AGRI-SCIENCE IV
Aquaculture

Overview

Agri-Science IV students will focus on those areas of interest they have developed over the previous three years and concentrate on developing skills more specific to those areas of interest. All Agri-Science curricula are aligned with the national Agriculture, Food, and Natural Resources (AFNR) standards.

Agribusiness Systems (ABS) —the study of business principles, including management, marketing and finance, and their application to enterprises engaged in Agriculture, Food and Natural Resources

Agricultural Mechanics/Power, Structural and Technical Systems (PST)—the study of agricultural equipment, power systems, alternative fuel sources and precision technology, as well as woodworking, metalworking, welding and project planning for agricultural structures

Animal Science/Animal Systems (AS)—the study of animal systems, including life processes, health, nutrition, genetics, management and processing, through the study of small animals, aquaculture, livestock, dairy, horses and/or poultry

Environmental Service Systems (ESS)—the study of systems, instruments and technology used in waste management and their influence on the environment

Food Products and Processing Systems (FPP)—the study of product development, quality assurance, food safety, production, sales and service, regulation and compliance, and food service within the food science industry

Natural Resource Systems (NRS)—the study of the management of soil, water, wildlife, forests and air as natural resources

Horticulture/Plant Systems (PS)—the study of plant life cycles, classifications, functions, structures, reproduction, media and nutrients, as well as growth and cultural practices, through the study of crops, turf grass, trees and shrubs and/or ornamental plants

Students are expected to complete the specific course of study related to their career interests and goals that they began in Agri-Science II that will define students as “completers”. An Agri-Science completer is an Agri-Science IV student who has successfully completed three or four years of study in agriculture, math, and English. Course selection is developed with the assistance of the SAE advisors and classroom teachers.

Agri-Science IV students will continue to have opportunities to further develop leadership skills through participation the in the FFA. Students at this stage are encouraged to participate in FFA Career Development Events (CDEs) in order to further develop skills. Although participation in Agri-Science is limited to those who complete applications, when space allows, ECE classes may be open to other juniors and seniors within Ledyard High School. Course enrollment opportunities by other LHS students will change from year to year based on space availability. Interested students should contact the Agri-Science Instructional Leader or their School Counselor for further information.

Agri-Science IV Aquaculture students will further develop abilities and competencies relative to aquaculture lab production, management, and processing. Students will be presented opportunities to incorporate individual concepts and design s to the aquaculture lab to improve the health, quality and production of the existing aquatic species and systems. The role of responsibilities will change from theoretical concepts to practical application focusing primarily on aquatic systems mechanics, water quality control and aquatic organism growth and health. There will be ample opportunities for practical work where students will apply classroom instruction to real-world situations in the aquaculture lab and classroom.

The culmination of Agri-Science IV is the Senior Projects unit. All Agri-Science IV students will have the opportunity to research, design, and conduct an independent project. For those students in Levels 1 & 2 there exists an option to take a more traditional unit in Agricultural Products.

Units Levels 1 & 2

Aquaculture Lab Design and Management
Anatomy and Physiology of Aquatic Organisms
Aquaculture Products and Marketing or Ag Research Projects
Senior Projects or Agricultural Products

Title: Agri-Science IV Supervised Agricultural Experience (SAE)

Unit Overview: SAE is a vital aspect of agricultural education. As part of Agri-Science I & II students have explored their options and developed work experience programs suitable for young students exploring agriculture as a career. Students have learned how to keep records and the best methods for documenting their day to day work as well as their progress. By the end of Agri-Science III students have developed and implemented plans for supervised work experience relating to their interests and career goals and have shown growth over the previous years.

Agri-Science IV students are expected to continue to demonstrate increased responsibility and new learning relative to their SAEs. Through advanced SAE work, students may be more involved in starting and operating their own businesses or taking employment in agriculturally-related enterprises. It is strongly recommended that students apply for local and state FFA proficiency awards as well as the FFA State Degree.

SAE advisors work with individual students, parents, work-site mentors, and employers to ensure student activities are appropriate, meet student needs, and are in compliance with state labor laws. All students work with their SAE advisors to complete the Universal Structured Work-Based Learning Plan. In addition, some students must complete the Connecticut Department of Labor forms LED 75-1 (Workplace Learning Experiences for Minor Students in Hazardous Occupations).

Suggested Time: On-going

Ledyard High School Expectations for Student Learning:
- Read and write critically and effectively for a variety of purposes
- Speak clearly and communicate ideas accurately in a variety of settings
- Demonstrate critical thinking skills

Agriculture, Food, and Natural Resources Standards:
CS.01.01.07.c Evaluate actions taken and make appropriate modifications to personal goals.
CS.01.03.02.c. Create a plan of action to complete a task based on a conceptualized idea
CS.01.06.03.c Use problem solving strategies to solve a professional or personal issue
CS.01.06.05.c Implement a plan to develop new knowledge and skills related to professional and personal aspirations
CS.02.03.03.c. Demonstrate employability skills for a specific career
CS.03.01.01.b. Select the appropriate form of technical and business writing or communication for a specific situation.
CS.03.02.03.b. Practice ethical behaviors.
CS.07.04.01.c. Apply general workplace safety precautions/procedures.
CS.08.01.01.c. Use tools and equipment appropriately to complete a specific task.
ABS.03.01.01.a Maintain production and agri-business records

Common Core State Standards

RST.11-12.4 Determine the meaning of words and phrases as they are used in text, including analyzing how an author uses and refines the meaning of a key term over the course of a text

WHST.11-12.1.e Provide a concluding statement or section that follows from or supports the argument presented.

WHST.11-12.2a Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension

WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience

MP 6 Attend to precision

Objectives	Required Activities/ Suggested Activities	AFNR Standards/CCSS
Implement planned improvements to enhance or improve work experience program	• Develop and expand work experience activities/projects in line with career goals • Write SMART goals for SAE improvement over the year	CS.01.01.07.c CS.01.03.02.c CS.01.06.03.c CS.01.06.05.c CS.02.03.03.c. ABS.03.01.01.a RST.11-12.4 WHST.11-12.4
Accurately (or independently) complete appropriate work experience forms utilizing AFNR standards	• Identify key skills necessary to complete the Structured Work-Based Learning Form using AFNR standards • Complete appropriate CT Departments of Labor and Education forms for student work experience independently	CS.01.06.05.c CS.02.03.03.b. CS.03.01.01.b. WHST.9-10.4
Demonstrate effective and appropriate work skills	• Work safely and effectively • Document safe handling of equipment, plants, and animals • Demonstrate appropriate workplace skills such as time management, interpersonal skills, organization, communication, technology and tool use, and problem solving	CS.01.06.03.c CS.02.03.03.c. CS.01.06.05.c CS.03.02.03.b. CS.07.04.01.c. CS.08.01.01.c. ABS.03.01.01.a RST.11-12.4 WHST.11-12.4

Develop and maintain clear records	• Document time spent in activities, skills learned, income, and expenses • Keep all SAE records in a well-organized binder • Provide evidence of work using photographs, videos, and journals • Meet with SAE advisor weekly during the school year and at least once during the summer • Set up/organize appointments with SAE advisor and employer/supervisor/parent	CS.02.03.03.c. CS.03.01.01.b. ABS.03.01.01.a RST.11-12.4 WHST.11-12.1.e WHST.11-12.2a WHST.11-12.4

Italics indicates technology use

Vocabulary

501(c)(3)
Entrepreneurship
Hazardous Occupations
Liability
Non-Profit Entity
Paid Placement
Structured Work-Based Learning Plan
Worker's Compensation Insurance
Work-site Mentor

Assessments:

- Weekly record checks
- Monthly and annual summaries
- On-site visits by advisor in coordination with parent/supervisor/employer
- SAE rubrics

Resources/Materials:

- AFNR Standards
- Binder and record sheets
- SDE/SDOL employment forms

Title: Aquaculture Lab Design and Management

Unit Overview: Aquaculture Lab Design and Management provides students the opportunity to perform the numerous tasks and responsibilities involved in the operation of a closed systems aquaculture facility. Students will use practical application and previous knowledge to design, construct and modify aquaculture systems to accommodate new crops of aquatic species. Students are accountable for the background knowledge and skills in aquarium management, re-circulating systems, production fish, filtration, basic plumbing, and water quality.

Suggested Time: One quarter

Ledyard High School Expectations for Student Learning:

- Employ problem solving skills effectively
- Demonstrate critical thinking skills

Agriculture, Food, and Natural Resources Standards:

ABS.03.02.01.b. Use computer technology in inventory management and reporting, including spreadsheets, databases, word processing, networked systems and the Internet.
AS.02.01.02.a. Identify major animal species by common and scientific names.
AS.02.03.02.c. Develop efficient procedures to produce consistently high quality animals, well suited for their intended purposes.
AS.03.01.01.b. Perform simple health-check evaluations on animals.
AS.03.02.01.a. Explain the importance of biosecurity to the animal industry.
AS.04.01.01.a. Compare and contrast common types of feedstuffs and the roles they play in the diets of animals.
AS.04.01.02.b. Appraise the adequacy of feed rations using data from the analysis of feedstuffs, animal requirements and performance.
AS.06.01.01.b. Outline safety procedures for working with animals by species.
AS.07.01.01.a. Identify facilities needed to house and produce each animal species safely and efficiently.
AS.07.01.02.a. Identify equipment and handling facilities used in modern animal production.
BS.02.04.02.b. Inventory biological and chemical materials, and maintain accurate records of supplies and expiration dates.
CS.01.01.01.c. Work independently and in group settings to accomplish a task.
CS.01.01.03.c. Implement an effective project plan.
CS.01.02.02.b. Utilize communication skills to collaborate in a group setting.
CS.07.01.01.b. Use appropriate personal protective equipment for a given task.
CS.07.04.01.c. Apply general workplace safety precautions/procedures.
CS.08.01.01.c. Use tools and equipment appropriately to complete a specific task.
CS.08.01.02.b. Demonstrate appropriate operation, storage, and maintenance techniques for tools and equipment.
CS.08.02.01.a. Use the appropriate procedures for the use and operation of specific tools and equipment.

ESS.01.01.01.b. Determine the appropriate sampling techniques needed to generate statistical analysis data, and prepare valid chemical laboratory samples according to instruction.
ESS.04.02.01.b. Evaluate environmental hazards created by different types of solid waste, solid waste accumulation and solid waste disposal.
FPP.02.04.01.a. Explain safety standards that must be observed in facility design and equipment use.
PST.01.03.01.a. Identify and demonstrate safe use and maintenance of measurement and layout tools.
PST.04.01.01.a. Identify symbols and drawing techniques used to develop plans and sketches.

Common Core State Standards

WHST 11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience
RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics
SL.11.-12.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

MP1 Make sense of problems and persevere in solving them
MP 3 Construct viable arguments and critique the reasoning of others
MP 4 Model with mathematics
MP 5 Use appropriate tools strategically

Objectives	Required Activities/ Suggested Activities	AFNR Standards/CCSS
Select appropriate aquaculture equipment and components	• Identify and describe in writing the purpose and/or function of aquaculture equipment, re-circulating system components and plumbing in an aquaculture lab.	CS.08.01.02.b. AS.07.01.02.a. RST.11-12.3 WHST.11-12.4
Assess the operational status of re-circulating systems in the aquaculture lab	• Perform a 'walk through' of the lab noting system conditions, functioning and potential problems • Identify system malfunctions and note suggestions to remedy issues • Prioritize necessary maintenance tasks	CS.08.02.01.a. AS.07.01.01.a. AS.07.01.02.a. WHST 11-12.4
Determine water quality and the impact on fish health	• Safely perform water tests according to instruction and classroom guidelines	ABS.03.02.01.b. AS.02.03.02.c.

	• Sample and test water parameters such as Ammonia, Nitrite, Nitrate, pH, and Dissolved Oxygen using water test kits • Determine and record specific chemical levels based on water test results • Assess water quality by recording and analyzing results of the water tests • Locate, read and interpret specific information from SDS's regarding water testing reagents • Locate and use proper safety equipment/attire while water testing and/or working in the aquaculture lab	AS.03.01.01.b. AS.07.01.01.a CS.01.01.01.c. ESS.01.01.01.b. WHST.11-12.4 RST.11-12.3 RST.11-12.4 MP1 MP4 MP5
Maintain recirculating systems	• Perform maintenance on re-circulating system equipment based on maintenance schedules and equipment lifespan • Maintain, replenish and/or replace media in system filtration devices • Disassemble and perform checks of all system filtration devices and production tanks. • Compile a list of material and equipment needs • Demonstrate safe tool and equipment use when working in an aquaculture lab • *Digitally record maintenance data using spreadsheet programs*	ABS.03.02.01.b. AS.02.03.02.c. AS.03.01.01.b AS.07.01.01.a BS.02.04.02.b. CS.01.01.01.c. CS.07.01.01.b CS.07.04.01.c CS.0.8.01.01.c. ESS.01.01.01.b. ESS.04.02.01.b WHST.11-12.4 MP 4
Evaluate mechanical functioning of specific filtration devices and aeration systems	• Perform multi-point inspection on system filtration devices, aeration devices, plumbing and fittings • Disassemble and inspect filtration media, screens, inlet/outlet plumbing and fittings	AS.02.03.02.c. AS.07.01.01.a CS.01.01.01.c. WHST.11-12.4
Demonstrate proper use, care and sanitation of aquaculture equipment	• Safely use aquaculture equipment • Demonstrate safe practices in the lab and classroom while working with equipment, tools and production systems • Maintain biosecurity • Exercise proper sanitation of equipment.	AS.03.02.01.b AS.07.01.01.a AS.07.01.02.a. CS.07.04.01.c.
Identify aquaculture production species.	• Identify aquaculture species by common and binomial name • Use differences in morphological features of finfish to identify and differentiate among species	AS.02.01.02.a.

Select, evaluate and distribute production species to appropriate lab systems	• Identify life stages of production fish based on size, weight, and age • Weigh and measure fish to determine life stage • Record weights and crop sizes • Establish consistent crop sizes by combining populations of fish of similar size and weight	AS.02.01.02.a. AS.07.01.01.a. CS.01.01.01.c. WHST.11-12.4 MP 4
Sample, transport, and acclimate fish using appropriate techniques.	• Demonstrate proper handling and transport of aquatic organisms • Identify anatomical features of finfish that may cause human injury • Properly acquire a sample of fish from a production system for weight analysis • Prepare equipment for proper transport of aquatic organisms • Acclimate aquatic organisms to appropriate systems using proper techniques	AS.03.01.01.b. AS.06.01.01.c. CS.01.01.01.c.
Determine fish growth data to update lab data display board	• Weigh, measure and record a sample of each production system to determine average fish weight and crop size • Determine feed percentages based on average weights and crop size • Determine feed amounts per day based on crop size	AS.04.01.01.c AS.04.01.02.b. CS.01.01.01.c. CS.07.04.01.c. ESS.04.02.01.b. WHST.11-12.4 MP1 MP4 MP5
Create an aquaculture lab facility plan	• Determine measurements and dimensions of lab, equipment, systems, drainage, exits, water and aeration. • Evaluate current lab layout • Create a dimensional diagram of the aquaculture lab • Work in class groups to brainstorm specific changes to accommodate new equipment and species. • Work as a class to discuss and implement a plan to relocate species and equipment, determine crop sizes and feeding regimens, and to plan system improvements.	AS.02.01.02.a. AS.04.01.01.a AS.07.01.01.a. CS.01.02.02.b. CS.01.01.03.c. FPP.02.04.01.a. PST.01.03.01.a. PST.04.01.01.a. SL.11.-12.4 WHST.11-12.4 MP1

		MP4 MP5
Create and maintain a lab display board	• Use lab display board to exhibit production species and systems, record crop sizes, and list feed amounts	AS.02.01.02.a. AS.04.01.01.a AS.04.01.02.b. AS.07.01.01.a. CS.01.02.02.b. CS.01.01.03.c. FPP.02.04.01.a. PST.01.03.01.a. PST.04.01.01.a. WHST.11-12.4 MP1 MP4 MP5
Design and implement a lab improvement project	• Plan and design a system upgrade • Keep a detailed materials list with appropriate dimensions, measurements and costs • Use plumbing and construction tools appropriately and safely to complete a task	AS.02.03.02.c. AS.03.01.01.b AS.07.01.01.a CS.01.01.01.c. CS.07.01.01.b CS.07.04.01.c CS.0.8.01.01.c. PST.01.03.01.a. PST.04.01.01.a. WHST.11-12.4 MP1 MP4 MP5

Level 1

Objectives	Required Activities/ Suggested Activities	AFNR Standards/CCSS
Select appropriate aquaculture equipment and components	• Assess the mechanical functions of the lab filtration devices and suggest improvements and maintenance.	CS.08.01.02.b. AS.07.01.02.a. RST.11-12.3 WHST.11-12.4

Assess the operational status of re-circulating systems in the aquaculture lab	• Pose as acting lab manager (weekly rotation) and perform lab checks on systems and lab equipment.	CS.08.02.01.a. AS.07.01.01.a. AS.07.01.02.a. WHST 11-12.4
Determine water quality and the impact on fish health	• Provide suggestions on how to remediate any water quality issues. • Design a plan of action for water quality remediation	ABS.03.02.01.b. AS.02.03.02.c. AS.03.01.01.b. AS.07.01.01.a CS.01.01.01.c. ESS.01.01.01.b. WHST.11-12.4
Maintain recirculating systems	• Maintain water testing equipment, chemicals, instructions and SDS's.	BS.02.04.02.b. ESS.01.01.01.b. ESS.04.02.01.b WHST.11-12.4
Evaluate mechanical functioning of specific filtration devices and aeration systems	• Prioritize maintenance tasks using a weekly log sheet	AS.02.03.02.c. AS.07.01.01.a CS.01.01.01.c. WHST.11-12.4
Identify aquaculture production species.	• Identify aquatic species by binomial name	AS.02.01.02.a.
Determine fish growth data to update lab data display board	• Calculate feed conversion ratio based on feed and weight gain from previous year • Update growth data on both *spreadsheet* and display board.	AS.04.01.01.c AS.04.01.02.b. CS.01.01.01.c. CS.07.04.01.c. ESS.04.02.01.b. WHST.11-12.4 MP1 MP4 MP5
Create an aquaculture lab facilities plan	• Pose as acting lab manager to confirm system measurements, layout and species location.	CS.01.02.02.b. CS.01.01.03.c. FPP.02.04.01.a. PST.01.03.01.a. SL.11.-12.4

		MP1 MP4 MP5

Italics indicates technology use

Assessed Vocabulary:

Biofiltration	Directional valve	PVC Plumbing/Fittings	Sump
Biomedia	Gate Valve	Refractometer	Un-ionized Ammonia
Bioreactor	In-Line Heater	Regenerative Blower	UV Filter
Blower	Magnetic Drive Pump	Sodium Bicarbonate	Zeolilte
Check Valve	Pressure Gauge	Sodium Chloride	
CPVC Plumbing/Fittings	Protein Skimmer	Sodium Thiosulphate	

Classroom Use Vocabulary:

Activated Carbon	Clarifier	Production/Culture Tank
Air Diffuser	Comet Goldfish (*Carassius auratus*)	Red Claw Crawfish (*Cherax quadricarinatus*)
Air Lift	External Power Filter	Re-Circulating System
Ammonia	Hydrometer	Settling Tank
Bead Filter	Koi (*Cyprinus carpio*)	Wet/Dry Trickle Filter
Canister Filter	Nile Tilapia (*Oreochromus niloticus*)	Submersible Pump
Channel Catfish (*Ictalurus punctatas*)	Nitrification	

Assessments:

- Written Quizzes
- Class assignments
- Weekly grades
- Lab Improvement Project
- Systems Maintenance
- Lab Quizzes
- Unit Test

Resources/Materials:

- Aquatic Systems Engineering: Devices and How they Function
- Fundamentals of Aquaculture: Step by Step Guide to Commercial Aquaculture
- Text: Aquaculture Science, Second Edition. Parker.
- Production Tanks and Fish

- Re-Circulating Systems Equipment and Materials
- General Aquaculture Equipment
- PVC/CPVC Plumbing – Fittings and pipe
- Water Testing Safety Equipment and Kits
- Southeastern Regional Aquaculture Center Publishing: www.srac.msstate.edu

Title: Anatomy and Physiology of Aquatic Organisms

Unit Overview: This class will explore the unique aspects of organisms that inhabit aquatic ecosystems. Students will study the anatomy, physiological functions and morphology of several classes of organisms. Students will observe the differences between aquatic organisms and terrestrial animals and focus on each organism's unique characteristics that help it survive and thrive in many different types of aquatic environments. Students will also identify the basic external and internal anatomy of common fish, mollusks and crustaceans.

Suggested Time: One quarter

Ledyard High School Expectations for Student Learning:

- Read and Write critically and effectively for a variety of purposes
- Employ problem solving skills effectively
- Demonstrate critical thinking skills

Agriculture, Food, and Natural Resources Standards:

AS.01.01.01.b. Evaluate and describe characteristics of animals that developed in response to the animals' environment and led to their domestication.
AS.02.02.01.a Identify basic characteristics of animal cells, tissues, organs and body systems
AS.02.02.06.c Explain the impact of animal body systems on performance, health, growth and reproduction
AS.02.03.01.b. Compare and contrast desirable anatomical and physiological characteristics of animals within and between species.
AS.02.03.02.b. Assess an animal to determine if it has reached its optimal performance level based on anatomical and physiological characteristics.
AS.03.01.01.b. Perform simple health check evaluations on animals
AS.03.01.02.c. Treat common diseases, parasites and physiological disorders of animals.
AS.04.01.01.c. Select appropriate feedstuffs for animals based on factors such as economics, digestive system and nutritional needs.
AS.06.01.01.c. Interpret animal behaviors and execute protocols for safe handling of animals.
AS.06.01.02.a. Explain the implications of animal welfare and animal rights for animal agriculture.
AS.07.01.01.a. Identify facilities needed to house and produce each animal species safely and efficiently.
AS.07.01.02.a. Identify equipment and handling facilities used in modern animal production.
AS.08.02.01.c. Establish and maintain favorable environmental conditions for animal growth and performance.
CS.01.01.01.c Work independently and in group settings to accomplish a task
CS.08.01.01.c Use tools and equipment appropriately to complete a specific task
NRS.01.02.04.a. Describe morphological characteristics used to identify aquatic species.

Common Core State Standards:

RST.11-12.4 Determine the meaning of words and phrases as they are used in text, including analyzing how an author uses and refines the meaning of a key term over the course of a text

WHST.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience

Objectives	Required Activities/ Suggested Activities	AFNR Standards/CCSS
Apply knowledge of anatomy and physiology to assess health of fish, aquaculture systems, and water quality	• Identify the characteristics of aquatic organisms that contribute to their health, survival and function in an underwater environment • Identify and compare the characteristics of fish organs and body systems to those of other animals • Recognize water quality issues that may affect fish and aquaculture system health	AS.01.01.01.b. AS.02.02.01.a AS.02.02.06.c AS.07.01.01.a. NRS.01.02.04.a. WHST.11-12.4
Identify and differentiate among species of fish, crustaceans and mollusks	• Use differences in anatomical and morphological features of fish, crustaceans and mollusks to identify and differentiate among species	AS.02.03.01.b. AS.01.01.01.b. NRS.01.02.04.a.
Classify fish into taxonomic groups	• Classify three different classes of fish • Differentiate fish from other phyla of animals • Create a general description of fish based on characteristics	AS.02.03.01.b. AS.01.01.01.b. NRS.01.02.04.a. RST.11-12.4 WHST.11-12.4
Determine age of finfish through analysis of anatomical structures	• Perform scale analysis on various finfish picture samples to determine age, life stages, breeding periods and other life occurrences • Acquire scale sample from both a native finfish species and a production raised species for scale analysis and growth comparisons • Acquire and process opercula samples from native species for age analysis • Dissect native finfish species to acquire the otolith for age analysis.	AS.02.03.02.b. AS.06.01.01.c. CS.01.01.01.c CS.08.01.01. RST.11-12.4 WHST.11-12.4
Identify and interpret the anatomical structures and morphology of a fish	• Identify the external features of a fish • Compare the external structure of a fish to that of other animal phyla	AS.02.02.01.a AS.02.03.01.b. AS.02.03.02.b.

	• Identify and define the functions of the external anatomy of a finfish • Observe the functions of fins, mouth and operculum using production and aquarium fish • Differentiate between spines and rays • Use appropriate lab practices to safely handle finfish • Differentiate among the shape, form, fin position, fin shape, eye position, mouth position and other specialized characteristics of fish • Categorize fish based on external features and anatomy	AS.03.01.01.b. AS.06.01.01.c AS.07.01.02.a AS.08.02.01.c CS.01.01.01.c CS.08.01.01.
Identify and describe the internal anatomical structures and systems of fish	• Identify the internal organs and skeletal features of a fish • Compare the internal structures and organs of a fish to other animal phylum • Label and define the functions of the internal anatomy of a fish • Perform a dissection of a finfish to identify , number, and categorize the internal and external anatomy • Create a slideshow of the internal anatomy of a finfish	AS.02.02.01.a AS.02.02.06.c AS.02.03.01.b. AS.02.03.02.b. AS.04.01.01.c. AS.06.01.01.c AS.07.01.02.a AS.08.02.01.c CS.01.01.01.c CS.08.01.01. RST.11-12.4 WHST.11-12.4
Identify and interpret specific components of a fish's physiological system	• Identify the components and structures of the circulatory system • Trace the blood flow through a closed circulatory system • Identify the gill structures and functions • Define and interpret respiration functions of the gill including diffusion, countercurrent flow and opercula movement • Identify the components and structures of the lateral line system • Compare and contrast the structures and functions of the ear vs. the lateral line • Discuss the function and uses of a lateral line in a fish • Compare and select appropriate fish feed composition based on digestive system and nutritional needs	AS.02.02.01.a AS.02.02.06.c AS.02.03.01.b. AS.02.03.02.b. AS.08.02.01.c WHST.11-12.4

Interpret osmoregulatory processes in different species of fish	• Read and interpret information pertaining to osmoregulatory processes and how they differ among saltwater and freshwater species • List and explain the body functions that assist in regulation of water and ion concentrations • Compare anadromous and catadromous fish	AS.02.02.01.a AS.02.02.06.c AS.02.03.01.b. AS.02.03.02.b. AS.08.02.01.c CS.01.01.01.c RST.11-12.4 WHST.11-12.4
Assess fish health based on external body condition	• Observe production and aquarium fish for signs of poor water quality, injury or poor health • Record health information • Diagnose health concerns and treat accordingly	AS.03.01.02.c. AS.06.01.01.c CS.01.01.01.c. WHST.11-12.4

Level 1

Objectives	Required Activities/ Suggested Activities	AFNR Standards/CCSS
Apply knowledge of anatomy and physiology to assess health of fish, aquaculture systems, and water quality.	• Identify and describe the characteristics of aquatic organism that assist in their survival and functioning in an underwater environment • Describe the impacts of aquatic systems on fish health, growth and reproduction	AS.01.01.01.b. AS.02.02.01.a AS.02.02.06.c AS.07.01.01.a. WHST.11-12.4
Classify fish into taxonomic groups	• Compare and contrast anatomical and physiological characteristics of aquatic organisms within and between species • Analyze taxonomic names to determine their etymology	AS.02.03.01.b. AS.01.01.01.b. RST.11-12.4 WHST.11-12.4
Determine age of finfish through analysis of anatomical structures	• Compare the otolith, scale and opercula data to hypothesize age, life occurrences and life stages.	AS.02.03.02.b. AS.06.01.01.c. CS.01.01.01.c CS.08.01.01. RST.11-12.4 WHST.11-12.4
Identify and interpret the anatomical structures and morphology of a fish	• Compare the external structure of a finfish to other animal phyla • Categorize and classify (Taxonomic System) fish based on external features and anatomy.	AS.02.02.01.a AS.02.03.01.b. AS.02.03.02.b. AS.03.01.01.b.

		AS.06.01.01.c AS.07.01.02.a AS.08.02.01.c CS.01.01.01.c CS.08.01.01.
Identify and interpret components of a fish's circulatory system	• Discuss the bi-products of respiration in respect to fish health and water quality in an aquatic system	AS.02.02.01.a AS.02.02.06.c AS.02.03.01.b. AS.02.03.02.b. AS.08.02.01.c WHST.11-12.4
Interpret osmoregulatory processes in different species of fish	• Compare the osmoregulatory processes of all three phyla of fish	AS.02.02.01.a AS.02.02.06.c AS.02.03.01.b. AS.02.03.02.b. AS.08.02.01.c CS.01.01.01.c RST.11-12.4 WHST.11-12.4
Assess fish health based on external body condition	• Diagnose fish health, water quality and aquatic system problems and treat accordingly	AS.03.01.02.c. AS.06.01.01.c CS.01.01.01.c. WHST.11-12.4

Italics indicates technology use

Assessed Vocabulary:

Afferent Artery	Caudal Fin	Dentary	Gill Arch
Ampullae of Lorenzini	Caudal Peduncle	Depressed	Gill Filaments
Anadramous	Caudal Ray	Diphycercal	Gill Rakers
Anal Fin	Chemoreception	Dorsal Ray	Gonad
Anal Ray	Clavicle	Dorsal Spine	Heart
Aorta	Compressed	Efferent Artery	Hemal Spine
Atrium	Countercurrent Flow	Electroreception	Heterocercal
Barbel	Ctenoid	Emarginate	Homocercal
Bulbous Arteriosus	Cupula	Fusiform	Hyoosmotic
Catadramous	Cycloid	Ganoid	Hyperosmotic

Hypural
Inferior
Isotonic
Lamellae
Lateral Line
Lateral Line Canal
Lateral Line Nerve
Lateral Opening
Lunate
Maxilla
Mechanoreception
Myomere
Neural Spine
Olfactory Bulb
Opercula
Orbit
Osmoregulation
Osmosis
Otolith
Pectoral Ray
Pelvic Fin
Pelvic Girdle
Pelvic Ray
Placoid
Poikilotherm
Protocercal
Pyloric Ceca
Radial Cartilage
Ray
Sensory Hair
Sinus Venosus
Soft Ray Dorsal
Spine
Spiny Ray Dorsal
Superior
Swim/Air Bladder
Terminal
Truncate
Urea
Urinary Bladder
Urogenital Opening
Ventricle

Classroom Use Vocabulary:

Anguilliform
Cartilaginous
Class: Agnatha
Class: Chondrichthyes
Class: Osteichthyes
Diffusion
Ichthyology
Respiration

Assessments:

- Quizzes
- Unit test
- Written assignments
- Dissection project
- Weekly grades
- Slideshow

Resources/Materials:

- Fundamentals of Aquaculture: Step by Step Guide to Commercial Aquaculture
- Text: Aquaculture Science, Second Edition. Parker. Delmar, 2002
- Production Fish
- General Aquaculture Equipment
- Water Testing Safety Equipment and Kits
- Computers: Microsoft Excel, Microsoft Word
- Southeastern Regional Aquaculture Center Publishing: www.srac.msstate.edu
- Introduction to Fish Physiology. Dr. Lynwood S. Smith
- Ichthyology. Lagler, Bardach and Miller

Title: Aquaculture Products and Marketing

Unit Overview: This unit will explore methods of aquaculture and commercial fisheries as they apply to the seafood industry. Students will study various species of aquatic organisms to gain knowledge of their source, method of aquaculture/capture, processing and marketing. Seafood products will be traced from their origin to the dinner plate. Emphasis will be placed on safe handling, preparing and inspection of seafood products found in our local markets. Students will have the opportunity to prepare and sample various seafood items.

Suggested Time: One quarter

Ledyard High School Expectations for Student Learning:

- Read and write effectively for a variety of purposes
- Employ problem solving skills effectively
- Demonstrate critical thinking skills

Agriculture, Food, and Natural Resources Standards:

ABS.04.01.01.b. Manage assets, including credit, for agribusiness goal achievement.
ABS.04.01.02.a. Identify financial concepts associated with production and profit.
ABS.06.01.02.a. Describe functions in agricultural marketing.
ABS.06.04.01.b. Develop advertising campaigns that promote products and services.
ABS.06.05.01.a. Identify, explain and organize components of the sales process.
ABS.07.02.02.b. Examine legal and industry requirements for a production facility.
AS.02.01.02.a. Identify major animal species by common and scientific names.
AS.02.03.01.b. Compare and contrast desirable anatomical and physiological characteristics of animals within and between species.
AS.03.02.01.a. Explain the importance of biosecurity to the animal industry
AS.02.03.02.c. Develop efficient procedures to produce consistently high quality animals, well suited for their intended purposes.
AS.03.01.01.b. Perform simple health-check evaluations on animals.
CS.01.01.01.c. Work independently and in group settings to accomplish a task.
CS.01.02.02.b. Utilize communication skills to collaborate in a group setting.
CS.01.01.03.c. Implement an effective project plan.
CS.07.01.01.b. Use appropriate personal protective equipment for a given task.
CS.07.04.01.c. Apply general workplace safety precautions/procedures.
CS.08.01.01.c. Use tools and equipment appropriately to complete a specific task.
CS.08.01.02.b. Demonstrate appropriate operation, storage, and maintenance techniques for tools and equipment.
FPP.01.01.01.a. Discuss the history and describe and explain the components (e.g., processing, distribution, byproducts) of the food products and processing industry.

FPP.01.02.01.a. Explain the purposes of organizations that are part of or regulate the food products and processing industry.
FPP.01.02.02.b. Discuss the application of industry standards in the food products and processing industry.
FPP.02.01.03.b. Develop a basic equipment and facility maintenance program.
FPP.02.02.02.b. Explain the implementation of the seven principles of HACCP.
FPP.02.04.01.a. Explain safety standards that must be observed in facility design and equipment use.
FPP.03.01.06.c. Prepare and label foods according to the established standards of regulatory agencies.
FPP.04.02.01.c. Evaluate, grade and classify processed meat, egg, poultry, fish and dairy products.
FPP.04.03.06.b. Select methods and conditions for storing raw and processed food products.
NRS.01.02.04.a. Describe morphological characteristics used to identify aquatic species.
NRS.03.01.10.a. Identify uses of aquatic species.

Common Core State Standards:

WHST 11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience
RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics

MP 4 Model with mathematics
MP 5 Use appropriate tools strategically

Objectives	Required Activities/ Suggested Activities	AFNR Standards/CCSS
Identify the organizations, departments and administrations that monitor, inspect and determine safe practices of aquaculture and commercial fisheries products	• Discuss the role and responsibilities of the FDA and USDA in respect to inspection and safety of seafood products • Define and explain HACCP management practices and their role in seafood safety • Perform a mock seafood facilities inspection • Research how local shellfish commissions regulate shellfish grounds	ABS.07.02.02.b. CS.01.02.02.b. CS.07.04.01.c. FPP.01.02.02.b. FPP.02.01.03.b. FPP.02.02.02.b. FPP.01.02.01.a. FPP.01.01.01.a. FPP.02.04.01.a.

Identify aquaculture production and commercial fisheries products, species, and forms in which they are marketed.	• Identify commercial and aquaculture species commonly used in local markets • Recognize specific cuts and forms of fish • Categorize shellfish products and market forms • Distinguish between aquaculture species by common and binomial name • Use differences in morphological features of finfish, mollusks and crustaceans to classify and differentiate among species	FPP.01.01.01.a. AS.02.01.02.a. AS.02.03.01.a. NRS.01.02.04.a. NRS.03.01.10.a. WHST.11-12.4
Identify and compare methods of commercial fishing and aquaculture production	• Compare and contrast commercial fisheries capture methods • Discuss the advantages and disadvantages of aquaculture production methods • Debate sustainable methods of commercial fisheries and aquaculture vs. unsustainable methods	AS.02.03.02.c. NRS.01.02.04.a. NRS.03.01.10.a. FPP.01.01.01.a.
Locate the sources of local and global aquaculture and commercial fisheries products.	• Create a map display that shows the source of common aquaculture and commercial fisheries products • Visit a grocery store or seafood market to explore origin of common aquaculture products and market forms • Distinguish between seafood products that are raised in aquaculture and those that are commercially harvested.	CS.01.01.01.c. CS.01.01.03.c. NRS.01.02.04.a. NRS.03.01.10.a. FPP.01.01.01.a.
Describe how seafood products are processed, stored and displayed to ensure quality	• Discuss quality control, storage and display of finfish and shellfish products • Define and discuss biosecurity • Read and compare various seafood standards provided by seafood markets and grocery stores • Visit local seafood departments to observe methods of storage, display and quality control. • Read and analyze shellfish tags	AS.03.01.01.b. AS.03.02.01.a. CS.07.04.01.c. FPP.01.02.01.a. FPP.04.02.01.c. FPP.04.03.06.b. RST.11-12.4
Safely prepare various seafood products for consumption	• Evaluate, safely handle and prepare seafood products for consumption • Discuss the risk of consuming raw or undercooked products • Identify market cuts and forms of seafood	CS.08.01.01.c. CS.08.01.02.b. FPP.01.02.02.b. FPP.04.02.01.c. FPP.04.03.06.b.

Develop a plant to improve school facilities to comply with health and safety regulations required to market aquaculture products	• Evaluate the school's facility from the perspective of a potential customer. • Discuss the positive and negative aspects of the current school lab arrangement with respect to marketing, product safety and biosecurity • Identify potential lab improvement needs and create a lab improvement plan	ABS.07.02.02.b. AS.03.02.01.a. CS.08.01.02.b. FPP.01.02.02.b. FPP.02.01.03.b. FPP.02.04.01.a.
Identify and remediate sanitation and biosecurity concerns associated with the school aquaculture lab systems, equipment and facility	• Conduct periodic HACCP inspections and identify unsanitary conditions or biosecurity issues • Remediate problems identified during inspection	ABS.07.02.02.b. AS.03.02.01.a. CS.01.01.03.c. CS.07.01.01.b. CS.08.01.01.c.
Identify the four P's of marketing and explain the variables involved in seafood product marketing	• Discuss the four P's (Product, Price, Promotion and Place) involved in an aquaculture marketing plan • Evaluate a seafood package based on the four P's	ABS.04.01.02.a. ABS.06.01.02.a. ABS.06.05.01.a. ABS.06.05.01.a.
Examine and complete a net worth spreadsheet	• Complete a personal five year plan based on career goals and potential living situations and develop a net worth spreadsheet • Differentiate liabilities and assets for both business and personal use • Complete and analyze an online amortization schedule for an intermediate and long term liability.	ABS.04.01.01.b. ABS.04.01.02.a. MP4 MP5
Develop a marketing plan for an aquaculture or commercial fisheries products	• Create a package for a local seafood product. • Develop and advertising campaign • Research prices for similar products in a local seafood market	ABS.06.04.01.b. ABS.06.05.01.a. FPP.03.01.06.c. FPP.04.03.06.b.
Create a marketing campaign for Ledyard aquaculture.	• Develop a marketing campaign for Ledyard aquaculture products	ABS.06.04.01.b. ABS.06.05.01.a. FPP.03.01.06.c. FPP.04.03.06.b.

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Objectives	Required Activities/ Suggested Activities	AFNR Standards/CCSS
Identify the organizations, departments and administrations that monitor, inspect and determine safe practices of aquaculture and commercial fisheries products.	• Compare the FDA and USDA in respect to seafood safety and inspection	ABS.07.02.02.b. CS.01.02.02.b. CS.07.04.01.c. FPP.01.02.01.a. FPP.01.02.02.b. FPP.02.02.02.b FPP.02.02.02.b
Identify and compare methods of commercial fishing and aquaculture production	• Identify and provide examples of sustainable methods of commercial fisheries and aquaculture.	AS.02.03.02.c. FPP.01.01.01.a.
Locate the sources of local and global aquaculture/commercial fisheries products.	• Design a layout for the class display on global seafood products	CS.01.01.01.c. CS.01.01.03.c. FPP.01.01.01.a.
Identify and explain characteristics of quality control, storage and display of local seafood products	• Contact local seafood markets and agencies to gather information on laws, closures, limitations and health concerns of local seafood	AS.03.01.01.b. AS.03.02.01.a. CS.07.04.01.c. FPP.01.02.01.a. FPP.04.02.01.c. FPP.04.03.06.b. RST.11-12.4
Design a lab development plan to improve aquaculture product safety and marketability.	• Initiate lab improvement plan as 'lab manager' • Determine a course of action to improve water quality in production systems • Complete biofiltration surface area to volume ratios	ABS.07.02.02.b. AS.03.02.01.a. CS.08.01.02.b. FPP.01.02.02.b. FPP.02.01.03.b. FPP.02.04.01.a.
Identify the four P's of marketing and explain the variables involved in seafood product marketing	• List the different variables associated with generating an accurate cost, finding a location to sell, and advertisement of seafood products.	ABS.04.01.02.a. ABS.06.01.02.a. ABS.06.05.01.a. ABS.06.05.01.a.

Examine and complete net-worth spreadsheet	• Accumulate a list of Aquaculture facility assets and liabilities. • Complete a Net Worth spreadsheet based on liabilities and assets of aquaculture program	ABS.04.01.01.b. ABS.04.01.02.a. MP4 MP5
Complete a financial assessment of aquaculture program including liabilities and assets	• Accumulate a list of Aquaculture facility assets and liabilities.	ABS.04.01.01.b. ABS.04.01.02.a.

Italics indicates technology use

Assessed Vocabulary:

Added Value	HACCP	Net Worth	Purse Seining
Asset	Liability	Net/Pen Aquaculture	Shellfish Commission
Dredging/Dragging	Line/Pole Aquaculture	Pond Aquaculture	Trawling
FDA	Longlining	Pot/Trap	USDA

Classroom Vocabulary:

Biosecurity
Amortization
Financing
Re-Circulating Systems Aquaculture
Open System
Closed System

Assessments:

- Quizzes
- Class assignments
- Lab assessment project
- Net Worth project
- Advertisement project
- Class Participation
- Unit Test

Resources/Materials:

- Fundamentals of Aquaculture: Step by Step Guide to Commercial Aquaculture
- Text: Aquaculture Science, Second Edition. Parker.
- Production Tanks and Fish
- Re-Circulating Systems Equipment and Materials
- Videos

Title: Senior Project

Unit Overview: Most Agri-Science IV students will develop and complete a culminating project at the end of the school year. This project will give students the opportunity to demonstrate the application of critical skills learned over the course of their high school careers through a comprehensive project selected with the assistance of their Agri-Science teachers. Although this option is available to all students there are some who may select an alternative unit as a replacement. "Agricultural Products" (see Ag Sci IV, Animal Science curriculum) will be available to all students with the exception of those who are enrolled in ECE Horticulture classes.

Suggested Time: One quarter

Ledyard High School Expectations for Student Learning:

- Read and write critically and effectively for a variety of purposes
- Speak clearly and communicate ideas accurately in a variety of settings
- Employ problem-solving skills effectively
- Demonstrate critical thinking skills
- Employ effective research and study skills

Agriculture, Food, and Natural Resources Standards:

CS.01.01.01.c Work independently and in group settings to accomplish a goal
CS.01.01.02.c Assess outcomes to determine success for a task
CS.01.01.03.c Implement an effective project plan
CS.01.01.04.b. Use appropriate and reliable resources to complete an action or project
CS.01.01.05.c. Implement a plan that minimizes physical, financial, and professional risks and analyze results
CS.01.01.07.c. Evaluate actions taken and make appropriate modifications to personal goals
CS.01.03.02.c. Create a plan of action to complete a task based on a conceptualized idea
CS.01.02.02.c. Engage others in conversations to respond to an obstacle when completing a task
CS.01.04.06.c. Analyze one's level of self-discipline and causes for lack of self-discipline
CS.01.06.05.c. Implement a plan to develop new knowledge and skills related to professional and person aspirations.
CS.02.04.01.c Demonstrate critical and creative thinking skills while completing a task
CS.02.04.02.c Implement effective problem solving strategies
CS.03.03.03.c. Respond to feedback to improve a situation, skill or performance
CS.06.02.01.a Use proper safety practices/personal protective equipment
CS.07.04.01.c Apply general workplace safety precautions/procedures.
CS.08.01.01.c Use tools and equipment appropriately to complete a specific task

Common Core State Standards

RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem

WHST. 11-12.1e. Provide a concluding statement or section that follows from or supports the argument presented.

WHST. 11-12.4. Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes

SL.11.-12.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence to add interest.

SL.11-12.6 Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate

Objectives	Required Activities/ Suggested Activities	AFNR Standards/CCSS
Develop a plan for an independent, agriculturally-related project	• With assistance from advisors, identify a suitable topic to meet the established requirements for the senior project • Submit a formal project proposal delineating goals, activities, procedures, and materials • Conduct necessary background research to develop a plan	CS.01.01.04.b. CS.01.03.02.c. CS.02.04.01.c RST.11-12.4 WHST. 11-12.4.
Execute a project plan in order to meet established goals	• Establish clear project objectives • Create a weekly plan for research and work • Identify procedures to effectively complete the project • Create a time-line to complete work • Work safely and efficiently • Conduct research as needed to identify and solve problems • Work safely in a shop / lab situation	CS.01.01.01.c CS.01.01.03.c CS.01.01.04.b. CS.01.01.05.c. CS.01.03.02.c. CS.01.06.05.c. CS.02.04.01.c CS.02.04.02.c CS.06.02.01.a CS.07.04.01.c CS.08.01.01.c RST.11-12.4

		RST.11-12.7 WHST. 11-12.4.
Assess progress and modify plans as needed	• Use journal to record successes and problems • Discuss issues with advisor and peers in order to solve problems • Make adjustments to plan as needed • Conduct research as needed to identify and solve problems	CS.01.01.02.c CS.01.01.04.b. CS.01.01.05.c. CS.01.01.07.c. CS.02.04.01.c CS.02.04.02.c RST.11-12.4 RST.11-12.7 WHST. 11-12.4.
Journal accomplishments, problems, and propose solutions	• Record progress in a journal including weekly assessments of work	CS.01.01.02.c CS.01.01.07.c. CS.02.04.02.c WHST. 11-12.4.
Present a summary of project	• Make a presentation to class of project work • Evaluate work and final project	CS.01.01.02.c CS.01.01.07.c. CS.02.04.01.c WHST. 11-12.1e WHST. 11-12.4. SL.11.-12.4 SL.11-12.5 SL.11-12.6

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Develop a plan for an independent, agriculturally-related project	• Select AFNR standards applicable to project	CS.01.01.01.c
Assess progress and modify plans as needed	• Initiate discussions with advisors and peers in order to identify and solve problems	CS.01.02.02.c CS.01.04.06.c.

ECE Students

Develop a plan for an independent, agriculturally-related project	• Work independently to develop an appropriate topic to meet established criteria	CS.01.01.01.c
Assist students with project tasks	• Provide assistance to other students as needed	CS.02.04.02.c
Assess progress and modify plans as needed	• Reflect in journal and through discussions	CS.01.04.06.c. CS.01.02.02.c CS.03.03.03.c.
Present a summary of project	• Create a presentation for peers utilizing digital media	SL.11-12.5

Italics indicates technology use

Vocabulary:
Vocabulary is dependent upon topic and will be identified by each student

Assessments:
- Weekly plan
- Weekly journal
- Weekly work/participation evaluation
- Completed project
- Presentation

Resources/Materials:
- Resources are dependent on topic and will be identified by each student

Title: Agricultural Products

Unit Overview: This unit will look at the food delivery system. After a quick review of human digestion and food nutrients, the course will look at the production and safe handling of agricultural products from production to consumer. Included will be food borne illnesses, preservation, and handling. Further students will consider the implications of a vegetarian and vegan diet, as well as conventional versus small scale, locally grown agricultural products.

Suggested Time: One Quarter

Ledyard High School Expectations for Student Learning:

- Read and write critically and effectively for a variety of purposes
- Speak clearly and communicate ideas accurately in a variety of settings
- Demonstrate critical thinking skills

Agriculture, Food, and Natural Resources Standards:

ABS.01.01.01.a. Recognize principles of capitalism as related to AFNR businesses.
ABS.05.01.02.a Name and explain the impact of external economic factors on an AFNR Business.
ABS.05.01.04.a Calculate percentages, ratios, and related business applications
CS.02.04.01.c Demonstrate critical and creative thinking skills while completing a task
CS.02.04.02.c Implement effective problem solving strategies
CS.06.02.01.a Use proper safety practices/personal protective equipment
CS.07.04.01.c Apply general workplace safety precautions/procedures.
CS.08.01.01.c Use tools and equipment appropriately to complete a specific task
FPP.01.01.01.b. Evaluate changes and trends in the food products and processing industry.
FPP.01.01.02.b. Discuss the issues of safety and environmental concerns about foods and food processing (e.g., Genetically Modified Organisms, microorganisms, contamination, irradiation).
FPP.01.02.01.b. Evaluate the changes in the food products and processing industry brought about by industry organizations or regulatory agencies.
FPP.02.02.01.b. Outline procedures to eliminate possible contamination hazards associated with food products and processing.
FPP.02.03.01.a. Explain techniques and procedures for the safe handling of food products.
FPP.02.03.03.a. Describe the effects food-borne pathogens have on food products and humans.
FPP.03.01.03.a. Explain the Food Guide Pyramid in relation to essential nutrients for the human diet.
PP.03.01.04.a. Discuss common food constituents (e.g., proteins, carbohydrates, fats, vitamins, minerals).
FPP.03.01.05.b. Describe the purpose of common food additives.
FPP.04.01.01.b. Discuss factors that affect quality and yield grades of food products.
FPP.04.01.03.a. Identify and describe accepted animal treatment and harvesting techniques.

FPP.04.02.01.b. Discuss desirable qualities of processed meat, egg, poultry, fish and dairy products.
FPP.04.03.05.a. Explain materials and methods of food packaging and presentation.
FPP.04.03.06.a. Identify and explain storage conditions to preserve product quality.
FPP.04.03.06.b. Select methods and conditions for storing raw and processed food products
PS.03.05.03.b. Explain the proper conditions to maintain the quality of plants and plant products held in storage

Common Core State Standards:

WHST.11-12.2d Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
WHST 11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience
RST 11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
SL.11.-12.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

MP1 Make sense of problems and persevere in solving them
MP 4 Model with mathematics
MP 6 Attend to precision

Objectives	Required Activities/ Suggested Activities	AFNR Standards/CCSS
Identify and describe the function of the organs of the human digestive tract.	• Label a diagram of the human digestive tract, identifying the organs and giving the function of each.	FPP.03.01.03.a. SL.11.-12.4
Outline the role each of the six food nutrients provide in the human diet.	• Name the six food nutrients and explain what they provide for normal human health and physiology.	FPP.03.01.04.a.
Outline the guidelines for safe handling of food and raw materials.	• Summarize the Ledge Light Health District guidelines for safe handling of food.	ABS.05.01.02.a FPP.02.02.01.b. FPP.02.03.01.a FPP.02.03.03.a. FPP.04.01.01.b FPP.04.01.03.a FPP.04.02.01.b. RST 11-12.4

Identify food spoilage and differences in food poisoning (contrast food borne infection and intoxication).	• Categorize food borne pathogens as causing food infection or food intoxication.	FPP.02.03.03.a PS.03.05.03.b.
List common food additives and how they enhance foods.	• Create a chart of food additives and how they alter foods.	FPP.03.01.05.b
Apply methods of food preservation (i.e. - freezing, drying, fermenting, pickling, etc.)	• Make butter • Make yogurt • Make ice cream • Make mozzarella • Dehydrate fruit • Make (dried meat) jerky • Make pickles	ABS.05.01.04.a CS.02.04.01.c CS.02.04.02.c CS.06.02.01.a CS.07.04.01.c CS.08.01.01.c FPP.04.03.05.a FPP.04.03.06.a. FPP.04.03.06.b.
Recognize principles of capitalism as relates to food and food distribution.	• Create a flow chart of various foods and their path from farm to consumer. • Compare specific diets (vegetarian, vegan, etc.)	ABS.01.01.01.a. FPP.01.01.01.b. FPP.01.02.01.b

Level 1

Objectives	Required Activities/ Suggested Activities	AFNR Standards/CCSS
Apply methods of food preservation (i.e. - freezing, drying, fermenting, pickling, etc.)	• Compare and contrast various preservation methods on raw foods	ABS.05.01.04.a CS.02.04.01.c CS.02.04.02.c CS.06.02.01.a CS.07.04.01.c CS.08.01.01.c FPP.04.03.05.a FPP.04.03.06.a. FPP.04.03.06.b.
Analyze the feasibility of personal independence and sustainability with regard to food in New England.	• Outline an annual, month by month schedule of home grown and produced food. • Compare availability of New England produced foods to that of foods for sale from other parts of the U. S. and other countries	ABS.05.01.04.a CS.02.04.01.c CS.02.04.02.c CS.06.02.01.a CS.07.04.01.c CS.08.01.01.c

		FPP.04.03.05.a FPP.04.03.06.a. FPP.04.03.06.b. WHST.11-12.2d RST 11-12.4 SL.11.-12.4
Discuss the issues of safety and environmental concerns about foods and food processing (e.g., Genetically Modified Organisms, microorganisms, contamination, and irradiation).	• Prepare and give a Power Point presentation on a safety or environmental issue in the food delivery system.	FPP.01.01.02.b.

Italics indicates technology use

Assessed Vocabulary:

Absorption	Digestion	Homogenization	*Staphylococcus aureus*
C. botulinum	*Escherichia coli*	Metabolism	Sterilization
Casein	Food infection	Myoglobin	Value-added
Clostridium perfringens	Food Intoxication	Pasteurization	
Colloid	Food Nutrient	*Salmonella*	

Assessments:

- Lab activities
- Class assignments
- Tests
- Quizzes
- Guest presentation/field trip reflections

Resources/Materials:

- Introduction to Food Science, Rick Parker, Delmar, 2003.
- Food Science and Safety, George J. Seperich, Interstate, 1998.
- Ledge Light Health District Guide for Food Handling.