QSAEC

Queensland Schools Animal Ethics Committee

An independent committee formed by
Department of Education,
Queensland Catholic Education Commission and
Independent Schools Queensland

AQUATIC ANIMAL ACTIVITIES

(Aquaculture, aquaponics, specimen tanks, growth studies, dissection)

STANDARD OPERATING PROCEDURE
Approved 15 November 2023

For the purpose of this Standard Operating Procedure (SOP), aquatic animals are defined as vertebrates that live in water for most or all of their life, and cephalopods (e.g. octopus, cuttlefish, and squid).

Please note: Animal ethics approval is not required for the use of bivalves, yabbies, crayfish or other aquatic creatures not considered to be animals under the *Animal Care and Protection Act 2001* (Qld) (the Act). Observation and basic husbandry of fish in a classroom aquarium is a Category 1 activity and does not require animal ethics approval. Dissection of aquatic animals purchased dead through seafood suppliers does not require animal ethics approval.

Approval to conduct activities under this SOP is conditional upon curriculum justification for this use of animals being documented by the activity leader and reviewed by the principal.

Schools may undertake the approved activities outlined in this SOP once authorised to do so by the Queensland Schools Animal Ethics Committee (QSAEC) Animal Ethics Officer.

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SECTION 1 | OBLIGATIONS

1.1. LEGAL OBLIGATIONS

Schools have legal obligations under the *Animal Care and Protection Act 2001* (Qld), the Animal Care and Protection Regulation 2023 (Qld), and the *Australian code for the care and use of animals for scientific purposes* 8th edition 2013 (updated 2021) (Cwlth) (the Code), including:

1) ensuring persons in charge of an animal fulfil their duty of care to that animal
2) obtaining animal ethics approval prior to conducting scientific activities involving animals and acting in accordance with that approval once granted
3) reporting on the use of animals for scientific purposes.

Non-compliance with this legislation may result in schools receiving a maximum fine of 2000 penalty units. (Penalty unit value is notified in the **Penalties and Sentences Regulation 2015 (Qld)**).

All Queenslanders have a 'general biosecurity obligation' under the *Biosecurity Act 2014* (Qld). Schools are responsible for managing biosecurity risks that are under their control and that they know about, or should reasonably be expected to know about. Contact Biosecurity Queensland on 13 25 23 for advice on managing specific risks or to report notifiable incidents.

1.2. DUTY OF CARE FOR ANIMALS

If you are in charge of an animal, you have a duty of care to that animal - no matter why you are in charge of it, what you are using it for or how long it will be in your care. All decisions and actions involving the care and use of animals for scientific purposes must be underpinned by respect for animals. This respect is demonstrated by:

- using animals only when justified
- supporting the wellbeing of the animals involved
- avoiding or minimising harm, including pain and distress, to those animals
- applying high standards of scientific integrity
- applying the principles of Replacement, Reduction and Refinement (the 3Rs) at all stages of animal care and use through:
    - **replacement** of animals with other methods (alternatives)
    - **reduction** in numbers of animals used
    - **refinement** of techniques used, in order to minimise adverse impacts on animals
- knowing and accepting one's responsibilities.

1.3. CURRICULUM JUSTIFICATION FOR THE USE OF ANIMALS IN EDUCATION

It is the teacher's responsibility to provide a curriculum justification for any learning activity that involves the use of animals, including activities approved under a SOP. The use of animals must provide an added component to the learning that is neither trivial nor available in other ways, and there must be evidence to support this position. **Planning documents should clearly identify how the use of animals is essential to achieving the learning objectives.** The justification should consider whether non-animal alternatives could achieve the same learning objectives, the minimum number of animals necessary to achieve the objectives, the impact on the animal/s involved and whether the potential effects on the wellbeing of the animals are justified by the potential benefits of their use.

The QSAEC, when undertaking a site visit at the school, may request to see documentation detailing the curriculum justification for the use of animals.

If there are viable alternatives to animal use that meet the learning objectives, they must be used in preference to using animals. At all times the impact on the animal/s should be considered and, where appropriate, discussed with the students in an age-appropriate way.

Activities outside the scope of this SOP **must be considered by QSAEC before approval can be granted.** To seek approval to conduct activities additional to those approved under this SOP, or to modify an activity approved in this SOP, submit a Modification, SOP variation or amendment form in conjunction with the Application/Activity notification form at the last page of this SOP.

Please note: The QSAEC will **not** approve any activities classified as Category 4 in the Categories of animal use.

1.4. ANIMAL HEALTH AND WELFARE

Responsibilities of school personnel under the Code details obligations of staff under animal welfare legislation to promote the responsible care and use of animals for scientific purposes.

An **unexpected adverse event** is any event that may have a negative impact on the wellbeing of an animal and was not foreshadowed in the approved proposal, SOP or subsequent documents to the QSAEC.

An unexpected adverse event may result from different causes, and includes but is not limited to:

- death of an animal, or group of animals, that was not expected (e.g. during surgery or anaesthesia, or after a procedure or treatment)
- adverse effects following a procedure or treatment that were not expected
- adverse effects in a larger number of animals than predicted during the planning of the project or activity, based on the number of animals actually used, not the number approved for the study
- a greater level of pain or distress than was predicted during the planning of the project or activity
- power failures, inclement weather, emergency situations or other factors external to the project or activity that have a negative impact on the welfare of the animals.

In the event of an unexpected adverse event or emergency, prompt action must be taken to address any adverse impacts on the animal/s. Alleviating unanticipated pain and distress must take precedence over an individual animal reaching the planned endpoint of the project, or the continuation or completion of the project. Emergency treatment may be required and, if necessary, animals must be humanely killed without delay.

In response to an unexpected adverse event, action and investigation by the activity leader or facility manager is required to ensure students, staff, or other animals are not inadvertently affected. The specific response will depend on the animal and the circumstances. It may require seeking advice from a veterinarian to determine the best course of action (e.g. necropsy of the dead animal by the vet), removal of the deceased animal (e.g. by the supplier), or diagnostic investigations of facility or management practices to determine cause of death (e.g. water testing of fish tank, checking of ventilation).

All adverse events provide opportunities for students to learn from the experience. Activity leaders should optimise student learning outcomes (incidental and planned) by focussing on the learning potential of a specific event (e.g. prevention, animal welfare, diagnostic tools, treatment, security, harm minimisation).

Notify the QSEAC within 7 days of the event, using an Unexpected adverse event report.

Please note: Necropsy of a dead animal is not an approved activity under this SOP due to potential health and biosecurity risks and must only be performed by a competent person. QSAEC recommends that if a necropsy is required it is performed by a vet.

Further advice about reporting unexpected adverse events is available on the Department of Primary Industries (DPI) website.

1.5. STUDENT AND STAFF HEALTH

Those involved in the care and use of animals should make themselves aware of the potential disease hazards and other associated occupational health and safety issues, and manage risks according to the school's risk management process. Apart from injuries which may occur due to handling animals, there are a variety of infectious diseases (zoonoses) that are transmissible from various animals to humans.

Zoonotic diseases are common and the illnesses they cause can be serious. They can be spread by direct contact with animals, for example via bites or scratches, or through contact with animal faeces, bodily fluids, airborne particles, birth products, or enclosures contaminated with these materials.

Staff should familiarise themselves with the zoonoses the animals in their care may potentially transmit, the routes of transmission and what activities may potentially expose staff or students to infection. This research will inform the risk assessment to determine how to manage these risks or determine whether the activity should be conducted at all.

For comprehensive advice regarding zoonotic diseases and precautionary measures to minimise risks to staff and students, refer to Animal observation and handling, Animal contact guidelines - reducing the risk to human health 2014 (Interim) and Preventing zoonoses.

Risk management of animal activities ensures the health, safety and wellbeing of students, staff and others involved. If a Curriculum Activity Risk Assessment activity guideline exists, that guideline must be adhered to at a minimum. Risks associated with zoonotic diseases carried by animals must be identified and measures planned to allow activities to be conducted with an acceptable level of residual risk.

Any incident or injury that occurs in association with an activity must be reported, recorded and notified in accordance with the school's health and safety incident recording procedures (e.g. state schools must adhere to the Health, safety and wellbeing incident management procedure).

1.6. RECORDKEEPING

Schools must keep a school-based animal activity register which includes records relating to their use of animals for scientific purposes for seven years for audit purposes. This includes:

- scientific user registration (for non-state schools)
- signed applications, activity notification forms and modifications
- approval responses from QSAEC
- signed QSAEC reports (e.g. annual completion reporting, unexpected adverse events, complaints)

Clear and accurate records relevant to the particular species used in the activity/s should be readily available, including, as relevant:

- animal identification records (e.g. number of each species kept in each tank, identification of tanks)
- dates and sources of acquisition of each batch of fingerlings/tank (include relevant agreements such as for agistment or the use of privately-owned animals)
- feeding logs (times/amount) for each tank
- supervision/monitoring logs of animal health and wellbeing
- water quality and equipment monitoring logs for each tank
- dates and types of husbandry practices carried out
- breeding records
- vaccination/treatment records (include chemical/medication administration details and any veterinary treatment provided)
- fate plan and disposal details and dates for each batch/tank (including transport requirements)
- emergency contacts and procedures.

SECTION 2 | QUALIFICATIONS, SKILLS AND EXPERIENCE

Any teacher conducting scientific animal activity must have competency in the particular procedure and:

- a relevant science or science education qualification (e.g. Agricultural Science, Biological Science)
  or
- relevant science or science education experience as deemed appropriate by the school principal (generally 2 years' experience).

For new or inexperienced teachers (less than two years' experience), all activities must be conducted under the supervision of a Science or Agricultural Science Head of Department (HOD) or suitably experienced person.

Where direct supervision of a suitably experienced person is not available, a new or inexperienced teacher must:

- identify a mentor, maybe a Science or Agriculture HOD from a neighbouring school
- provide planning documents to the mentor.

Persons deemed to be suitably qualified must have:

- conducted risk assessments on the procedure/s to be carried out
- found the procedure/s to be safe and humane considering animal and student welfare

- considered the maturity and suitability of the student/s involved in the activity.

Teachers should ensure that animal users, including students, staff and volunteers are provided with adequate prior instruction in specific activities to enable appropriate care of an animal and to minimise risk of undue stress or harm to an animal.

SECTION 3 | STANDARDS OF PRACTICE

Where 'fish' are referred to in this SOP, the inclusion of other aquatic animals as defined by the Act is inferred.

3.1. AQUACULTURE

AQUACULTURE is the farming of aquatic plants and animals, under varying degrees of controlled conditions, both in marine and freshwater environments.

Aquaculture can also have negative impacts on the welfare of aquatic animals, and the health of the local environment. Only aquaculture activities considered to be low-impact under the Accepted development requirements for material change of use that is aquaculture are covered by this SOP. Low-impact aquaculture activities must not cause or result in the discharge of waste into Queensland waters, and must meet all code standards at Section 3 and 4 of the accepted development requirements (e.g. stock may not be sold or used as bait or used for stocking public waters or farm dams; culture stock must be sourced from within Queensland). Examples of low-impact aquaculture activities are:

- indigenous freshwater fish where the species is indigenous to the particular catchment where the aquaculture occurs and is carried out in ponds or above-ground tanks with a total water surface area of no more than 10 hectares

  or
- indigenous freshwater fish where the species is not indigenous to the particular catchment where the aquaculture occurs and is carried out in rain-proofed, above-ground tanks that are impervious to predators of the stock, with a total area of no more than 100m^2 (excluding water storage areas free of stock)

  or
- non-indigenous fish, carried out in rain-proofed, above-ground tanks that are impervious to predators of the stock, with a total area of no more than 100m^2 (excluding water storage areas free of stock)

  or
- indigenous marine fish, carried out in rain-proofed, above-ground tanks with a total area of no more than 100m^2 (excluding water storage areas free of stock).

If any aspect of the accepted development requirements cannot be complied with, a development application would be required. Fees apply. Contact Fisheries Queensland on 13 25 23 for enquiries relating to the accepted development requirements for aquaculture, or the regional office of the Department of State Development, Manufacturing, Infrastructure and Planning for more information in relation to assessable aquaculture activities.

QSEAC approval to conduct aquaculture activities not considered to be low impact must be sought using an Application to use animals for scientific purposes, rather than this SOP.

3.2. AQUACULTURE SYSTEM DESIGN

SITE SELECTION Tank culture has a number of advantages over pond-based culture – requiring less land and water, and allowing operations in areas with soil and topography limitations. Using temperature-controlled systems also eliminates the need to consider ambient climate/temperature as criteria when selecting a site. Water supply is critical in a school situation, and access to suitable dechlorinated water (tanks or dam water) should be considered.

BASIC INTENSIVE RECIRCULATION SYSTEMS consist of a number of tanks (usually 1000-1300L in size) housed within a vermin proof, and preferably climate-controlled, room or shed. Tanks are independently or group filtered by large biofilters, which are used to strip nitrogenous waste and nutrients from the water. Recirculation systems can also incorporate a number of other filtration units – including UV and ozonation systems to disinfect water, and protein skimmers to remove protein based waste. After passing through the filters, the water is then recycled back to the tanks.

Specialised technical advice should be sought to determine the best system design that would meet the school's needs.

3.3. AQUAPONICS

AQUAPONICS is the combination of aquaculture (growing fish in water) and hydroponics (growing plants in water). Fish and plants are grown in an integrated system, creating a symbiotic relationship between the two.

In an aquaponic system, the water from the fish tank circulates through a grow bed where the plants are grown.

Micro-organisms (e.g. nitrifying bacteria) convert fish wastes (ammonia) into plant-available nutrients. The plants use these nutrients as their main nutrient supply for growth. The plants also filter the water, giving the fish clean water to live in.

When aquaponics systems are combined with a climate-controlled environment (e.g. a greenhouse), food can be produced all year round.

Only aquaculture activities considered to be low-impact under the Accepted development requirements for material change of use that is aquaculture are covered by this SOP. Refer to Section 3.1. Aquaculture for more information.

3.4. AQUAPONIC SYSTEM DESIGN

There are 3 main styles of designs in aquaponics systems including:

- media based (also known as 'flood and drain' or 'ebb and flow' systems)
- deep flow / raft
- Nutrient Film Technique (NFT)

MEDIA-BASED SYSTEMS is the most common style of aquaponic design used in backyard systems. They use gravel or expanded clay medium located in grow beds where plants are grown directly where they are sown. The grow beds are usually flooded and drained periodically, allowing water to circulate through the system on a regular basis.

DEEP-FLOW / RAFT SYSTEMS are used mainly in commercial situations. They are constructed with long channels which hold water at a depth of around 30-40 cm, with boards that float on top of the water. Boards can be made from a material that floats (e.g. Styrofoam, plastic). Holes are made into the boards, and net pots are fitted. Plants are either sown directly into the net pots, or transplanted from other growing areas. The plants grow with their roots always immersed in the long channel of water below the boards.

NFT SYSTEMS is the least used design. These systems have high maintenance needs, including the requirement for very good mechanical filtration systems. Plants hang in net pots much like deep-flow systems, but instead of there being a body of water always present to hang into, a small amount of water is run along the base of the channel where the plants roots can access it.

When constructing the system, take care to use food grade materials and media/pumps that are meant for use with fish. Fish health problems may arise from toxins leaching out of grow bed media, using culture tanks that have previously been used for harsh chemicals, or using old or second-hand plumbing and glues/silicones.

3.5. SPECIES SELECTION FOR AQUACULTURE/AQUAPONICS

Please note: Animal ethics approval is not required for the use of bivalves, yabbies, red claw or other aquatic creatures not considered to be animals under the Act.

There are various species of fish that are proven performers in intensive aquaculture and suitable for using in a school's aquaculture/aquaponics enterprise. Care should be taken to ensure that species that are most appropriate to the school environment are selected. Species for aquaculture/aquaponics need to be:

- able to thrive in an artificial tank environment
- able to be held at appropriate density
- able to accept and grow on a commercial pellet
- amenable to artificial feeding

- efficient food converters
- non-cannibalistic
- disease resistant
- capable of rapid and uniform growth
- marketable with high meat recovery (depending on planned fate at the end of the activity).

Invasive or high-risk pest fish have characteristics that are detrimental to other fish, aquatic habitats or humans. Under Queensland law, fish declared as noxious under the *Biosecurity Act 2014* (Qld) may not be kept, fed, given away, sold or released into the environment without a permit. Penalties apply. Refer to Department of Primary Industries website for further information on pest and noxious fish.

Sourcing animals by collecting broodstock from the wild is not permitted under this SOP and would require the submission of a Modification, SOP variation or amendment form (including details of relevant licensing, justification, method of capture) in conjunction with the Activity notification form at the last page of this SOP.

Use of the fish species in Table 1 are approved under this SOP. If a species not listed in Table 1 is to be used, Appendix A: Species information summary must accompany the Activity notification form when the application is made, and approval will require the consideration of the QSAEC.

Mixing species or fish of different ages is not recommended. Doing so will usually result in health problems or cannibalism and losses will occur.

TABLE 1: SPECIES APPROVED FOR AQUACULTURE/AQUAPONICS UNDER THIS SOP

Species	Species-specific information
Jade perch	Section 7.1
Silver perch	Section 7.2
Barramundi	Section 7.3
Murray cod	Section 7.4
Sleepy cod	Section 7.5

3.6. FISH STUDY DESIGN AND SPECIES SELECTION

OBSERVATION AND BASIC HUSBANDRY OF FISH IN A CLASSROOM AQUARIUM does not require animal ethics approval as these activities are classified as Category 1 in Categories of animal use in Queensland schools.

OBSERVATION AND BASIC HUSBANDRY OF FISH IN SPECIMEN TANKS/EXHIBITS (e.g. those housed onsite by Environmental Education Centres) requires animal ethics approval as these activities are classified as Category 2 in Categories of animal use in Queensland schools. Specialised instruction and training is required for the appropriate care and husbandry of these animals.

FISH STUDIES involving specific activities to achieve scientific learnings are within the scope of this SOP. Such activities might include extended experimental investigations requiring students to manipulate the aquarium environment, measure fish growth, and/or collect and analyse data. The fish used in these studies may be part of an aquaculture/aquaponics activity (i.e. of the species shown in Table 1) or may be acquired specifically for fish study/experimentation, usually involving small aquarium set-ups.

A wide variety of fish species are suitable for experimental study using small aquariums. Appendix A: Species information summary must be completed if using any species other than those listed in Table 1, and must accompany the Activity notification form when applying for approval to conduct the activity.

Aquariums must provide sufficient space and water for fish depending on size, number of fish and type of aquarium. Fish must have adequate space to swim and to participate in normal behaviours. Where different species are housed in the same tank, species compatibility must be considered.

Aquariums must be placed in an appropriate position to minimise stress and reduce risk of unexpected adverse events to both animals and students. A minimum water requirement of 4.5 L of water per 1.5 cm of fish must be provided. One to two aerators must be used per 35-75 L of water and suitable aquarium covers must be used. Refer to Section 3.8. Environment for further minimum requirements for the aquarium environment.

3.7. PHYSICAL ATTRIBUTES OF FISH

As physical attributes of fish vary greatly with species, stage of growth and environmental conditions, refer to Section 7 Species information for further details.

If a species of fish other than those listed in Table 1 is to be used, Appendix A: Species information summary must accompany the Activity notification form when the application is made, and approval will require the consideration of the QSAEC.

Studies are being conducted into the mental attributes of aquatic animals. Refer to Section 6 - References for more information.

3.8. ENVIRONMENT

HOUSING An appropriate housing system that optimises conditions for the particular fish species must be set up and established prior to acquiring any animals. Consideration must be given to the species, size and expected growth. Aquaculture experts, usually the supplier of fingerlings, should be consulted about the needs of each species. The natural environment should be replicated in the tank where possible. All fish holding facilities and support systems must be inspected every 24 hours.

Housing design must allow for routine monitoring of animal health. Glass and clear plastic tanks should be used for shelving style housing (i.e. no black tubs). Large scale fish holding tanks should allow for easy observation and monitoring of the fish.

Ensure that additional tanks are available to quarantine sick or injured animals. Consider the need for grow-out tanks to separate fish that develop at different rates.

CONTINUOUS POWER SUPPLY Uninterrupted power supply (UPS) units providing automated power back-up systems are required to ensure optimum dissolved oxygen levels are maintained to support the wellbeing of fish.

SPACE The area where the animals are housed should be secure and protected from extreme weather conditions.

LIGHTING The normal diurnal pattern of lighting must be provided - with 12 hours of dark and 12 hours of light each day. Make sure the tank is covered from direct sunlight by using a lid. In an aquaponics system direct sunlight will cause algae to grow, taking away nutrients from the plants that are growing in the grow beds.

SHELTER Aquaculture tanks should be placed undercover or in a building out of direct sunlight to provide an environment with relatively low light intensity. Tanks and aquariums must have appropriate covers. Smaller aquariums should try to replicate the natural environment providing areas of shelter and privacy (e.g. using aquatic plants, objects for hiding and exploring).

BEDDING/GROWING MEDIA Aquaponic grow beds can be filled with lightweight clay balls, gravel or plastic biobeads. Biobeads provide a high surface area for bacteria and therefore a much lower volume/weight of media is required. Inclusion of a source of calcium carbonate (e.g. shell grit or coral) in the media will help buffer and keep pH in the correct range for the filter. Aquarium bedding must be clean and free from chemical residue and should be 75 mm thick on average.

WATER QUALITY Maintenance of good water quality is the most important aspect of fish husbandry. Good water quality must be monitored, maintained and recorded daily. This includes monitoring of suitable pH, dissolved oxygen level, temperature, ammonia and salinity as well as monitoring the cleaning of filters and tanks. Other variables that influence water quality include alkalinity, hardness, turbidity and ammonium, nitrite, hydrogen sulphide and carbon dioxide levels.

TEMPERATURE Temperature affects all chemical and biological processes. The metabolic rate of fish doubles for every rise of 10 °C. Therefore, temperature has a direct effect on important factors such as growth, oxygen demand, food requirements and food conversion efficiency. The higher the temperature, the greater the requirement for oxygen and food and the faster the growth rate, up to the optimal temperature for that species. Temperature partly determines the concentration of oxygen in water. The solubility of oxygen decreases with increasing temperature, and so concentrations are usually lower in summer.

DISSOLVED OXYGEN All fish require dissolved oxygen to survive. The amount of oxygen that the water can hold depends on the properties of the water, particularly temperature, with warmer water holding less

oxygen. High oxygen depletion occurs shortly after feeding. Factors that will change the amount of dissolved oxygen in the system include stocking density (more fish, less oxygen), temperature (higher temperature, less oxygen), salinity of water (high concentration of dissolved salts, less oxygen) and use of air diffusers (smaller bubbles, more oxygen). Water will only absorb a certain amount of oxygen before it becomes saturated.

All aquaculture housing facilities should be aerated. Tanks and aquaria should be aerated continuously with diffused air or water splash systems; and ponds with mechanical aerators such as paddlewheels for around 8 hours/day. In circular, self-cleaning tanks, a constant flow of water must be used to facilitate the removal of solids and dissolved wastes to supplement aeration. If tanks need to be static (e.g. during chemical treatment), fish should not be fed and water (10-30 %) should be exchanged daily. Dissolved oxygen is the most critical and limiting variable in fish husbandry and culture. Although fish can survive at levels of 4 mg/L, they may suffer stress, reduced growth and increased susceptibility to disease. Oxygen enters water through diffusion at the air-water interface and as a result of photosynthesis when there are plants in the water. For aquaria, tanks and raceways, dissolved oxygen is usually supplied through low pressure compressors or blowers (e.g. through diffusers like air stones) or by careful design of water flow. In ponds, paddlewheel aerators are among the most efficient methods of transferring oxygen from the air to the water. This also helps with mixing water throughout the pond.

Pumps and air supply conduits/hoses should be checked periodically.

SALINITY Salinity refers to the total concentrate of all dissolved ions. Many Australian native fish tolerate a wide range in salinity, with freshwater species coping with up to 5 g/L and many estuarine species coping with salinity as low as 10 g/L. Fish need to be given time to adjust to changing salinity.

PH The desirable range for fish is from 6-9, depending on the species. A pH of 4 is lethal for most species while prolonged exposure to pH levels of above 10 is also lethal. In freshwater systems, a pH of 7.6-7.8 is a good compromise for maintaining an effective biofilter and suitable ammonia levels. Generally, pH will fall with time in an aquaponics system. Potassium bicarbonate (available from hardware stores) and calcium carbonate will often need to be added to the filter to maintain high enough pH to maintain effective denitrification over time. Potassium bicarbonate has the added bonus of balancing up the plants potassium requirement (which is low in fish waste). Shading of tanks to prevent algal growth will reduce the pH fluctuation. In tanks with algae, pH can change significantly over the day especially if carbonate levels are low. Note that, in an aquaponics system, iron chelate will need to be added to the filter as there is insufficient iron for plants in fish waste and iron has low availability above a pH of 6.

AMMONIA Ammonia can enter the tank environment via tap water, decomposition of organic protein matter (e.g. excess food) or excretion by fish through the gills. New systems are especially prone to ammonia accumulation as the biofilter takes time to develop. The bacteria in a biofilter facilitate the conversion of ammonia to nitrates. The bacteria in these filters are more effective at removing ammonia at higher pH but the toxicity of ammonia in tank water increases with pH so optimum pH is a trade-off.

HARDNESS Hardness measures the total concentration of calcium and magnesium ions in the water, and is measured in parts per million (ppm) of calcium carbonate. Generally speaking, total hardness should be about 100 ppm for water temperatures of 20-25 °C.

WATER EXCHANGE Poor water quality can result from inadequate water exchange. Water exchange can be achieved through:

- partial draining of the pond or tank and then replacing the lost water
- flow-through systems with the pond, tank or raceway remaining full through water entering and leaving the system at the same time from different locations
- recirculating systems.

FILTRATION The maintenance of water quality in tanks and aquariums can be assisted through a filtration system. The filtration type can be mechanical, chemical or biological. Filter pumps and intake filters should be checked regularly to ensure they remain free from debris.

BACTERIA Plants are mostly absorbing nitrates which are the end product of nitrification, so the wastes need to be processed by bacteria in a filter medium, whether it be an aquaculture filter or the grow bed. It is critical to build up biofilter bacteria number before introducing fish to the tank. Use of commercial fish filter inoculant or use of wet filter media from an existing operating filter is recommended. It can take up to 6 weeks for biofilters to fully develop.

CLEANING A high level of hygiene and cleanliness must be kept at all times and sufficient water exchange must be maintained. Tanks should be cleaned regularly, by siphon or vacuum pump, to reduce problems with the accumulation of organic matter (e.g. uneaten food, faeces) and fouling organisms, bacteria and algae. Filters need to be backwashed regularly to prevent build up and decomposition of accumulating waste material. Floors and drains associated with tank rooms should be cleaned and sterilized on a regular basis. Dilute pool chlorine or sodium hypochlorite (NaOCl 20 ppm) or caustic soda (NaOH 1%) are suitable cleaning agents for this purpose.

VENTILATION Air surrounding tanks and ponds must be of acceptable quality with respect to dust, chemicals and smells. Special care should be taken when spraying insecticides in the area.

MOSQUITO CONTROL Mosquito management should be considered. Larger species such as perch will eat mosquito larvae when they are young fish but once they grow bigger they are not effective at reducing mosquito wrigglers. Recommendations for mosquito control can be found at Ausyfish.com.

3.9. STOCKING DENSITY

Stocking density is dependent on the housing conditions, prevailing water quality, the species and size of the fish, the temperature of the water and the oxygen supply.

Recommended aquaculture stocking is at no more than 1 fish per 10 L of water, assuming that adequate filtration is available to process fish waste.

3.10. FOOD REQUIREMENTS

Fish must be provided with a suitable diet for their species, age, size, growth stage and stage of production.

TYPE Commercial diets are available from a number of feed manufacturers for marine and freshwater fish including diets for larvae, juveniles and adult. Pellet food sizes range from 1 mm to 6 mm, with sinking pellets available for bottom feeders. The commercial diet used should be designed for the target species, life stage and size.

Commercial fish diets should be stored for as short a time as possible before use and kept cool and dry. If the diets are to be stored for longer than one month they should be kept in cool (<15 °C), dry conditions or frozen.

Care must be taken to ensure that fresh food (e.g. baitfish or plant material) is not contaminated and does not deteriorate.

QUANTITY AND REGULARITY Fish should be fed to optimise survival and growth. A general rule is to provide as much feed as the fish can eat in 2-3 minutes. Any uneaten food after 5 minutes should be removed to prevent adverse water quality. Fish ‘going off’ their food is one of the best indicators that water quality is not optimum and necessitates further investigation. At such times feeding should be reduced or suspended until conditions improve. Daily feeding logs must be maintained.

3.11. NORMAL BEHAVIOUR

Aquaculture behaviour and needs vary between species. Research must be undertaken to select a species appropriate to a particular location, aquaculture/aquaponics/aquarium setup and intended fate of the fish (e.g. consumption) to allow for normal behaviour.

3.12. BREEDING MANAGEMENT

In accordance with s.4.6 of the Code, animal breeding that does not achieve an educational outcome in science and fails to provide for the lifetime welfare of animals (and their offspring) cannot be demonstrated to, or carried out by, students.

3.13. SUPERVISION AND MONITORING

Fish must be inspected at least once daily to assess health and wellbeing.

Daily feeding logs must be easily accessible, preferably displayed, for ease of monitoring.

Diligence in observation does not alter on weekends and holidays. Staff members need to be rostered to maintain observation schedules as per weekdays.

Daily/weekly monitoring logs must be maintained and should include monitoring of water quality, leaks, electrical equipment, air hoses, filters, back-up power, security, as well as animal health and behaviour.

Ongoing risk management of potential hazards (e.g. water spills, exposed plumbing and pumps, zoonotic diseases) should be rigorously applied.

3.14. HANDLING

Handling of live fish should be minimised. Skin, scale and slime layers are easily damaged by nets, dry hands and dry surfaces, leaving fish vulnerable to fungal skin infections. Suitable non-abrasive nets (e.g. lightweight mesh nets) should be used to capture fish. Ensure nets are wet and catch fish one at a time to ensure the animals don't scrape against each other and cause external damage.

Care must be taken to ensure that a fish is out of water for the shortest possible time.

Use of light anaesthesia is recommended to reduce animal stress when handling is required. If anaesthesia (e.g. Aqui-S, clove oil) is used for non-invasive procedures such as weighing, anaesthetic response should be monitored closely.

All persons working in the aquaponics facility should maintain a high degree of personal cleanliness and should take all necessary precautions to prevent contamination to the fish. People with known skin conditions, (e.g. cuts, abrasions, boils, sores) must not place any part of the affected area into the water unless the affected area is covered with a waterproof adhesive dressing and gloves are worn.

Personal protective equipment should be used as appropriate, as indicated in the CARA activity guideline for handling marine organisms and other relevant guidelines.

Hands and equipment must be washed before and after handling any animals and between handling different groups of animals. Ethanol hand wash gel and a thorough rinse in water are recommended as detergents may be toxic to aquatic animals.

3.15. TRANSPORT

There are a number of policies and protocols that must be followed when moving live aquatic animals in Queensland.

Ensure confirmation has been received from the animal supplier that relevant protocols have been followed. If animals are being transported live at the end of the activity (e.g. to be returned to the supplier), seek advice from the Department of Primary Industries (Telephone: 13 25 23) about which protocols apply.

Only healthy fish should be transported. The likelihood of problems during transportation is increased when fish have had recent disease problems or have physical deformities.

Whenever possible, confirm the day of transportation with the carrier in order to confirm the last feeding time. No food should be given on the day of transportation to reduce water fouling during transport.

Ensure transport housing (e.g. insulated foam boxes) is cleaned and sterilised prior to use, and can maintain temperatures and aeration within an acceptable range for the specific species. Animal health and water quality, particularly ammonia levels, should be monitored every 2-3 hours during transport. The use of a mild sedative such as a low dose of Aqui-S could be considered to reduce animal stress, particularly for larger biomasses of fish. If anaesthetics are being used then aeration must be provided.

Note that approval to transport fish interstate is not included in this SOP and would require consideration by the QSAEC through the submission of a Modification, SOP variation or amendment form.

3.16. DISEASE PREVENTION

Refer to Health management technical guidelines for aquaculture.

Health protocols for moving live fish are available at Moving live aquatic animals. These protocols include detail of diseases of concern for individual species.

Health problems usually occur when the fish are stressed from poor water conditions, unsuitable water temperature, aggressive behaviour, poor diet, or sometimes it can be from their environment.

Risks associated with zoonotic diseases related to aquaculture industries must be managed.

All activities should be documented using the appropriate records.

3.17. SIGNS OF ILLNESS

Fish health should be monitored daily and, preferably, more often. While 100% survival of fish should be the aim, industry mortality rates below 5% are expected.

The first sign of ill health may be a change in the animal's natural demeanour. Common signs of illness include skin lesions such as spots, fin erosion, gross colonies of bacteria, ulcers or growths, floating, listing, swelling of the body cavity and swimming upside down.

Once familiar with the normal behaviour of the species, this can be closely monitored to identify any changes that may suggest illness, inadequate diet or insufficient water quality. Any sign of abnormal behaviour should be acted upon quickly as the health of most species used in aquaculture can deteriorate rapidly. If there are concerns that an animal is acting abnormally, contact an expert (e.g. the fish supplier). If the cause of ill-health cannot be identified and corrected, assistance should be sought from a veterinarian who is familiar with the particular species.

Any fish showing signs of stress or disease should be removed from the tank, quarantined in an isolation tank and treated appropriately until it recovers fully. If this is not feasible or if the disease has spread to a number of fish, then the entire tank should be treated.

Treatments must only be administered by trained personnel.

A quarantine period of at least two weeks is recommended. At the end of the quarantine period, tanks must be thoroughly cleaned.

Any signs of illness or injury, and treatments given, should be documented in the appropriate records. Such records should include reports of unexpected incidents such as equipment failures.

Note that all medication used to treat fish diseases in an aquaponics system will in some way harm the plants. For this reason, it may be necessary to isolate the grow bed, or remove the fish to a separate tank with adequate filtration.

Deaths and other unexpected adverse events must be advised to QSAEC as soon as practicable after the incident's occurrence, using the Unexpected adverse event report.

3.18. ANIMAL EMERGENCY ARRANGEMENTS

The school must have an emergency management plan to deal with events in and out of school hours. Details of the plan will vary according to the needs of each school and must include:

- signage that includes emergency contacts, animal identification details
- monitoring of animals, including on weekends and school holidays
- a first aid kit for animals
- at least one local veterinarian on call
- strategies to withdraw individual animals (e.g. due to illness or death) or all stock (e.g. due to equipment issues, leaks, natural disasters, vandalism)
- arrangements for power outages (e.g. checking on back-up power, battery level checking)
- a list of who is competent to euthanase animals if necessary
- a schedule of persons authorised to respond to emergencies and engage veterinary assistance.

3.19. HUMANE KILLING AND EUTHANASIA

Deaths for the purpose of consumption or dissection are an expected outcome under this SOP and do not have to be advised to QSAEC on an Unexpected Adverse Event Report as individual incidents. However, deaths due to other causes must be reported to QSAEC using an Unexpected adverse event report.

HUMANE KILLING FOR CONSUMPTION OR DISSECTION

The decision about which method to use will be determined by the need to preserve the fish as a whole.

Use of anaesthetic overdose using Aqui-S or clove oil will preserve the fish whole, while spiking and percussive stunning will destroy the brain. Use of Aqui-S or clove oil is not recommended for fish intended for consumption as questions exist about the carcinogenic potential of eugenol products.

Fish should remain in water until immediately prior to humane killing.

Spiking involves driving a sharp spike (e.g. ice pick, sharpened screwdriver) into the brain of the fish. The spike should be placed in a position to penetrate the brain of the fish and then pushed quickly and firmly into the skull. The impact of the spike should produce immediate unconsciousness. The spike should then be moved from side to side to destroy the brain. Visit www.ikijime.com or https://www.youtube.com/watch?v=cBAzhUiJ4ys for a detailed description of this process.

Percussive stunning followed by severing of the spinal cord, usually by decapitation, involves a forceful and accurate blow to the head with a blunt instrument. The force required will depend on the size of the fish. The blow should be aimed just above the eyes to impact on the brain. The effectiveness of the stun should be checked and another blow applied if the fish is not unconscious.

EUTHANASIA

Where a fish is so sick, diseased or injured that recovery is unlikely or undesirable on humane grounds, euthanasia must be arranged by a person competent in the technique for fish. Refer to Factsheet H of Guidelines to promote the wellbeing of animals used for scientific purposes for approved methods of humane killing and euthanasia of fish. Skin absorption (e.g. using Aqui-S or clove oil) is recommended however stunning and brain destruction or cervical dislocation (for small fish only) by a suitably trained person is acceptable.

The following methods are not suitable for killing fish as they do not result in a rapid or humane death: chilling with ice in holding water; carbon dioxide in holding water; chilling with ice and carbon dioxide in holding water; salt or ammonia baths; asphyxiation by removal from water; bleeding out without stunning.

Notify the QSAEC of deaths and other unexpected adverse events within 7 days of the incident's occurrence, using the Unexpected adverse event report. The signed hardcopy should be held in the school's animal activity register. Biosecurity Queensland should be notified if a significant disease event occurs.

3.20. DISPOSAL – FATE PLANNING

Fish may be humanely killed for sale/consumption/dissection or returned to the supplier. Where relevant, carcasses must be disposed of in accordance with local council regulations. Fish used in school aquariums, aquaponics or aquaculture tanks cannot be released into waterways.

SECTION 4 | APPROVED ACTIVITIES

All activities must be conducted in line with industry and veterinary standards. Chemicals and drugs used must be judged to be required by a qualified instructor, must be registered products, and must be used in accordance with Safety Data Sheet information and manufacturer's instructions.

Note: Instructor:student and student:animal ratios cannot always be specified with accuracy given the wide variety of class sizes, student ages and settings in which activities are being conducted. While ratios stated in this document for dissection are minimum requirements, careful consideration must be given to determine ratios that are most effective in supporting and safeguarding animal wellbeing.

4.1. SETTING UP TANKS

Category 1 – very low impact				
Activity	Objective	3R activities	Ratios	References
Setting up fish tanks	To instruct students in the procedures for setting up fish tanks	Theoretical learning, step-by-step guides, modelling, simulations.	**Instructors:Students** 1:30 instructing 1:5 supervising	NT Government - Aquaponics; 3.8. Environment

Before stocking an aquaponics system, it is important to fill and run the tank to ensure that there are no leaks and that syphons work etc. Once this is done, run the system for at least a week with all the grow media installed and pumps running. This allows the system to establish bacteria and the water parameters to settle. Biofilters in new systems can take weeks to fully develop and benefit from preconditioning/inoculation using commercial products.

Liaise with the fish supplier to find out about the quality of the water from which the fish are coming so that the aquaponics environment can be adjusted to assist acclimatisation of the new fish.

Test water pH, ammonia, hardness and temperature morning and night. Log the results for a week to establish a baseline trend in water quality and to assess whether further treatment is necessary and when fish can be safely stocked.

4.2. TRANSPORTING FISH

Category 3 – moderate to high impact				
Activity	Objective	3R activities	Ratios	References
Transporting fish	To instruct students in the procedures for transporting fish	Theoretical learning, step-by-step guides, modelling, simulations.	**Instructors:Students** 1:30 instructing 1:5 supervising **Students:Animals** No ratio specified.	3.15. Transport

Fingerlings are delivered from a commercial hatchery by commercial courier. After arrival, any unusual clinical signs or mortalities in the stock should be reported immediately to the supplier. The fish should be quarantined for at least 48 hours to prevent the introduction of disease into the facility and for general observation, isolation and treatment of unhealthy fish.

If live fish are being returned to the supplier at the end of the activity, liaise with the supplier about relevant procedures prior to transport (e.g. purging).

4.3. ADDING FISH TO A NEW ENCLOSURE

Category 3 – moderate to high impact				
Activity	Objective	3R activities	Ratios	References
Adding fish to a new enclosure	To instruct students in the procedures for adding fish to a new enclosure	Step-by-step guides, modelling, videos, simulations	**Instructors:Students** 1:30 instructing 1:5 supervising **Students:Animals** No ratio specified.	NSW Department of Education: Fish

It is important when adding fish to the new environment that sufficient care is taken to acclimatise the animals and ensure that their new tank is suitable for them prior to adding the fish. Speak to an expert prior to adding the fish to learn the best way to introduce the fish to their new environment.

Fingerlings may be placed in a salt dip once they arrive from the hatchery to remove ectoparasites.

Float the bags of fingerlings in the tank to equilibrate the temperature in the bag and, as soon as possible, release the fish to minimise stress. Leave the fish undisturbed for a few hours to allow the fish to acclimatise. Access to the area should be limited to reduce disturbance during the settling-in period.

Close monitoring should occur when fish are first introduced to a new tank to ensure that temperature, pH, salinity and oxygen levels are appropriate for the fish and they are not displaying any signs of illness or abnormal behaviour.

If different species of fish are to be in the same tank, more docile species should be added first to allow them time to settle into their new environment, to discover hiding places and gain some territory, prior to the addition of more aggressive species.

4.4. OBSERVATION OF EXTERNAL ANATOMY, NORMAL BEHAVIOUR AND CONDITION

Category 2 – low impact				
Activity	Objective	3R activities	Ratios	References
Observation of external anatomy, normal behaviour and condition	To instruct students in the procedures for the observation of external anatomy, normal behaviour and condition	Theoretical learning, modelling	Instructors:Students 1:30 instructing 1:5 supervising **Students:Animals** 30:1 observing 1:1 performing	

4.5. TESTING AND ADJUSTING WATER QUALITY AND TEMPERATURE

Category 3 – moderate to high impact				
Activity	Objective	3R activities	Ratios	References
Testing and adjusting water quality and temperature	To instruct students in the procedures for testing and adjusting water quality and temperature	Theoretical learning, modelling, step-by-step guides, simulations	**Instructors:Students** 1:30 instructing 1:5 supervising **Students:Animals** No ratio specified.	

Temperature, pH and dissolved oxygen levels should be measured daily. Nitrates/nitrites can be measured weekly. One third water change should be done as needed. Students should be instructed in the checking and cleaning of filtration and aeration equipment to maintain water quality.

4.6. FEEDING FISH

Category 2 – low impact				
Activity	Objective	3R activities	Ratios	References
Feeding fish	To instruct students in the procedures for feeding fish	Step-by-step guides, modelling	**Instructors:Students** 1:30 instructing 1:5 supervising **Students:Animals** No ratio specified.	3.10. Food requirements

It is important not to overfeed fish. Ensure that any food not consumed after 5 minutes is removed from the tank. After feeding, ensure tank covers are replaced to stop any fish escaping. All food preparation utensils should be thoroughly washed and rinsed.

4.7. DETERMINE EFFECT OF ENVIRONMENTAL VARIABLES

Category 3 – moderate to high impact				
Activity	Objective	3R activities	Ratios	References
Determine effect of environmental variables	To instruct students in the procedures for determining the effect of environmental variables	Analysis of available datasets, theoretical learning, modelling, simulations, sampling, use of invertebrates other than cephalopods	**Instructors:Students** 1:30 instructing 1:5 supervising **Students:Animals** No ratio specified.	

Distribute the fish to experimental tanks. Determine the effect of the environmental variable (e.g. change in water temperature, different feeding regimes). Due consideration needs to be taken so that the fish are not exposed to an environment that is outside the parameters of what is suitable for the species. Instruction and research into the common diseases of the particular species and early signs of illness must be undertaken to minimise harm and provide appropriate treatments.

4.8. EXPERIMENTAL GROWTH TRIALS

Category 3 – moderate to high impact				
Activity	Objective	3R activities	Ratios	References
Experimental growth trials	To instruct students in the procedures for, and analysis of, experimental growth trials	Analysis of available datasets, theoretical learning, modelling, simulations, sampling, use of invertebrates other than cephalopods	**Instructors:Students** 1:30 instructing 1:5 supervising **Students:Animals** 30:1 observing 1:1 performing	4.7. Determine effect of environmental variables; 4.11. Measurement of body weight, growth and body proportions

Students select a factor likely to influence growth rates (e.g. temperature, protein levels in feed, level of weed). Any variation in environmental conditions must be within tolerance limits for the species.

4.9. CAPTURE, RESTRAINT AND HANDLING OF FISH

Category 3 – moderate to high impact				
Activity	Objective	3R activities	Ratios	References
Capture, restraint and handling of fish	To instruct students in the procedures for the capture, restraint and handling of fish	Modelling, simulations, sampling	**Instructors:Students** 1:30 instructing 1:5 supervising **Students:Animals** 30:1 observing 1:1 performing	3.14. Handling; 4.12. Sedation of fish

To allow some management activities to be carried out (e.g. cleaning of a tank, sorting fish by size, moving fish to another tank), fish may need to be caught. This should be done using a suitable knotless/knot-free net and every effort made to ensure that fish are out of water for the shortest possible time.

Well-established routines should be applied to the care and feeding patterns used in the aquaculture facility to both minimise the frequency of cleaning and the moving of fish.

For some species, sorting is necessary to avoid cannibalistic behaviour. Fish are caught and sorted according to size in a knotless net using correct techniques and support. Fish are removed and sorted as quickly as possible. Students are explicitly taught the correct procedures, their importance to fish welfare, and the implications of stress on the animal.

Ensure that nets, hands and any equipment that is going to come into contact with the animals are wet at all times and that equipment is in good repair. This will minimise damage to the mucous layer.

Gloves and protective clothing should be used when required. Hands and arms must be thoroughly washed before and after handling any animals to reduce risk of infection to animals or transfer of zoonoses to users. Hands and equipment must also be washed between handling different groups of animals with an unknown disease status. Detergents are not recommended for hand washing as they may be toxic to aquatic animals.

Working with fish out of water should be minimised wherever possible. When it is considered necessary to remove a fish from water, the fish must not be out of the water for more than three minutes.

4.10. FISH PHOTOGRAPHY

Category 3 – medium to high impact				
Activity	Objective	3R activities	Ratios	References
Fish photography	To instruct students in the procedures for photographing fish	Sampling	**Instructors:Students** 1:30 instructing 1:5 supervising **Students:Animals** 30:1 observing 1:1 performing	NSW Department of Education: Fish; 3.14. Handling; 4.9. Capture, restraint and handling of fish

If fish are to be moved to a small photography tank, provide supervision and care when transferring fish. Be aware of the heat that may be generated by photographic lights.

4.11. MEASUREMENT OF BODY WEIGHT, GROWTH AND BODY PROPORTIONS

Category 3 – moderate to high impact				
Activity	Objective	3R activities	Ratios	References
Measurement of body weight, growth and body proportions	To instruct students in the measurement of body weight, growth and body proportions	Modelling, simulations, sampling, non-invasive procedures not requiring handling	**Instructors:Students** 1:30 instructing 1:5 supervising **Students:Animals** 30:1 observing 5:1 performing	NSW Department of Primary Industries: How to weigh your fish with a ruler; 4.9. Capture, restraint and handling of fish; 4.12. Sedation of fish

Weight estimates for certain species can be calculated using length/weight relationship data available at How to weigh your fish with a ruler. Individual fish weights will vary depending on age, sex, season and recent feeding activity.

The minimum interval for weighing to compare growth is one week.

Fish are caught in a small hand net and placed on a wet size chart to measure length. Hands should be wet if manoeuvring of the fish is required, to minimise damage to scales and slime coat. Use of anaesthesia is recommended for this activity to reduce animal stress and time taken to measure length.

To minimise handling of fish during weighing, weight can be measured by using a net to place fish into a container of water (where the weight is already known) and noting the change in the weight of the container.

4.12. SEDATION OF FISH

Category 3 – moderate to high impact				
Activity	Objective	3R activities	Ratios	References
Sedation of fish	To instruct students in the sedation of fish	Modelling, simulations, sampling	**Instructors:Students** 1:30 instructing 1:5 supervising **Students:Animals** 30:1 observing 5:1 performing	Flinders University: Standard operating procedure for working with fish; 4.9. Capture, restraint and handling of fish

Sedating fish prior to handling or transport will minimise potential physical trauma and stress to the animal. Stress can have a significant impact on the animal's physiology and behaviour, leading to reduced immune function. Commonly used anaesthetics for fish are Aqui-S and clove oil. Response to anaesthetic will depend on water temperature, size, species and health of fish. When sedating fish, there must be a constant supply of air to provide enough oxygen for the period of anaesthesia and recovery.

The recommended initial concentration of Aqui-S is 10 mL/L to sedate most fish for handling.

Clove oil should be diluted in alcohol (10 mL clove oil: 50 mL alcohol) and the mixture shaken before use. The recommended concentration is 0.5-1 mL/L in a small well-aerated tank/bucket.

Fish must be observed and removed from anaesthetic promptly as prolonged exposure can be fatal.

Fish should be carefully netted and placed in the tank holding the anaesthetic until they display ataxia (reduced and/or uncoordinated movement). A fish is suitably sedated when the fish does not try to escape when its tail is gently held.

Fish can then be gently removed for the required activity, then immediately placed in a recovery container of clean well-aerated water. As fish recover normal swimming, they can be returned to the original tank. This should take only a few minutes if they have been lightly dosed.

4.13. TAGGING FISH

Category 3 - moderate to high impact				
Activity	Objective	3R activities	Ratios	References
Tagging fish	To instruct students in the procedures for tagging fish	Theoretical learning, modelling, step-by-step guides, simulations	**Instructors: Students** 1:30 instructing 1:5 supervising **Students:Animals** 30:1 observing 5:1 performing	Department of Primary Industries: Tagged fish; 4.12. Sedation of fish

Tagging is a technique for stock assessment undertaken as part of habitat rehabilitation or environmental studies.

4.14. ADMINISTERING MEDICATION

Category 3 – moderate to high impact				
Activity	Objective	3R activities	Ratios	References
Administering medication	To instruct students in the procedures for administering medication	Theoretical learning, modelling, step-by-step guides, simulations	**Instructors:Students** 1:30 instructing 1:5 supervising **Students:Animals** 30:1 observing 5:1 performing	4.9. Capture, restraint and handling of fish

Generally, the administration of medication will be non-invasive (e.g. light salt bath). Administering medication may require handling and must only be carried out by trained personnel.

When using medications, animal care chemicals and equipment, staff must be appropriately qualified and care must be taken to:

- read labels carefully and follow label directions
- adhere to withholding periods and check expiry dates where applicable before use
- determine correct dosage/rate
- store and dispose chemicals/medications appropriately
- use protective clothing when required
- use correct equipment for application
- document the dose, chemical/medication name, batch number, expiry date, withholding period, identity of animal(s) administered to and date of administration.

4.15. REMOVAL OF SICK/DISEASED ANIMALS

Category 3 – moderate to high impact				
Activity	Objective	3R activities	Ratios	References
Removal of sick/diseased animals	To instruct students in the procedures for removing sick/diseased animals	Step-by-step guides, modelling, simulations	**Instructors:Students** 1:30 instructing 1:5 supervising **Students:Animals** 30:1 observing 5:1 performing	3.17. Signs of illness; 4.9. Capture, restraint and handling of fish

Staff and students should check tanks daily for any signs of distress e.g. fighting or disease. Any fish showing signs of stress or disease should be removed from the growing tank and placed in an isolation tank, quarantined and treated appropriately until it recovers fully. If this is not feasible or if the disease has spread to a number of fish, then the entire tank should be treated and quarantined. Most stress and illness is caused by poor water quality and so can be readily avoided by regular monitoring of the conditions in the tank and correcting any imbalances quickly.

4.16. HARVESTING

Category 3 – moderate to high impact				
Activity	Objective	3R activities	Ratios	References
Harvesting	To instruct students in harvesting fish for consumption	Step-by-step guides, modelling, videos, simulations	**Instructors:Students** 1:30 instructing 1:5 supervising **Students:Animals** 30:1 observing 5:1 performing	Department of Primary Industries - Aquaculture species; 4.19. Humane killing or euthanasia

Once fish reach plate size, to ensure that the fish taste as good as possible, 'purge' the fish for between five and 14 days (depending on species). This ensures that any flavours that are associated with farmed fish are reduced, as well as toning up any excess fat in the flesh. The process involves holding the fish in clean, algae-free, filtered water. The addition of 5 g/L of flossy salt (available from produce stores) for this period also helps to sweeten the flesh.

Appropriate euthanasia methods must be used.

4.17. FISH/SQUID DISSECTION

Category 2 - low impact				
Activity	Objective	3R activities	Ratios	References
Fish/squid dissection	To instruct students in the dissection of fish/squid	Theoretical learning, modelling, simulations	**Instructors:Students** 1:30 instructing 1:15 supervising **Students:Animals** 30:1 observing 3:1 performing	3.19. Humane killing and euthanasia

Ensure appropriate personal protective equipment (e.g. gloves, aprons, safety glasses) are worn and benches and equipment disinfected prior to and following the dissection.

Upon completion of the dissection activity, dispose of all animal tissue hygienically in plastic bags, placed in the school's garbage or medical disposal system.

The plastic bags may be sealed and stored in the freezer until the time of disposal.

4.18. PREPARE FISH FOR CONSUMPTION

Category 2 – low impact				
Activity	Objective	3R activities	Ratios	References
Prepare fish for consumption	To instruct students in techniques to prepare fish (i.e. clean, gut, scale, skin, fillet, store) for consumption	Modelling, videos, simulations	**Instructors:Students** 1:30 instructing 1:5 supervising **Students:Animals** 30:1 observing 1:1 performing	3.19. Humane killing and euthanasia

4.19. HUMANE KILLING OR EUTHANASIA

Category 3 – moderate to high impact				
Activity	Objective	3R activities	Ratios	References
Humane killing or euthanasia	To instruct students in humane methods for killing or euthanasing fish	Theoretical learning, modelling, simulations, sampling	**Instructors:Students** 1:30 instructing **Students:Animals** 30:1 observing	3.19. Humane killing and euthanasia

SECTION 5 | GLOSSARY

3R activities	Animals used for teaching and training are not being used to discover, prove or develop new ideas and techniques but to communicate scientific concepts and to develop manual skills and expertise in specific techniques. 3R activities provide opportunities to communicate scientific concepts and develop technical skills and expertise, ensuring animals are used only when necessary and minimising the impact on animals used.
Alternatives to animal use	Replacement of animals with other methods/activities for educative purposes must be sought and used whenever possible.
Aquatic animals	Marine and freshwater vertebrates and cephalopods.
DPI	Queensland Department of Primary Industries
Fish	Where 'fish' are referred to in this SOP, the inclusion of other aquatic 'animals' as defined by the Act is inferred.
QSAEC	Queensland Schools Animal Ethics Committee
Supervision	Supervision in all instances means supervision by a suitably qualified person familiar with the procedures and with normal and abnormal animal responses.
The Act	*Animal Care and Protection Act 2001* (Qld)
The Code	*Australian code for the care and use of animals for scientific purposes*, 8th edition, 2013 (updated 2021)

SECTION 6 | REFERENCES

- Aquaponic solutions
  http://www.aquaponic.com.au/

- Australian Government – Guidelines to promote the wellbeing of animals used for scientific purposes
  https://www.nhmrc.gov.au/about-us/publications/guidelines-promote-wellbeing-animals-used-scientific-purposes#block-views-block-file-attachments-content-block-1

- Australian Jade Perch – Jade Perch Man
  http://www.jadeperch.com/

- Ausyfish.com
  http://www.ausyfish.com

- Australian Museum – Do fishes feel pain?
  https://australianmuseum.net.au/learn/animals/fishes/do-fishes-feel-pain/

- Braithewaite, V. 2010. Do Fish Feel Pain? Oxford University Press.

- Breeding barramundi at Parndana, Kangaroo Island
  https://www.youtube.com/watch?v=rsb2cN-0M20

- Bribie Island research facility
  https://www.daf.qld.gov.au/contact/offices/stations-facilities/bribie-island

- Qld Department of Primary Industries - Aquaculture
  https://www.daf.qld.gov.au/business-priorities/fisheries/industry/aquaculture

- Business Queensland - Aquaculture
  https://www.business.qld.gov.au/industries/farms-fishing-forestry/fisheries/aquaculture

- NSW Department of Education – Animals in Schools
  https://education.nsw.gov.au/teaching-and-learning/animals-in-schools

- NSW Department of Primary Industries
  http://www.dpi.nsw.gov.au/fishing/aquaculture

- Practical Aquaponics
  http://www.aquaponics.net.au/

- Victoria State Government – Aquaculture
  http://agriculture.vic.gov.au/fisheries/aquaculture

SECTION 7 | SPECIES INFORMATION

7.1. JADE PERCH (SCORTUM BARCOO)

PHYSICAL ATTRIBUTES AND SPECIES-SPECIFIC INFORMATION	Jade perch are suited to production in well-managed recirculation tank systems used in aquaculture. They are hardy, grow fast and taste good on the plate. Jade perch have the highest level of Omega 3 oils in any seafood available in Australia. They are aggressive feeders, and care should be taken to ensure that all the fish in the tank get fed, not just the dominant fish in the population. This will help to ensure even growth. This species is one of the better growth performers in aquaculture. They can obtain a plate size of 500g in under 12 months (in South East Queensland), if conditions are suitable. Plate size in 18 months is more common and would be what is expected for most aquaculture systems.
STOCKING DENSITY	Maximum 40-50 kgs/1000 L
OPTIMAL TEMPERATURE RANGE	18-32 °C Growth rates decline rapidly at <20 °C
STRESS TEMPERATURE	<18 °C stop metabolising food <16 °C suffer stress <14 °C death likely
WATER HARDNESS	>80 ppm
PH	6.5-8.5
AMMONIA	Nil
DISSOLVED OXYGEN	≥ 4 mg/L Aeration and water exchanges need to be increased when pond water temperatures exceed 30 °C.
SALINITY	5 g/L acceptable for long-term exposure and to treat ectoparasite and fungal diseases
FOOD TYPE AND QUANTITY	Jade perch accept pellets and do well on a low protein, high fibre diet.
PLATE SIZE	650-1000 g
ADDITIONAL INFORMATION SPECIFIC TO THE SPECIES (E.G. DISEASE SUSCEPTIBILITY, SIGNS OF ILLNESS)	Bacterial and fungal problems are most prevalent in cooler temperatures, and ectoparasites during the spring and autumn. Most of these health issues can be avoided if water quality is kept at an optimum level and water temperature is maintained above 22 °C.

REFERENCES/RESOURCES

- Australian Jade Perch – Jade Perch Man
  http://www.jadeperch.com/
- Ausyfish.com
  http://www.ausyfish.com/our-fish/perch/jade-perch.html
- Queensland Government Business and industry portal - Jade perch aquaculture
  https://www.business.qld.gov.au/industries/farms-fishing-forestry/fisheries/aquaculture/species/jade-perch

7.2. SILVER PERCH (BIDYANUS BIDYANUS)

PHYSICAL ATTRIBUTES AND SPECIES-SPECIFIC INFORMATION	The Silver perch is a native freshwater fish that is well-suited to pond culture systems but may not perform as well in tanks. In pond systems, they are valued for their ability to be raised in high densities, general hardiness and high survival rate (>90%), rapid and uniform growth, willingness to accept artificial feeds, availability of fingerlings, non-cannibalistic nature, high meat recovery, excellent eating qualities, and ability to utilise a number of natural food sources. Silver perch usually show a large size variation during the fingerlings stage. At the completion of this stage, they must be graded into grow-out ponds/tanks. Silver perch tolerate extremes of water temperature better than most aquacultured fish, and will grow through about 9 months of the year in South East Queensland. Their main disadvantage in aquaponics systems is their slow growth. Once this species achieves about 300-350gms, additional growth becomes very difficult and it can take in excess of 2 years to reach plate size.
STOCKING DENSITY	Maximum 50 kg/1000 L
OPTIMAL TEMPERATURE RANGE	23-28 °C
STRESS TEMPERATURE	Negligible growth below 12 °C
WATER HARDNESS	> 80 ppm
PH	6.5-9
AMMONIA	Nil levels are optimal. Levels greater than 0.1 mg/L will limit production. Levels become lethal at 0.6 mg/L.
DISSOLVED OXYGEN	≥ 4 mg/L Supplementary aeration is required at densities greater than 5000 fish per hectare and is essential for commercial production.
SALINITY	5 g/L acceptable for long-term exposure and to treat ectoparasite and fungal diseases
FOOD TYPE AND QUANTITY	Silver perch do best on a low protein, high fibre diet based on plant and meatmeal proteins. Silver perch appear to be more sensitive to ammonia than Jade perch or Murray cod. Most feeds available have a protein content of around 35%. Commercial feeds for Silver perch are available in pellet form, with either sinking or floating properties. Food conversion ratios for Silver perch are generally in the range of 1.3-2:1 (kg of food:weight growth), often depending on the producer's experience and husbandry practices. Silver perch are often fed fresh or frozen baitfish or aquatic plant material. This food needs to be stored frozen and care must be taken to ensure it is not contaminated and does not deteriorate.
PLATE SIZE	500-600 g

ADDITIONAL INFORMATION SPECIFIC TO THE SPECIES (E.G. DISEASE SUSCEPTIBILITY, SIGNS OF ILLNESS)	White spot or freshwater ich is one of the most common and serious diseases of Silver perch in ponds and tanks, with rapid progression through stock and high mortality rate. Decrease in water temperature to/below 15 °C in autumn is associated with outbreaks. Infection with disease and parasites is a response by fish to stressors – most commonly water quality deterioration and over-crowding.

REFERENCES/RESOURCES

- Ausyfish.com
  http://www.ausyfish.com/our-fish/perch/silver-perch.html
- NSW Department of Primary Industries - Diagnosis, treatment & prevention of the diseases of the silver perch
  http://www.dpi.nsw.gov.au/ data/assets/pdf_file/0005/209309/Silver-Perch-Diseases-Manual.pdf
- NSW Department of Primary Industries, Silver perch – aquaculture prospects
  https://www.dpi.nsw.gov.au/dpi/fishing/aquaculture/publications/general-publications/species2/freshwater/silver-perch
- Queensland Government Business and industry portal - Silver perch aquaculture
  https://www.business.qld.gov.au/industries/farms-fishing-forestry/fisheries/aquaculture/species/silver-perch

7.3. BARRAMUNDI (LATES CALCARIFER)

PHYSICAL ATTRIBUTES AND SPECIES-SPECIFIC INFORMATION	Barramundi farming is the second largest aquaculture activity in Queensland after marine prawn farming. Juveniles mature at 3-4 years as males and change at 6-8 years to females. However, under aquaculture conditions, maturation occurs in about half that time. Barramundi are territorial and aggressive feeders. Cannibalism in fingerlings can cause massive losses unless they are regularly graded (every 7-10 days for smaller fingerlings). Grading normally starts at 30-50 mm, or earlier if there is a large size variation in the batch, and continues until the fingerlings are at least 100mm long.
STOCKING DENSITY	Up to 15 kg/1000 L
OPTIMAL TEMPERATURE RANGE	20-30 °C Commercial growth rates 25-30 °C
STRESS TEMPERATURE	<20 °C suffer stress <18 °C stop metabolising food <13 °C death likely
WATER HARDNESS	>100 ppm
PH	7.0-8.5
AMMONIA	Nil
DISSOLVED OXYGEN	≥ 4 mg/L
SALINITY	Can tolerate all levels of salinity from fresh to seawater
FOOD TYPE AND QUANTITY	High protein semi-floating pellets 5-6 times per day as fingerlings; 1-2 times per day as they grow. Pellet size dependent on fish size. Feed until all feeding ceases. Maximum intakes at 27-29 °C
PLATE SIZE	400-800 g in 12 months 2-3 kgs after second grow-out season
ADDITIONAL INFORMATION SPECIFIC TO THE SPECIES (E.G. DISEASE SUSCEPTIBILITY, SIGNS OF ILLNESS)	Barramundi are the most popular fish for aquaponics but are not always a good choice as they are a tropical species and require heating, and can be aggressive to each other. They do not tolerate poor water conditions or poor husbandry.

REFERENCES/RESOURCES

- Australian Barramundi Farmers Association http://www.abfa.org.au/
- Ausyfish.com http://www.ausyfish.com/our-fish/22-our-fish/barramundi.html
- NSW Department of Primary Industries - Barramundi – aquaculture prospects https://www.dpi.nsw.gov.au/dpi/fishing/aquaculture/publications/general-publications/species2/freshwater/barramundi
- Queensland Department of Primary Industries - Health protocol for the importation and movement of live barramundi, Aquaculture Protocol FAMPR002 https://www.daf.qld.gov.au/ data/assets/pdf_file/0007/65842/Aqua-BarramundiMovementProtocol-FAMPR002.pdf
- Queensland Government Business and industry portal – Barramundi aquaculture https://www.business.qld.gov.au/industries/farms-fishing-forestry/fisheries/aquaculture/species/barramundi
- Breeding barramundi at Parndana, Kangaroo Island https://www.youtube.com/watch?v=rsb2cN-0M20

7.4. MURRAY COD (MACCULLOCHELLA PEELII PEELII)

PHYSICAL ATTRIBUTES AND SPECIES-SPECIFIC INFORMATION	The Murray cod is the largest freshwater fish found in Australia. Its natural distribution extends throughout the Murray-Darling Basin, ranging west of the divide from South East Queensland, through NSW, into Victoria and South Australia. It is a predatory fish with a large mouth and olive green mottled body. Compared to Jade perch and Silver perch, which have a genetic potential of only a few kilos, Murray cod have the genetic potential to reach around 50 kg. They also have the best temperature range for survival and growing. Murray cod are only suited for grow-out in tanks as they need to be kept at high density to suppress territorial behaviour. Intensive culture of Murray cod is mainly suited to intensive recirculation tank systems.
STOCKING DENSITY	The stocking of fish at high densities reduces both the opportunity for the cod to establish territories and aggressiveness towards other tank members. Stocking rates in tank systems vary, depending on the capacity of the system and the intensity of the operation. In well-developed and highly advanced systems, stocking rates of up to 60 kg/1000 L may be obtained, however most systems average around 30-40 kg/1000 L.
OPTIMAL TEMPERATURE RANGE	18-26 °C
STRESS TEMPERATURE	<12 °C >26 °C susceptible to bacterial and fungal issues
WATER HARDNESS	>100 ppm
PH	6.8-7.0
AMMONIA	<0.5 mg/L
DISSOLVED OXYGEN	>5 mg/L
SALINITY	<5 mg/L
FOOD TYPE AND QUANTITY	High protein diet required, usually in extruded pellet form available in various classes depending on the size of the fish. Can be a little difficult to feed and often take some training to get them to readily accept a pellet. It is strongly recommended that schools purchase pre-weaned fingerlings from a supplier.
PLATE SIZE	600-800 g in 18-24 months Murray cod has firm white flesh and provide a chunky fillet.
ADDITIONAL INFORMATION SPECIFIC TO THE SPECIES (E.G. DISEASE SUSCEPTIBILITY, SIGNS OF ILLNESS)	Murray cod are highly territorial and aggressive fish and can be susceptible to health problems. While the high stocking densities often used in intensive recirculation systems reduce overall aggression, there will always be size variation in stock, with some fish growing more quickly. To avoid a 'pecking order' developing and cannibalism occurring, it is recommended that regular size grading be undertaken so that all fish are being fed properly and growing at uniform rates. High protein diets and the sometimes-torrid feeding behaviour of cod means that water quality can suffer. Tanks should be siphoned and biofilters back-washed regularly to avoid malfunction. Back-up systems are essential. While generally hardy, Murray cod may be susceptible to bacterial and fungal infections at high stocking densities.
REFERENCES/RESOURCES • Ausyfish.com http://www.ausyfish.com/our-fish/murray-cod.html • NSW Department of Primary Industries - Murray cod – aquaculture prospects https://www.dpi.nsw.gov.au/dpi/fishing/aquaculture/publications/general-publications/species2/freshwater/murray-cod • Victoria State Government - Murray Cod aquaculture http://agriculture.vic.gov.au/fisheries/aquaculture/murray-cod-aquaculture	

7.5. SLEEPY COD (OXYELEOTRIS LINEOLATA)

PHYSICAL ATTRIBUTES AND SPECIES-SPECIFIC INFORMATION	Although not well known as an aquaculture species, Sleepy cod are an excellent table fish with one of the best tasting flesh for a saltwater fish. This species is best suited to tank culture as grow-out in ponds has not been very successful. Some commercial growers have experienced slow growth while others report quite acceptable growth rates. This species is a little more challenging because of the need to keep them crowded, and they can be difficult to feed. They need warm water.
STOCKING DENSITY	50 kg/1000 L
OPTIMAL TEMPERATURE RANGE	22-27 °C
STRESS TEMPERATURE	<18 °C stop metabolising food <16 °C death likely
WATER HARDNESS	>100 ppm
PH	6.8-8.0
AMMONIA	Nil
DISSOLVED OXYGEN	≥4 mg/L
SALINITY	Consult the supplier
FOOD TYPE AND QUANTITY	High protein sinking pellets are required. They will accept a pellet, although they can be frustrating to feed, often requiring several small feeds a day to ensure that all are fed.
PLATE SIZE	>600 g in 18 months in good conditions
ADDITIONAL INFORMATION SPECIFIC TO THE SPECIES (E.G. DISEASE SUSCEPTIBILITY, SIGNS OF ILLNESS)	

REFERENCES/RESOURCES

- Ausyfish.com
  http://www.ausyfish.com/sleepycod
- Fishes of Australian – Sleepy Cod
  http://fishesofaustralia.net.au/home/species/4155
- Queensland Department of Primary Industries – Sleepy cod
  https://www.qld.gov.au/recreation/activities/boating-fishing/rec-fishing/fish-species-guide/fish-species-id/species-page?grid=122oGEAtLKktC2ximq5zdF&id=2qRFWqYxVrRZt0VfUgjdw4

SECTION 8 | APPLICATION/ACTIVITY NOTIFICATION FORM

To seek QSAEC approval for animal use activities covered by this SOP, please complete the online Activity notification form (ANF) prior to the activities commencing.

Before completing the ANF, please ensure the following documents (if applicable) are available to upload to the online application:

Privately-owned animal use template agreement:

- If you are using privately-owned animals a **template agreement** with the details and duration of the owner's responsibility must be attached to your QSAEC application. Note the owner's personal details and signature are not required to be included for the QSAEC, however schools must ensure the agreement is completed by the owner and stored on their school-based animal activity register for 7 years for audit purposes. If there are any changes to the agreement once signed by the owner then a copy of the updated template agreement must be provided to the QSAEC prior to the animal use activities commencing.

For Aquatic animal activities - photos of housing/tanks, and Appendix A:

- **Photographs** of the fish housing/tanks must be attached to your QSAEC application.
- If you are using species other than the pre-approved species as included in the Aquatic animal activities SOP, i.e. species other than Jade perch, Silver perch, Barramundi, Murray cod, or Sleepy cod, please attach a completed Appendix A: Species information summary for each species which is not pre-approved to your QSAEC application. Note applications with Appendix A submissions are required to be tabled at the next available QSAEC meeting prior to the animal use activities commencing.

Ensure all required fields are completed in the ANF and submit as per the outlined instructions.