild fish in seine nets, which are transferred to cages and towed by tug boats to the on-growing sites for ‘fattening’, is highlighted. Learners will become aware of the unsustainable nature of current production regimes, necessitating the development of closed cycle production. The risks of a down turn due to wild stock scarcity will be discussed, incentivising diversification and development of Amberjack production. Learners will explore the recent Amberjack research and development that is bringing commercial ‘closed cycle’ production of this promising new farmed species closer, in some depth, satisfying Outcome 2.

Learners will be made aware of the live feed production trials underway in an attempt to improve the survival rate of Tuna larvae during the critical first 10 days of rearing. Outcome 3 is satisfied by learners establishing, maintaining and monitoring a demonstration scale live feeds unit for algae, rotifers and *Artemia* (brine shrimp) *nauplii*, gaining some of the basic skills and disciplines that would be required in a Tuna or Amberjack hatchery.

Outcome 4 requires learners to demonstrate an understanding of fish husbandry requirements during the on-growing phase, developed through a combination of centre based study and visits to farms and research facilities. Finally, through the completion of Outcome 5, Learners will gain an appreciation of factors influencing the selection and development of farm sites, including the criteria for economically viable fish production and the need to mitigate environmental impact. The influence of site conditions and production regimes on the selection and operation of aquaculture technology will be considered.

Learning Outcomes

On completion of this unit the student will be able to

1. *Describe tuna and amberjack production regimes, with reference to the need for improved long-term sustainability.*
2. *Explain the development of hatchery techniques and technologies for farmed Tuna and Amberjack with reference to current research and development.*
3. *Conduct live feed culture operations according to established conventions in marine finfish hatcheries.*
4. *Describe the fish husbandry and site maintenance requirements during the on-growing phase for tuna and amberjack with reference to the Maltese industry.*
5. *Describe the influence of site specific factors on the selection of equipment and technology that is suitable for on-growing Tuna and Amberjack.*

ASF5H-406-1510: Marine Ornamental Aquaria

Unit Level (MQF/EQF): 4

Credits: 6

Delivery Mode: Fully Face-to-Face Learning

Total Learning Hours: 150

Unit description

This unit is designed for centre-based delivery to meet the needs of learners looking to enter the ornamental sector, or progress to higher education. Skills relating to marine aquarium systems and an understanding of how to provide the environmental conditions required by commonly held flora and fauna will be developed.

Outcome 1 is introductory, introducing the marine flora and fauna of commercial interest. Learners will research the habitat requirements and optimal conditions for fish and aquatic invertebrates commonly kept in marine aquaria, and the operating procedures that maintain a healthy aquatic environment.

The sources of fish and aquatic invertebrates for the ornamental trade will be revealed and sustainability issues facing the ornamental sector, considered. They will progress to the establishment of mixed fish populations and themed displays subsequently, satisfying Outcome 2.

Outcome 3 encourages learners to explore the technology, equipment and materials used in the aquatics industry, including the components of single and multi-tank systems used by hobbyists and the ornamental trade.

Outcome 4 develops the learner's knowledge of the animal health and welfare legislation with which the ornamental sector must comply, exemplified through case studies. The welfare of animals is taken seriously by society, and fish are subject to the same moral, ethical and legal considerations as other animals when kept in captivity.

Through practical demonstration, instruction and practise, marine aquatic husbandry skills will be nurtured and consolidated. Learners will be equipped to establish and maintain an aquarium environment for selected compatible species of marine fish, and aquatic invertebrates, thereby satisfying Outcome 5 and completing the Unit.

Learning Outcomes

On completion of this unit the student will be able to

1. *Describe the habitat and environmental requirements of marine aquatic organisms, with reference to fish and invertebrates.*
2. *Describe the marine species that are suitable for keeping in a range of marine aquaria configurations with reference to their compatibility.*
3. *Explain environmental control principles with reference to the function of the equipment used in marine aquaria to support aquatic life.*
4. *Explain the implications of the major legislation governing the aquatics industry with reference to its impact on operating procedures.*
5. *Establish a marine aquarium community and maintain suitable environmental conditions informed by routine monitoring.*

ASFSH-406-1511: Aquascaping and Ornamental Invertebrates

Unit Level (MQF/EQF): 4

Credits: 6

Delivery Mode: Fully Face-to-Face Learning

Total Learning Hours: 150

Unit description

This unit is designed for centre-based delivery to meet the needs of learners looking to enter the ornamental sector, or progress to higher education. The Unit has two distinct strands, the specialist art of ‘aquascape’ creation, and the biology and husbandry of ornamental invertebrates.

Outcome 1 introduces learners to ‘aquascaping’, developing an appreciation of a number of popular distinct styles, including the garden-like Dutch style and the Japanese-inspired nature style. The craft skills to create an arrangement of aquatic plants, rocks, stones and driftwood to compose attractive aquascapes, will be developed. Although the primary aim is to create an aesthetically pleasing underwater landscape, the technical aspects of aquatic plant maintenance will be considered. To ensure the success and continuity of an aquascape, learners must balance many factors in a closed system aquarium, including; filtration, maintaining carbon dioxide to support photosynthesis, substrate and fertilization, lighting, and algae control. Learners will be required to design, develop and maintain their own aquarium aquascape, gaining real hands on experience and skills to satisfy Outcome 2.

Working with captive species of invertebrates in the retail or public aquarium sectors, demands a thorough knowledge of the general biology of the invertebrates kept and maintained. As the species commonly held belong to a diverse and varied range of classes, many have unique and specialised features that can influence their husbandry and care.

Outcome 3 develops the learners’ knowledge of the range of invertebrate species kept for ornamental purposes, initially building an understanding of the classification system and evolutionary history of the taxa ‘in scope’. Learners will be familiarised with the general internal and external anatomy of the key taxa, so that the more unusual biological features of some organisms can be understood. They can then reflect on how extraordinary features may determine or influence animal care and husbandry, linking their biological knowledge to practical workplace implications.

A practical working knowledge of invertebrate reproductive strategies and requirements will be developed as captive breeding programmes are becoming increasingly important in the conservation of many aquatic animals. In addition, selective breeding is used to develop new strains for the ornamental trade, successfully. Real 'hands on' experience, working with a range of captive ornamental invertebrates over an extended period will consolidate learners' knowledge and understanding, developing key husbandry skills and satisfying Outcome 4.

Learning Outcomes

On completion of this unit the student will be able to

1. *Describe how aquascapes are designed, created and maintained with reference to current influential trends.*
2. *Design, construct, and maintain an aquascape, conforming to approved plans.*
3. *Explain the biology of ornamental aquatic invertebrates, with reference to the husbandry implications and emerging breeding practices.*
4. *Feed and maintain a selection of ornamental invertebrates, maintaining optimal environmental conditions.*

ASFSH-406-1512: Navigation

Unit Level (MQF/EQF): 4

Credits: 6

Delivery Mode: Fully Face-to-Face Learning

Total Learning Hours: 150

Unit description

A comprehensive introduction to Navigation and Boat handling in short trip sea passages for inexperienced individuals in non-tidal waters.

The course will equip individuals with enough knowledge to be able to plan short trip sea passages, understand the vessel they are on, communicate with authorities, behave in a competent manner as a crewmember onboard and navigate local and familiar waters by day. The learner will also acquire a good grounding in weather monitoring and be able to exert a judgement on the state of the weather during a trip.

The course also includes nautical language and words, rope handling, safety procedures, collision regulations, compass and electrical navigational aids, chart work, weather, passage planning and pilotage, buoyage systems.

In addition, the course will introduce the learner to navigational lights so as to provide a basic knowledge should the voyage overlap into night time.

NB in the course of this unit, students will also learn how to handle a boat. At the end of this unit students will be competent to undertake the Nautical License exam held by Transport Malta. It is advisable that learners do so in order to be in possession of the correct license as required by Transport Malta under Maltese Law and thereby enable them to apply a practical use of this unit to its fullest extent.

Learning Outcomes

On completion of this unit the student will be able to;

1. *Demonstrate Seamanship.*
2. *Demonstrate Navigational Competence.*
3. *Interpret and Apply Rules and Regulations.*
4. *Apply and Interpret Weather forecasts and Patterns.*

CDKSK-404-1915: Employability and Entrepreneurial Skills

Unit Level (MQF/EQF): 4

Credits: 4

Delivery Mode: Fully Face-to-Face Learning

Total Learning Hours: 100

Unit Description

This unit complements the vocational and key skill units at Level 4 and provides an opportunity for learners to enhance their employability and entrepreneurial skills.

Quite often, learners tend to focus most on technical skills and competences required in a certain trade which enable them to access employment. On the other hand, employers expect employees to be appropriately skilled to follow instructions, take initiative, work effectively in a team, take a lead when necessary and more. In view of this the unit starts with an introduction to the 4th industrial revolution and proceeds to the transversal skills necessary to find employment, retain employment and advance at the place of work. Learners will be able to highlight their strengths and identify the areas that require improvement.

The rest of the unit focuses on entrepreneurial skills, a skill which is one of the most important transversal skills identified by UNESCO. Learners are introduced to methods which can be used to generate new and innovative business ideas and methods which help them evaluate ideas and choose the most feasible. Furthermore, learners will cover the various stages of product and/or service development, including market analysis, processes, pricing strategy, promotion and resources required.

Learners will work in a small team and by the end of the unit they will have the opportunity to develop a business idea which is commercially viable. Furthermore, they will present the idea to prospective investors/stakeholders.

Learning Outcomes

On completion of this unit the learner will be able to:

1. *Understand the employability skills required for Industry 4.0*
2. *Use idea generation techniques to come up with ideas and evaluate chosen ideas*
3. *Understand the various stages of product and/or service development*
4. *Work in a team to develop a business idea which is commercially viable*

CDKSK-402-2104: Community Social Responsibility

Unit Level (MQF/EQF): 4

Credits: 2

Delivery Mode: Fully Face-to-Face Learning

Total Learning Hours: 50

Unit Description

This unit focuses on Community Social Responsibility and provides an opportunity for learners to better understand themselves and the others and to establish goals in life. Community social responsibility enables learners to understand their strengths and areas for improvement and prepares them for life, employment and to become active citizens in society.

Moving away from traditional delivery of other units, learners will be empowered to take ownership of their learning process. Hence, community social responsibility will be delivered through a combination of workshops, small-group sessions with mentors and various opportunities to reflect.

The set of sessions will tackle community social responsibility skills and will mostly focus on the self, the ability to work independently and important values in life. The second set of sessions will address interpersonal skills and will focus on working with others, dealing with diversity and conflicts. Furthermore, at the end of the sessions, the learners will be introduced to the importance of active citizenship in life.

Learning Outcomes

On completion of this unit the learner will be able to:

1. *Identify personal goals through self-reflection.*
2. *Evaluate how collaboration with others can be more effective.*
3. *Explain the importance of giving and receiving feedback.*
4. *Contribute actively to make a difference in society.*

CDKSK-406-2001: English

Unit Level (MQF/EQF): 4

Credits: 6

Delivery Mode: Fully Face-to-Face Learning

Total Learning Hours: 150

Unit Description

The main objective of this unit is to prepare students to use the English language to understand, analyse, organise and communicate specific technical knowledge by inferring meaning from, and using, embedded information, being able to evaluate information critically and communicate through different types of texts, as required by various but often specific technical contexts within the selected field of study.

The emphasis is on the processes needed to transition from use of the English language in General Education to that required for access to Higher Education.

In particular, L4 Key Skills English is targeted at learners who have completed Foundation College programmes (Levels 1 to 3) and seek to further their studies at Technical or Degree level.

In this respect, this unit recognises the necessity to meet two linguistic demands at this threshold level; strengthening students' linguistic competences to be able to communicate more specifically within their vocational area and stream and to prepare them for more rigorous academic thinking, research and writing as necessitated by degree courses.

Being introduced at this level are core and elective unit outcomes. Reading and writing outcomes are core components in this syllabus while listening and speaking are elective components. Every L4 programme must deliver the two core outcomes and any one of the two elective learning outcomes. The elective criteria to be assessed cannot be selected from and across both outcomes.

Learning Outcomes

On completion of this unit the learner will be able to:

1. *Read technical texts effectively to improve knowledge of the subject area;*
2. *Understand information presented orally in the form of recordings, or talks, discussions, seminars, interviews or presentations;*
3. *Demonstrate own understanding of the subject matter via oral presentation, mock interviews or similar oral delivery;*
4. *Write a research paper or technical report demonstrating cohesion, structure and appropriate style.*

CDKSK-406-2109: Information Technology

Unit Level (MQF/EQF): 4

Credits: 6

Delivery Mode: Fully Face-to-Face Learning

Total Learning Hours: 150

Unit Description

This unit aims to impart to the learners the necessary skills to produce, report, and analyse their work in a digital environment. Based on five learning outcomes which when combined give the learners the possibility to create advanced reports, represent data visually, understand the target audience and prepare outstanding presentations as well as manipulate images. Finally, the unit shows the learners how to keep the files generated safe from various mishaps.

At this level, most of the reports being prepared by the learners will require a certain level of detail, possibly producing reports which contain a substantial number of pages. This unit will show the learners how to master such large documents. Some information is better represented in a visual form. Using spreadsheet software, this unit will demonstrate to the learners how to create advanced charts, create what-if scenarios as well as how to analyse and validate the data being inputted. Building upon previous learning, this unit demonstrates how to create presentations, which are adequate for the audience and the venue. Moreover, the presentations will be enriched with multimedia content to enrich the experience of the audience.

Throughout the unit, the learners will be making use of images. Hence image manipulation skills will also be conveyed during the delivery of the unit. This ensures that the images being used are adequate for the task and represent the message that the learner needs to convey.

With each unique file being created representing tens of hours of work, it is imperative that files are backed up properly. The final part of this unit deals with the various forms of data replication and will provide the learners with the possibility of implementing and testing their own backup strategy that fits their needs.

Learning Outcomes

On completion of this unit the learner will be able to:

1. *Use a word processing application to manage complex documents.*
2. *Present data visually and produce advanced outputs using a spreadsheet application.*
3. *Use a presentation application to produce multimedia centric outputs.*
4. *Use an image editing application to manipulate images.*
5. *Analyse and implement a data replication strategy.*