Year 9-10

Design & Technologies

Agriculture in Education:
an educational resource for Year 9-10 Design and Technologies

Salmon Growing in Tasmania

Funded by the Australian Government, Department of Education and Training under the Agriculture in Education initiative

AGRIFOOD SKILLS AUSTRALIA

Salmon Growing in Tasmania

Year 9-10 Design and Technologies

Content Description	
Investigate and make judgments on the ethical and sustainable production and marketing of food and fibre	ACTDEK044
Investigate and make judgments on how the characteristics and properties of materials, systems, components, tools and equipment can be combined to create designed solutions	ACTDEK046
Investigate and make judgments, within a range of technologies specialisations, on how technologies can be combined to create designed solutions	ACTDEK047
Evaluate design ideas, processes and solutions against comprehensive criteria for success recognising the need for sustainability	ACTDEP051

Source: Australian Curriculum v8.1
http://www.australiancurriculum.edu.au/technologies/design-and-technologies/curriculum/f-10?layout=1 - level9-10

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Learning Outcomes

At the end of the unit, students will have a greater understanding of:

- The role of aquaculture in meeting the increasing world demand for seafood;
- The nature and importance of Australia's salmon industry;
- The comparative advantages/disadvantages of farmed fish and wildcatch;
- How sustainability is addressed at all stages of the salmon production cycle; and
- The application of research and innovation within the Australian salmon industry.

Description

These activities have been designed to be used in conjunction with the case study video.

Salmon Growing in Tasmania (5.53 minutes) (*https://youtu.be/43NI0mAv7vw*).

This video provides an overview of Huon Aquaculture's salmon production operation at Hideaway Bay in southern Tasmania. Huon Aquaculture is one of Tasmania's leading salmon producers. The video contains a challenge for students to produce a designed solution for improving the salmon pens - a designed solution that provides the salmon with better protection from seals and other predators, improves worker safety and minimises the impact on the marine environment.

The supporting activities provide a framework for students, to design an improved salmon pen. They undertake a series of guided investigations to develop a sound knowledge base from which to critically assess how ethical and sustainability considerations are upheld throughout all stages of the salmon production cycle in Tasmania.

Activities encourage students to undertake an in-depth investigation of Huon Aquaculture's vertically integrated salmon farming operation.

Activity 1:	Introduction to aquaculture
Assessment:	Design Challenge - an innovative salmon pen
Activity 2:	All about salmon - wild-catch versus farmed salmon
Activity 3:	All about salmon - the life cycle of salmon
Activity 4:	All about salmon - a sustainable production process
Activity 5:	All about salmon - innovation and research

Teacher Background Information

Aquaculture

Aquaculture is defined by the Food and Agriculture Organization of the United Nations as the farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants with some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding and protection from predators.

The various stages of aquaculture operations include:

- hatchery operations which produce fertilised eggs, larvae or fingerlings;
- nursery operations which nurse small larvae to fingerlings or juveniles; and
- grow-out operations farming fingerlings or juveniles to marketable sizes.

Depending on the species, aquaculture can be carried out in freshwater, brackish water or marine water. Various systems that can be used for aquaculture, including ponds, tanks, pens and floating cages.

Aquaculture can be extensive, semi-intensive or intensive, depending on the level of input and output per farming area and the stocking density. Intensive aquaculture involves intervening in the growing process, by supplementing feeding and aerating water (such as prawn farming). Extensive aquaculture allows the stock to grow on its own, using natural food sources and conditions (such as oyster farming). It produces food species including fish, molluscs, crustaceans and aquatic plants for human consumption, or ornamental species and other products such as pearls.

Department of Agriculture and Water Resources *http://www.agriculture.gov.au/fisheries/aquaculture*

Aquaculture industry in Australia

As world populations grow, so too does the demand for sustainable sources of seafood. Seafood demand in Australia has increased considerably over the last three decades, to the point where consumer demand for seafood exceeds the supply from domestic production. Fortunately, Australia has the potential to expand igs aquaculture industry to help meet domestic and international demand.

Aquaculture production occurs throughout Australia, from the tropical north to the temperate south. The industry is based mostly in regional Australia and makes a significant and positive contribution to regional development.

Since 2002–03, the real gross value of aquaculture production has increased by 12 per cent ($108 million) to over $1 billion. The largest increase over this decade came from the value of production of salmonids (salmon and trout) and edible oysters. In 2012–13 farmed salmonids, almost entirely from Tasmania, were Australia's most valuable fisheries product, worth $497 million. Tasmania is by far Australia's largest aquaculture producer and is responsible for over half of Australia's production.

Australia has an international reputation as a producer of safe, sustainable and high quality seafood products. Most of the value of Australian aquaculture production comes from high value species such as pearls, salmonids, tuna and oysters but there are over forty species commercially produced in Australia.

Department of Agriculture and Water Resources *http://www.agriculture.gov.au/fisheries/aquaculture/aquaculture-industry-in-australia*

The Tasmanian salmon industry

Salmon farming commenced in Tasmania in the mid 1980s with stock brought into Australia from Canada. The first commercial harvest of 53 tonnes was in the summer of 1886/87. The Tasmanian salmon industry today produces 47,000 tonnes per annum with a value of over $500m. Of the eleven companies that began farming salmon in Tasmania in the mid 1980s, three remain today. The key marine grow-out areas for these aquaculture activities are the Huon Estuary and D'Entrecasteaux Channel to the south of Hobart, Macquarie Harbour on the west coast and in the Tamar River on Tasmania's north coast.

Tasmania has distinct advantages for growing, processing and selling salmon to domestic and export markets:

- Access to pristine and remote waterways.
- Geographic isolation and biosecurity measures are keeping Tasmanian salmon production free from diseases and pests commonly affecting aquaculture production elsewhere.
- A reputation for high environmental performance and an aquaculture industry legislative framework that ensures this high standard is maintained.
- World-leading food safety, animal health and animal welfare standards. Salmon is a 'safe food'.
- Proximity to key emerging Asian markets.

World leading technology and farming practices are used to grow Tasmanian salmon; including advanced feeds, computerised feeding technology and hi-tech net cleaning equipment. Salmon take three years to grow, spending approximately 1½ years in freshwater and 1½ years in salt water.

discuss

Setting the Scene

Explain to students that they will be undertaking a design challenge as a major assessable component of this unit. It is the same design challenge currently facing one of Australia's leading salmon producers - Tasmanian based company - Huon Aquaculture. The challenge is given by Huon Aquaculture's Group Technical Manager - David Whyte, in the accompanying video - *Growing Salmon in Tasmania* (5.53 minutes) (*https://youtu.be/43NI0mAv7vw*)

David explains the difficulties faced in keeping the farmed salmon safe from predator seals and birds that are a huge threat to the sustainability and viability of salmon farming operations in Tasmania.

The challenge to students is to produce a designed solution that increases the overall productivity and sustainability of the salmon farming operation by providing the salmon with better protection from seals and other predators, ensuring a safer working environment for employees and minimising the impact on the surrounding marine environment.

Teachers are advised to print and hand out copies of the assessment task after students undertake the introductory discussion in Activity 1. Students will subsequently require copies of the remaining activity sheets - all of which will help them plan their investigations into the requirements for salmon farming and guide them to obtain the necessary background context from which to plan and develop their designed solution.

discuss

Student Activity 1: Introduction to aquaculture

Background information

Commercial fishing is the harvesting of wild fish. Aquaculture is the raising fish for harvest under controlled conditions. Aquaculture is defined by the Food and Agriculture Organisation of the United Nations as the farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants with some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding and protection from predators.

Aquaculture is an ancient practice. There is evidence that as early as 6,000BC, Indigenous Australians raised eels within channels and dams throughout the flood plain of what is now the Murray-Darling Basin. The eels were captured in woven traps, smoked, and eaten all year round.

Commercial salmon farming, as we know it today, commenced in the 1970s, around the same time that countries set up 200 mile fishing zones. The various stages of aquaculture operations include:

- hatchery operations which produce fertilised eggs, larvae or fingerlings;
- nursery operations which manage small larvae to fingerlings or juveniles; and
- grow-out operations which farm fingerlings or juveniles to a suitable size for marketing.

Depending on the species, aquaculture can be carried out in freshwater, brackish water or marine water. Various systems can be used for aquaculture, including ponds, tanks, pens and floating cages.

Sea-cage aquaculture systems involve large netted cages, floated in estuaries. In these, dense schools of fish are penned, fed and reared for market. The pens are located in areas that are well-flushed by seawater and measures are taken by the operators to ensure that waste does not accumulate in the local environment.

Aquaculture can be extensive, semi-intensive or intensive, depending on the level of input and output per farming area and the stocking density. Intensive aquaculture involves intervening in the growing process, by supplementing feed and aerating water (such as prawn farming). Extensive aquaculture allows the stock to grow on its own, using natural food sources and conditions (such as oyster farming).

Aquaculture produces food species including fish, molluscs, crustaceans and aquatic plants for human consumption, or ornamental species and other products such as pearls.

Adapted from:

Department of Agriculture and Water Resources - Aquaculture
http://www.agriculture.gov.au/fisheries/aquaculture

Discussion

As a class, discuss the following:

- What items produced from aquaculture have you previously eaten?
- Is all seafood purchased and consumed in Australia produced from aquaculture? How might you know?
- In what ways has reading the information above altered your view of what aquaculture involves?
- Aquaculture production is increasing throughout the world. Suggest why this might be so.
- What, if anything, have you heard about fish farming? From your existing knowledge, what are the benefits and disadvantages of fish farming and wild-catch fishing?
- Sustainability of production and the environment is a key priority for Australia's fish farmers. Suggest aspects associated with raising large numbers of fish in pens, that may be important to investigate further in this unit. Share your suggestions.

assess

Design Challenge: An innovative salmon pen

Seals and sea birds prey on salmon. They threaten the sustainability of salmon farming operations in Tasmania. When seals break into a salmon pen, they can inflict a great deal of damage and destroy huge numbers of fish.

In recent years, Huon Aquaculture workers have researched and improved the pen design for their Tasmanian salmon farming operations. They have used new materials and design features and some clever home-grown innovative thinking, but there is still room for improvement. David Whyte, the Group Technical Manager at Huon Aquaculture's Hideaway Bay salmon farming operation, presents a challenge to Design and Technology students watching the accompanying video - Growing Salmon in Tasmania https://youtu.be/43NI0mAv7vw

David's challenge to you is to develop an improved design solution for the salmon pens that will:

- Keep the fish as far away from the seals and cormorants as possible;
- Prevent the seals from climbing over the nets;
- Protect the seals and sea birds;
- Create a safer working environment for the employees on site.

This needs to reflect the requirement for a productive and sustainable salmon farming operation with minimal impact on the surrounding marine environment.

The following U.S. website is a useful background reference - Next Generation Fish Farming Techniques Aim for Sustainability - *http://www.ibtimes.com/next-generation-fish-farming-techniques-aim-sustainability-1090528*

Investigate new materials that are now considered safer for a marine environment, such as:

- Dyneema® - Aquaculture

Further suggested online resources are listed within the student activities and also at the end of this unit.

The following steps are a guide as you plan, develop and present your designed solution.

1. Identify and explain the factors driving the need for increased salmon production.
2. Consider the requirements for feeding, moving and monitoring the health of the farmed salmon.
3. What changes are required to the existing pens and why?
4. Identify your ideas for:
    a. Enhanced farm worker, fish and the predator safety;
    b. Maintaining fish health and welfare;
    c. Ensuring a more sustainable salmon farming operation; and
    d. Maintaining the surrounding marine environment.
5. Explain and justify the components of your design, dimensions, materials and technologies used.
6. Establish and present a set of criteria against which to measure the success of your designed solution.
7. Decide how you will prepare your designed solution.
8. Decide how you will communicate your designed solution.

Keep this assessment sheet handy as you work through the following activities.

task

Student Activity 2: All about salmon - wild-catch versus farmed salmon

Background Information

Aquaculture is the world's fastest developing source of animal protein and has increased by over 60 percent during the past decade. The global supply of seafood from wild fisheries is limited and salmon aquaculture is expanding to meet the growing world demand. It is estimated by the United Nations Food and Agriculture Organization, that by 2025, over half of all seafood consumed globally will be farm produced.

Australia is renowned internationally as a producer of safe, sustainable and high quality seafood products.

Australian aquaculture has increased dramatically since the early 2000s. This increase is largely due to the growth in salmonids (Atlantic salmon and ocean trout) production. While aquaculture production occurs throughout Australia, Tasmania is Australia's largest aquaculture producer - over 50% of production.

The Tasmanian salmon industry: Salmon farming commenced in Tasmania in the mid 1980s. From the first commercial harvest of 53 tonnes in the summer of 1886/87, the Tasmanian salmon industry today produces 47,000 tonnes pa with a value of over $500m. Tasmania has many advantages for growing, processing and selling salmon to domestic and export markets.

Investigation 1

Access Tasmanian Salmonid Growers Association website *http://www.tsga.com.au/about/*. It provides a concise overview of the Tasmanian salmon industry.

From this source, have a class discussion about the following:

1. Where the industry is located in Tasmania and the key salmon producers.
2. The suitability of Tasmania for growing, processing and marketing salmon.
3. Tasmania's reputation as a salmon producer.
4. The key sustainability measures for Tasmanian salmon.
5. As a class, develop a vocabulary chart to display in a prominent position. Nominate terms to include and define as you undertake your research. Start with the terms - salmonid and pelargic.

Investigation 2

Many strong and often conflicting views exist about the sustainability of world fish supplies and the management of both international wild-catch and fish farming. Investigate current research and thinking on the relative nutritional benefits of farmed and wild-catch fish, what farmed fish should be fed and whether we can continue to increase our fish consumption.

An increased awareness of these views will provide a useful context for considering the sustainability aspects of salmon farming and assist you build an informed view on how to address the growing global demand for protein.

Working in small groups, divide up this short research task.

The Conversation: Aquaculture - *https://theconversation.com/au/topics/aquaculture*

Sustainable Table: Fishy Business - *http://sustainabletable.org.au/hungryforinfo/fishybusiness/tabid/143/default.aspx*

The Future of Fish Farming - *https://www.huonaqua.com.au/wp-content/uploads/2013/11/Future-of-Fish-Farming-At-Huon-For-Web.pdf*

Tasmanian Atlantic Salmon - *http://www.tasmaniansalmon.com.au/consumer/about/industry.html*

From each of the sources above:

1. Draw some key comparisons between wild-catch and farmed salmon.
2. Find arguments for and against farmed salmon.
3. As a group, try and reach a consensus as to how the world demand for fish might be met.
4. Share the views of your group with other members of the class.

Activity 3: All about salmon – the lifecycle of salmon

Teacher Preparation

Explain to students that the remaining activities in this unit, will assist them increase their understanding of salmon farming methods, the technologies now used to monitor and assure fish health and well-being and the methods used to guarantee the sustainability of fish farming within the pristine marine environments of Tasmania. They use the Huon Aquaculture operation at Hideaway Bay as a case study example from which to deepen their learning and develop their designed solution for sustainable fish production.

Once students have read the introductory information in Activity 3, show all or part of the accompanying video.

Growing Salmon in Tasmania (5.53 minutes) (*https://youtu.be/43NI0mAv7vw)*

Huon Aquaculture's Technical Manager - David Whyte, overviews Huon Aquaculture's operation at Hideaway Bay in southern Tasmania. He provides:

- Current statistics on world demand for aquaculture;
- Reasons for farming fish;
- Huon's vertically integrated operation:
  - closing the cycle - egg - adult - egg; and
  - egg to plate.
- A comparative analysis of salmon and other farmed protein sources - wild fish and farmed fish;
- How and what the farmed salmon are fed; and
- An overview of onsite research in Huon's specially designed research and development pens.

Teachers could stop the video, after 3.43 minutes, at the point where David says - "the key to our success is being able to try things before we do them." From here on it highlights the difficulties faced by Huon Aquaculture in protecting salmon from seals and cormorants that threaten the sustainability and viability of salmon farming in Tasmania. It contains the challenge to students to re-design the flotation pens.

Step 1: Students should be able to draw the following facts from what they saw and heard in the video.

- Fish provide the major source of protein for close on 18% of the world's population.
- Of the 117 million tonnes of fish currently produced each year from both wild catch and aquaculture, aquaculture now makes up 50% of this and the percentage is growing.
- Levels of wild fish catch cannot be increased without substantially depleting fish stocks. Aquaculture is increasingly making up the shortfall.

Step 2: Refer students to the additional online resources for this next investigation. Suggest they work in pairs to share this task. Encourage them to share their responses and their implications, specifically:

- Salmon life cycle stages and how these are managed in a farmed environment; and
- The growing world consumer demand for fish and the implications of this on the efficiency and sustainability of Tasmanian salmon farming operations.
- Finally, encourage students to suggest new terms to add to the class vocabulary list.

The following resource supports the statistics provided in the video.
Food and Agricultural Organization of the United Nations (FAO): The State of World Fisheries and Aquaculture - *http://www.fao.org/3/a-i3720e.pdf*

Activity 3: All about salmon – the lifecycle of salmon (cont)

Step 3: Students are asked to draw an initial line diagram sketch of a farmed salmon operation. It should be a work in progress diagram to assist them plan their designed solution. Students can refine it as they progress through the remaining activities. Encourage students to identify the component parts of the operation and how these are linked eg. how the smolt are moved from the freshwater upstream hatcheries to the salt water pens.

Students complete these initial investigations before they undertake **Activity 4: All about salmon – a sustainable production process**. When handing out copies of Activity 4, teachers will need to divide the class into two groups for the suggested hypothetical interview.

Ensure students also have a copy of the Salmon Sustainability table. Students access a number of online sites to critically assess the sustainability of Tasmanian salmon operations from the perspectives of:

- Fish health, welfare and biosecurity; and
- Environmental impact.

task

Student Activity 3: All about salmon – the lifecycle of salmon

Salmon are a temperate species that evolved in the cool, high latitude waters of the North Atlantic where defined seasons drive the life cycle the salmon. Tasmania offers a similar environment in the southern hemisphere.

Salmon live for three to eight years on average. They start their life in fresh water where they hatch from eggs, then spend most of their adult life in salt water. Amazingly, they return to the exact place where they hatched to lay their own eggs. Salmon farmers replicate this when breeding and growing farmed salmon.

Case study overview: Huon Aquaculture

Huon Aquaculture is a large vertically integrated salmon production and processing enterprise in Tasmania. It produces around 17,000 tonnes of salmon pa. Its operations are based at the following locations:

- Near Lennaville on the Huon River - the hatchery;
- Hideaway Bay further downstream on the Huon River - the main production site;
- Macquarie Harbour - just south of Strahan on the west coast - a second production site; and
- Parramatta Creek near Devonport on Tasmania's north coast - the new processing facility.

Managing, feeding, protecting and monitoring salmon from eggs through to final processing and sale, is a 24/7 year round operation. Operations are managed by a feed barge located near the salmon pens. The barge monitors and controls the feed provided to the salmon. The well boat, the Ronja Huon, also plays a critical role. You will be able to discover more about these vessels online.

Salmon are harvested every evening at the two producing centres and transported overnight to the processing facility near Devonport. Once processed, the salmon goes by ferry to Melbourne and from there is air freighted to local and overseas markets.

Step1:

Watch the video - Growing Salmon in Tasmania (*https://youtu.be/43NI0mAv7vw*)

Huon Aquaculture's Group Technical Manager - David Whyte, provides an overview of the Huon aquaculture operation at Hideaway Bay in southern Tasmania. Record what you recall from the video in relation to the background points below and share your views in a class discussion.

1. What % of the world's population now relies on fish as a major source of protein?
2. Explain how the gap between fish sourced from wild-catch and aquaculture is changing.
3. The implications for wild fish catch and the sustainability of world fish stocks?
4. The implications for aquaculture?
5. Are these comments in keeping with what you have already researched? Share your views in a follow up class discussion.

A number of further questions may have arisen from what you saw and heard in the video.

task

Student Activity 3: All about salmon – the lifecycle of salmon (cont)

Step 2:

Working in pairs or small groups, share the task of accessing the following websites to help your further investigation. This will reinforce your understanding of how the fish are fed, cared for and managed in a controlled environment as they develop through these life cycle stages.

Tasmanian Seafood Industry Council - *http://www.tsic.org.au/files/Sector_Groups/IndustryProfiles/Salmon_Profile.pdf*

Huon Aquaculture - Life Cycle *http://www.huonaqua.com.au/about/salmon/life-cycle/*

Huon Aquaculture - Recirculation Hatchery - *https://www.huonaqua.com.au/community/community-consultation/recirculation-hatchery-forest-home-judbury/*

Marine Education Society of Australia - *http://www.mesa.edu.au/aquaculture/aquaculture13.asp*

The Ronja Huon - *https://www.huonaqua.com.au/about/farm/well-boat/*

Answer the following.

1. Do farmed or wild-catch salmon mature at the same rate? Suggest reasons for your observations.
2. Suggest how environmental factors are altered in the hatchery to replicate the change of seasons.
3. At various life cycle stages, salmon either swim with the current or against it. When does this happen and suggest how is this is addressed in a farmed environment?
4. Record other aspects you discover on how farmed fish are managed during their development.
5. The Ronja Huon is an integral part of Huon's operation. What is its purpose and what improvements does it deliver to Huon's operations? How might this activity have been done in the past?

You can track the Ronja Huon's position at any time. Find it now. What might it be doing there at this time of day?

http://www.marinetraffic.com/ais/details/ships/shipid:312885/mmsi:258871000/imo:9682540/vessel:RONJA_HUON

6. What do you think might be the reason for the fish harvest to take place each evening? What implications would this have for managing the overall operation?

Step 3:

1. Construct a draft annotated line diagram of the Huon Aquaculture salmon operation. Consider how you could represent the development stages from egg to adult, to final harvesting, processing and dispatch to market.
2. Keep this as a work in progress draft and refine it as you undertake further activities in this unit.
3. Suggest new terms to be defined and placed on the class vocabulary chart.
4. Share your findings with other members of the class.

task

Student Activity 4: All about salmon - a sustainable production process

Watch the video again - Growing Salmon in Tasmania (*https://youtu.be/43NI0mAv7vw*)

In the second part of the video, David explains the key priorities in fish farming to manage the health and welfare of the fish and provides your design challenge to re-design the flotation pens.

In order to meet his challenge, you need to critically assess the various production processes involved in salmon farming. Use the case study example of Huon's operations and other online sources to assist you.

Step1:

As a class, divide into two groups to conduct a hypothetical interview. One group acts as Huon's Technical Manager and other workers on site. The second group is the interview team. Some questions to get you started are provided below - add further questions.

Conduct the interview. Record questions that can't be answered as a class list for follow-up investigation.

1. What are your key priorities as a fish farmer?
2. You have many thousands of fish in each pen, how do you monitor their health?
3. Many believe that too many fish kept in one place is unsustainable. What is the basis for deciding how many fish to keep in one pen?
4. How do you know that the fish have enough food? What do you feed them? Is this sustainable?
5. How are the salmon removed from pens in a humane way?
6. What do you do about the waste produced from the fish in each pen?

Step2:

"Australia has established a reputation as a supplier of safe, high quality seafood which is produced using environmentally sustainable practices."
Department of Agriculture and Water Resources: Aquaculture Industry in Australia - *http://www.agriculture.gov.au/fisheries/aquaculture/aquaculture-industry-in-australia*

As part of your follow-up, critically assess the accuracy of the above statement in relation to the sustainability of Tasmanian salmon farming. Do this by researching and completing the Salmon Sustainability Table.

Fish health, welfare and biosecurity

Stocking densities, fish safety and nutritional requirements are just some measures of sustainability in salmon farming.

1. Access the Huon Aquaculture website at - *https://www.huonaqua.com.au/* Search for the key management practices under a) Fish health and welfare and b) Freshwater use.
2. Huon aquaculture is in the process of installing new series of barges to feed the fish. Access the links below and consider how you could factor their capability into your design solution.

   Feeding Innovation - *https://www.huonaqua.com.au/about/farm/feeding-innovation/*

   Take a tour of our new Feed Barge - *https://www.huonaqua.com.au/take-tour-new-feed-barges/*

   Salmon facts - *https://www.huonaqua.com.au/sustainability/approach/huon-salmon-facts/*
3. Test you design ideas by comparing how another Tasmania salmon producer - Tassal, is working to ensure the sustainability of its operations - *http://www.tassal.com.au/sustainability/our-salmon/*

task

Student Activity 4: All about salmon - a sustainable production process (cont)

Protecting the marine environment

1. Access the following links, to find examples of fish farming practices designed to deliver improved the environmental benefits. Water quality and management of waste are further considerations.

   Australia's Sustainable Seafood Guide - *http://www.sustainableseafood.org.au/fish.php/1/6/atlantic-salmon*

   The Future of Fish Farming - *https://www.huonaqua.com.au/community/community-consultation/future-fish-farming/*

   Sustainability report - *http://www.tassal.com.au/wp-content/uploads/2016/05/Tassal-Sustainability-Report-2015.pdf*

2. Recirculation technology . Why is this getting so much attention in various parts of the world? What are some of the stocking rates being achieved? How might these compare with Tasmanian rates?

After carrying out your investigations, complete the Salmon Sustainability table by selecting key measures of sustainability and critiquing their contribution.

task

Salmon Sustainability Table

Name:			
Fish Health and Welfare		**Protecting the Marine Environment**	
Measure	**How Achieved**	**Measure**	**How Achieved**
Provide further sustainability considerations that slamon farmers are addressing:			

task

Student Activity 5: All about salmon – research and innovation

World leading technology and farming practices are used to grow Tasmanian salmon. These include advanced feeds, computerised feeding technology and hi-tech net cleaning equipment. These innovations are being supported by research conducted in Australia by the CSIRO.

Step1:

As you develop your designed solution for an improved salmon pen, familiarise yourself with some of this latest research - *http://www.csiro.au/en/Research/AF/Areas/Aquaculture*

- Breeding better salmon
- Improved aquaculture feeds
- Disease and parasite control in farmed fish – Atlantic salmon gill disease

1. Why is this research being undertaken and what benefits will it deliver?
2. Consider aspects for your pen design that would ensure the ready adoption of these benefits.

Step 2:

Recirculating aquaculture technology is gaining considerable attention as a means of increasing stocking rates of farmed fish - *https://www.business.qld.gov.au/industry/fisheries/aquaculture/site-selection-and-production/aquaculture-production-systems/recirculating-aquaculture-system-characteristics*

A Guide to recirculation Aquaculture *http://www.fao.org/3/a-i4626e.pdf*

1. What benefits does it deliver?
2. Consider the viability of this technology for your designed solution in the Tasmanian environment.

Step 3:

Take a close-up look at the salmon pens that Huon salmon is continually working to improve.

Huon Aquaculture - Our pens - *https://www.huonaqua.com.au/about/farm/pens/*

Information on seals and the new pen design - *https://www.huonaqua.com.au/sustainability/wildlife/seals/*

1. Revisit your line diagram and refine as appropriate. Submit this as a support document.
2. Make a list of the features that you will need to include in your pen design.
3. Assess these against the sustainability considerations you have identified in your investigations.

Step 4:

1. Prepare you design solution. Ensure it contains appropriate labels and dimensions.
2. Decide how you will present your supporting justification.
3. On advice from your teacher, deliver your presentation.

Online Teacher Support Resources

1. Aquaculture Industry in Australia - Department of Agriculture and Water Resources
   http://www.agriculture.gov.au/fisheries/aquaculture/aquaculture-industry-in-australia

2. An overview of the Salmonid Farming Industry - Tasmanian Seafood Industry Council
   http://www.tsic.org.au/files/Industry_Profile/sector_profiles/Salmonid_Profile3.pdf

3. Aquaculture Research CSIRO
   http://www.csiro.au/en/Research/AF/Areas/Aquaculture

4. Australia's Sustainable Seafood Guide – Australian Marine Conservation Society
   http://www.sustainableseafood.org.au/fish.php/1/6/atlantic-salmon

5. Dyneema® - Aquaculture
   http://www.dsm.com/products/dyneema/en_GB/industries/commercial-fishing-nets-and-ropes/aquaculture.html

6. Fish Health and Welfare -Tassal
   https://www.tassal.com.au/sustainability/our-salmon/ - fish-health-welfare

7. Growth of global aquaculture - Fishy Business
   http://www2.deloitte.com/au/en/pages/consumer-business/articles/the-growth-of-aqua-culture-fishy-business.html

8. History of Salmon Growing in Tasmania - Tasmanian Salmonid Growers' Association
   http://www.tsga.com.au/history/

9. Salmon Facts – Huon Aquaculture
   https://www.huonaqua.com.au/sustainability/approach/huon-salmon-facts/

10. New methods of Servicing our Pens – Huon Aquaculture
    https://www.huonaqua.com.au/about/farm/well-boat/

11. Track the Ronja Huon
    http://www.marinetraffic.com/ais/details/ships/shipid:312885/mmsi:258871000/imo:9682540/vessel:RONJA_HUON

12. World's largest salmon 'taxi' slips into town - The Hobart Mercury
    http://www.themercury.com.au/news/tasmania/worlds-largest-salmon-taxi-slips-into-town/news-story/2e38fdcd2d00d8cde0e33b06c9c7679f

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