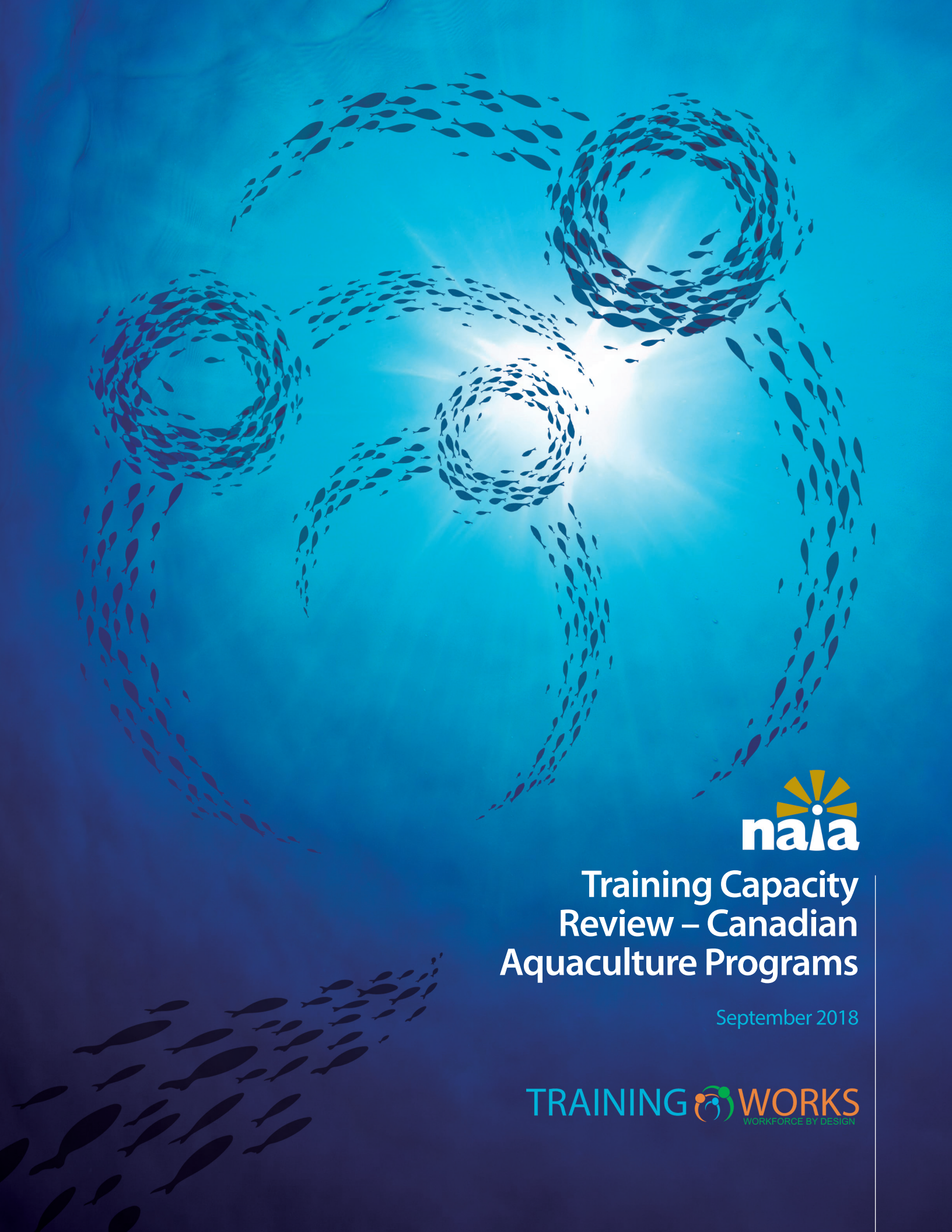

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Training Capacity Review – Canadian Aquaculture Programs

September 2018

TRAINING WORKS
WORKFORCE BY DESIGN

TABLE OF CONTENTS

INTRODUCTION

The Newfoundland and Labrador Aquaculture Association (NAIA) has a goal to grow salmon production to 50,000 metric tonnes and mussel production to 10,750 metric tonnes annually[1]. In achieving these targets, the number of year-round jobs supported by aquaculture will more than double, from 1000 to 2100[2]. Education and training are the driving forces to develop and maintain any skilled workforce required to achieve the increased production targets and meet the global challenge of providing increased sustainable food to the growing population. Diverse and adaptable educational opportunities are critical for the success and expansion of aquaculture locally and globally. Quality training linked to real-world experiences creates the core skills, knowledge and abilities essential for long-term sustainable development.

With an aging workforce, limited access to a skilled workforce in rural areas, and rapid technological advances, the Newfoundland and Labrador aquaculture industry is challenged to find ways to significantly increase its training capacity to meet the training demands at all levels of organizations. This paper summarizes key findings from a training capacity review conducted by Training Works, on behalf of NAIA, to document aquaculture-related instruction, teaching, and training within Newfoundland and Labrador and Canada. It represents an essential step toward assessing current status, future trends, and critical issues related to aquaculture workforce readiness to support long-term sustainable development of the industry.

METHODOLOGY

The concept for the project was initiated by the Newfoundland and Labrador Aquaculture Association. The Board of Directors of NAIA served as the project steering committee and had representatives from government, industry and two representatives from the provincial post-secondary trainer in aquaculture in Newfoundland and Labrador (Marine Institute of Memorial University of Newfoundland). The steering committee, led by Mark Lane (Executive Director of NAIA), provided feedback on the development of the Training Capacity Review questionnaire and interview guide and was consulted around specific areas of inquiry for the project.

The terms 'training' and 'capacity development' are sometimes used interchangeably but for this document they must be more clearly defined. "Training" is just one element of capacity development and usually focuses on providing skills for specific roles or challenges. "Capacity development" encompasses a whole range of activities designed to facilitate enhanced program delivery and the learning of the individuals engaged. The purpose of the Training Capacity Review is driven by the need to bring about a culture change, link partners together and effectively support training and career development in aquaculture. It is required to grow Newfoundland and Labrador's capacity to attract and retain people in the industry and create sustainable career pathways that will see the full utilization of the talent of the individuals engaged.

[1] http://www.flr.gov.nl.ca/aquaculturesummit/

[2] Ibid

The project included the following activities:

- A survey of aquaculture employees, including senior level managers was conducted to capture the current state of skills and training within the aquaculture industry (129 completed);
- Completion of telephone and face to face interviews with provincial, national and international aquaculture post secondary training providers to identify training best practices and trends and opportunities for training capacity development (19 completed – 13 Canadian (8 different institutions), 3 European (3 institutions) and 3 American (3 institutions));
- Post Secondary Student Discovery Sessions (2) (16 students surveyed);
- Completion of telephone and face to face interviews, with key stakeholders in the aquaculture industry (growers, processors, provincial and national aquaculture associations, local and national politicians, aquaculture suppliers, etc.) to determine potential skills gaps and development opportunities; and
- Site visits (hatchery, farms (salmon), processing plants).

Additionally, a preliminary document review was completed to provide additional background knowledge on applicable training and training trends in the aquaculture industry provincially, nationally and internationally. This review identified issues or challenges faced by the aquaculture industry in Newfoundland and Labrador, and the industry at large. It was acknowledged that many of NAIA's members operate transnationally with emerging global standards for training and skills development. Furthermore, perspectives on skills and training structures by current workers and aquaculture grads were assessed to determine whether these individuals felt they had the right skills for the job, needed additional training, and whether occupations in aquaculture met the expectations they had while going through formal training. Likewise, questions for employers around their perception of the adequacy of skills of recent graduates and the current workforce, including skills gaps and recommendations for further skills development, were included in the interviews with employers.

The design of both the survey and the key informant interviews revolved around the strategic objectives of:

- Determining what skills development and training are required for human resource development within the aquaculture industry;
- Providing a comprehensive description and listing of all current training programs available in Canada;
- Assessing whether the current training available meets industry needs; and
- Identifying any capacity gaps that needed to be filled.

For efficient organization of information and to maximize the ability to create targeted action items that would encompass the entire aquaculture learning system, the following types of programs were reviewed:

Classroom Based Training -Post- Secondary – This type of training would qualify an individual to support aquatic food production for marine, freshwater and land-based systems. It would focus on production techniques to produce a broad range of aquaculture foods.

Classroom Based Training -Post-Secondary – Advanced Level - This program would provide an individual with the education and technical skills required to participate in and support high-level aquaculture development.

On-the-job Training – Many workers within the aquaculture industry in Newfoundland and Labrador have not participated in formalized training outside the required mandatory safety training courses. To this end, we conducted a scan of the informal learning systems within various organizations and interviewed employees and employers to identify these learning trends within their workplaces. Within many industries, there is a shift towards workplace- based learning to train employees. Workplace-based training can serve as a standalone system but is more often utilized by various industries to support and enhance formalized learning systems. Within this document we explored the opportunity for this blended learning approach, that will fully utilize inherent organizational knowledge within the aquaculture industry in Newfoundland and Labrador.

Continuous/Further/ Short Training - This is additional training an individual would receive/undertake while doing his/her job in order to improve their qualifications for present or future work. Areas explored under further training included: Refresher course: These are aimed at refreshing the memory and to remedy deficiencies identified in the workplace. Short Courses: These are carried out at irregular intervals when further training on a specific topic becomes necessary for successful fisheries/aquaculture activity within an organization (e.g. fish disease control or water quality management). Self- Directed Learning – Independent learning conducted by those involved in the aquaculture industry out of interest or necessity to increase their knowledge or upskill.

Training Works endeavored to ensure that students and trainers from each of the various training categories were represented in the key informant interviews, surveys and focus groups.

A challenge of note was defining an aquaculture program, course or degree. Often, in Canada, there was no "aquaculture" department or specific degree program, but rather many course topics that support aquaculture education or training. Some institutions offered a concentration in aquaculture-specific or supporting courses; these programs were not included in the final analysis but rather the programs that offered a diploma, certificate or degree related to aquaculture were focused upon.

The subsequent report contained within this document contains an analysis of both the current and future training capacity needs in the aquaculture industry, the key players and the activity required to support not only training capacity but a comprehensive learning ecosystem for the aquaculture industry within Newfoundland and Labrador. To this end, the report examines the unique opportunities that each stakeholder can contribute in building training capacity. The stakeholders include: post-secondary trainers, industry associations, employers and the individual learner themselves.

THE IMPORTANCE OF CREATING AN AQUACULTURE LEARNING ECOSYSTEM

Traditionally, learning and training took place in a classroom, being directed by teachers and/or experts who shared their knowledge but, over time this has changed, and learning has evolved and is continuing to evolve at a rapid pace. Today, learning occurs everywhere, in the workplace, on-line, in the classroom, from peer networks, etc. and it is becoming increasingly critical that individuals become lifelong learners. What is also critically important is the creation of the knowledge infrastructure required to support an individual's life long learning. Non-traditional partnerships between post-secondary and private trainers, suppliers, employers and industry will be required. The primary role of stakeholders will be to work together to help people continuously learn, equipping the individual with the tools and technology they need, empowering them to work together, constantly collaborating, openly communicating, and figuring out what they need to know, and how to do it quickly and effectively.

This presents a unique opportunity for Newfoundland and Labrador's aquaculture industry to be trailblazers in establishing a fully linked and integrated skills and learning ecosystem.

DEMOGRAPHIC PROFILE OF SURVEY RESPONDANTS (EXCLUDING KEY INFORMANT INTERVIEWEES)

The Aquaculture Survey respondents were asked to report on selected demographic questions/items, including their age, gender, educational level, years in the aquaculture workforce and years to retirement. The following section provides an overview of the survey respondents' characteristics for the 2018 Aquaculture Training Capacity review.

Age

Approximately nine percent (9%) of respondents were between the age of 18 and 35 years of age; thirty-two percent (32%) were between the age of 35-49; and fifty-nine percent (59%) of respondents were 50 and above.

Gender

Approximately fifty-eight percent (58%) of survey respondents were male and forty-two percent (42%) were female.

Education Level

Approximately twenty-six percent (26%) of respondents had less than high school; thirty-three percent (33%) had high school or an equivalency; six percent (6%) had some trades school or technical training; nineteen percent (19%) of respondents were trade or technical school graduates; nine percent (9 %) had a university degree; and seven percent (7%) of respondents preferred not to identify their educational level.

Years to Retirement

Nineteen percent (19%) of respondents plan to retire in 1-4 years; twenty-three percent (23%) within the next 10 years; twenty-eight percent (28%) in 10 + years; and twenty percent (20%) of respondents were unsure as to when retirement would occur.

SUMMARY OF KEY FINDINGS

A. Current training capacity of universities and colleges includes: short courses (1 week – 6 months); 1 and 2 year technical certificates/diploma programs; 4 year undergraduate degrees; 1 year graduate certificates and advanced diploma programs; and 2 year master's programs;
B. One hundred percent (100%) of employers surveyed stated they provided some job-related training by: supporting on-the-job training (e.g., job shadowing, mentoring, etc.); allowing time off work to attend training; and/or supporting in-house formal training (i.e., provided within their company);
C. Eighty percent (80%) of employers feel they provide sufficient training to meet current employee needs;
D. Overall, employers determine the types and amount of employee related training based on employee need or performance; specific regulations; and job requirement;
E. Ninety-one percent (91%) of employees feel they have the skills required to perform their position;
F. Only thirty-five percent (35%) of respondents felt a college or university degree was valuable to their position;
G. Over sixty percent (60%) of current aquaculture workers feel they learned most of their skills "on the job";
H. One hundred percent (100 %) of the post secondary trainers interviewed indicated learning is changing and, in the future, more training will be completed on-line;
I. One hundred percent (100 %) of post secondary students interviewed indicated they undertake self-directed learning around the industry daily; and
J. The biggest challenged cited by both employers and trainers was keeping pace with the change of technology.

LEARNING STYLE ASSESSMENT

As a supplement to the original deliverables, Training Works integrated an assessment of "learning style" into this project. The purpose of the assessment was to identify the various general learning styles of the individuals engaged in the aquaculture industry. This information helped construct applicable and effective recommendations for training delivery within the industry.

To inform this assessment, the questionnaire's included a series of questions around an individual's past learning experiences. These questions were also asked during the discovery sessions, key informant interviews and site visit interviews. The focus of these queries were: Types of learning deliveries the individual had experienced; Programs they found most effective; and Pros and cons, in their opinion, of the various delivery methods.

The methods of learning discussed were:

Classroom Training with Instructor

E-learning (self-paced)

On the job training (OJT)

Results

The results indicate that one hundred percent (100%) of respondents currently engaged as employees in the aquaculture industry have experience with OJT. Classroom training with an instructor is the second most experienced method, with e-learning (self-paced) being the least experienced.

There were some significant differences by employee group in reference to experience with different methods. Managers, technical staff and those employed in professional occupations have more e-learning and "classroom with an instructor" experience than front line production workers. However, the front-line aquaculture production workers have extensive experience with OJT and are very familiar with being coached or coaching others.

Generally, the front- line workers preferred OJT as their training system of choice however, they were not averse to exploring both classroom based and online training. These results are not surprising given the nature of the environment and the educational backgrounds of the employees (53% having completed high school or less). Most of the front-line production workers observed during site visits received practical training that enables them to operate within their position. In the majority of cases, training has been carried out by in-house staff (e.g. supervisors' training new employees, peer on peer mentoring), coupled with the mandatory safety training required.

The training by in-house personnel seems to have been effective, but in the absence of standardized procedures for workplace-based knowledge transfer, it could be deduced there are inconsistencies in the instruction that different individuals deliver and therefore variance in the implementation of skills by the employees being trained.

Classroom training is the most traditional form of learning and closely resembles the educational model that most aquaculture employees experienced in the K-12 system and most post-secondary programs. Given the age demographic and educational level of the aquaculture workforce, many have very little experience with e- learning so any training delivered via this means will require a well applied change management process which should include an orientation to computers and online learning. The change management process is an approach that prepares and supports organizations in making organizational change.

Professional level employees indicated their experience with classroom-based learning, OJT and e-learning (self-paced). These groups also undertook a lot of independent study to expand their knowledge around new technologies and processes that would enhance their performance within their positions and allow them to generate solutions to certain operational challenges.

The aquaculture students interviewed were the most flexible in their approach to learning and training. One hundred percent (100%) had experience with all the modes of learning. In addition, they expressed that ongoing skills development would be an important part of their future careers. They believed that ongoing learning would be necessary to keep pace with change and indicated much of this learning would be undertaken digitally.

Sixty percent (60%) of all the stakeholder groups engaged indicated they undertook self- directed learning around the industry via: websites, newswires, webinars, search engines, YouTube, conferences, etc.

POST-SECONDARY TRAINING CAPACITY

The prosperity of the Aquaculture industry in Newfoundland and Labrador is dependent on its ability to produce a workforce with the skills industry needs. To help understand how post-secondary trainers are meeting these needs, both provincially and nationally, this section examines the findings of:

- Extensive secondary research around post-secondary training capacity for aquaculture programs;
- A comprehensive aquaculture program scan provincially and nationally (Appendix A); and
- Nineteen(19) telephone and face to face interviews with provincial, national and international aquaculture post-secondary training providers to identify training best practices and trends and opportunities for training capacity development.

Key Findings

As aquaculture becomes more science and technology-focused and information-rich, education and training will become more specialized with new research tools and instrumentation to support a more intensified, diverse and sophisticated sector. One hundred percent (100%) of post-secondary trainers interviewed indicated the biggest challenge for them will be designing programs that are able to keep pace with technological advancements. Additionally, they felt that stricter environmental regulations will stimulate new systems and development directions that will mold training moving forward.

Many interviewees representing the post-secondary training institutions indicated they thought real-world, campus-based higher education will continue to thrive for the next 5-10 years. They agreed a university education helps build intangible skills that are not replicable online and thus deepens the skills base of the student. However, over eighty percent (80%) of those interviewed expect that job-specific training will increase and will be managed by employers on the job and over seventy five percent (75%) of post- secondary trainers surveyed believe there will be an increase in online course content in the next five years. This was seen as an opportunity for increased enrollments.

Additionally:

A. Approximately ninety percent (90%) of Canadian post secondary trainers interviewed determine course offerings and the number of seats through participation on industry committees, research/data from government and industry sources, or continuous industry dialogue;
B. Enrollment in eighty percent (80%) of the programs reviewed nationally has remained steady for the past five years (2013-2017) (please note, this number is anecdotal as enrollment numbers were not provided by most of the institutions. These numbers were based on instructor observation);
C. Enrollment in twenty percent (20%) of the programs reviewed nationally experienced a decline;
D. Two programs are no longer offered due to low enrollments - M.Sc. Aquaculture Program, University of Guelph, Ontario; and the Aquaculture Technician at New Brunswick Community College, St. Andrews Campus;
E. One aquaculture program is currently being revamped to better meet industry needs and is scheduled to be delivered in 2019 - Aquaculture Technician 1 at North Island College, B.C.;
F. When asked to predict the level of enrolment for the coming 5 years (2019-24), most post-secondary trainers provincially, nationally and internationally predicted growth;
G. One hundred percent (100%) of post-secondary trainers have seen an increase in international student enrollment over the past 10 years;
H. The majority of post-secondary trainers indicated if training capacity in their aquaculture program(s) was expanded, the seats would be filled;
I. Respondents were asked how easy or difficult it would be for their organization to increase the number of seats in their aquaculture related courses and programs. Responses varied but generally the degree of difficulty for program expansion, directly correlated with funding availability;
J. Ninety percent (90%) of post secondary trainers indicated they feel their online presence will grow over the next five years; and
K. There are very limited online learning opportunities associated with aquaculture programs within Canada.

Based on the findings, the post-secondary trainers interviewed feel their content is keeping pace with industry needs (except for one post-secondary training provider that feels more industry feedback and workplace-based experience for students is required). This sentiment was echoed by Newfoundland and Labrador aquaculture employers who feel the training programs offered provincially, are currently meeting industry needs. Student satisfaction specific to the graduate diploma in aquaculture management at Memorial University of Newfoundland, is very high. Over eighty-five percent (85%) of students interviewed in the graduate diploma in aquaculture indicated they understood they would not enter the aquaculture workforce at the management level, that more hands-on training would be required, but they would ascend to management levels much quicker because of the program.

Despite employer's high degree of satisfaction with the current aquaculture post-secondary training environment in the province, employers acknowledged, the launch of one large scale aquaculture project would place extreme pressure on the available labour pool. Despite the growing aquaculture marketplace, and the continued demand for semi-skilled and skilled labour provincially and nationally, anecdotally, enrollments provincially and nationally seem to have demonstrated little variability over the past five years (2011-2016).

To this end, the future requirements for post-secondary training began to emerge from the responses received:

- The post-secondary training system must be able meet the labour market demand and increase training capacity quickly to meet these demands;
- Training programs should target various skill levels (entry-level, mid-level, management level) and have pathways for workforce entrance at these various levels; and
- The learning environment, and learner's preferences, are changing. Creating a system of learning that is flexible and accessible will become increasingly important.

OPPORTUNITIES FOR DEVELOPMENT – POST-SECONDARY TRAINERS

Priority Action Items

1. Create, Pilot and Evaluate a Robust Educational Training Program that Enhances Student Work Experience

Two of the main ways students gain work experience are through apprenticeships and co-op placements. Both apprenticeships and co-ops provide industry experience through work placements but may differ in the timing, duration, supervision, or other factors. Apprenticeship programs typically require logging a certain number of hours to progress through a program and require oversight from a journeyperson (i.e., expert in the field) to ensure skill-level is to a specific standard. Aquaculture apprenticeship programs are available in other jurisdictions, such as the UK and there are several aquaculture programs throughout Europe.

The power of apprenticeship programs in narrowing the skills gap/mismatch by creating custom skilled workers has long been demonstrated in northern Europe, where this centuries-old form of learning remains strong and enjoys both business and societal support. Throughout the European Union (EU) and the United Kingdom (UK) there has been intensive activity developing new strategies to create and improve apprenticeship training systems. Within the last two years, the UK has added just over 1 million new apprenticeships[3]. Likewise, North America has a renewed interest in the apprenticeship system for meeting the training needs of industry with the United States introducing 125,000 new apprenticeships between 2014-2016, with more to follow[4].

Within the UK, aquaculture apprenticeship programming provides a practical, 'on-the-job' training and skills development opportunity for people entering or progressing through the industry, leading to nationally recognised qualifications. This apprenticeship is available at three levels, providing a progression route and career-development path from first-entry to the aquaculture industry to senior management positions[5]. While it is normal to progress through the levels, an individual may enter directly at a higher level if they have relevant experience and/or previous qualifications. Most training and assessment is workplace-based, with some classroom-based study, with the higher qualification making extensive use of self-study via online distance-learning. The Scottish Vocational Qualification (SVQ) level 4 in Aquaculture Management on the Scottish Credit and Qualifications Framework level 9, is the newest addition to the aquaculture apprenticeships[6]. This program allows candidates to demonstrate competence in job-related skills in their particular area of work and expertise including: managing the aquatic production environment for farmed fish/shellfish and managing the production of farmed fish/shellfish for sale or transfer; planning and managing of shellfish depuration operations, implementation of the site fish health plan, fish/shellfish hatchery production, and a variety of operational and managerial units. Though this qualification is specific to the UK, during interviews with the UK based post-secondary trainers, they indicated there had been an overwhelming interest in this apprenticeship level internationally. They are beginning to explore creating an international apprenticeship in aquaculture management. Though the aquaculture environment within the UK has differences (legislative, credentialing, funding, etc.) from the Newfoundland and Labrador provincial landscape, these barriers could be remediated with a well-designed training development process initiated by a post-secondary institution that engages heavily with employees, employers, industry and the aquaculture supply chain at the forefront.

[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/482754/BIS-15-604-english-apprenticeships-our-2020-vision.pdf

[4] https://obamawhitehouse.archives.gov/blog/2016/10/21/apprenticeshipusa-upskilling-america

[5] https://www.skillsdevelopmentscotland.co.uk/media/41481/agriculture-level-3.pdf

[6] https://www.sqa.org.uk/sqa/76765.html

Predicted benefits of creating enhanced work experience in aquaculture programs:

- CO-OP/Apprenticeship - Enhanced hands on work experience which has been identified as critical to the success of skill acquirement within the aquaculture industry;
- CO-OP/Apprenticeship - Opportunities to gain relevant employment skills and realistic expectations of the work force before graduation;
- CO-OP/Apprenticeship - Documented practical experience, a resumé, job search skills and a network of contacts upon graduation;
- Apprenticeship - Increased training flexibility for students, with on and off ramps that allow for career progression that is aligned with workforce need; and
- Apprenticeship - Quicker workforce entrance of students that would allow for a more rapid response to fluctuating workforce requirements associated with aquaculture industry growth within the province.

A best practice that emerged during the review of aquaculture apprenticeship programs internationally, was the success of these programs were heavily influenced by ensuring there was alignment between the apprenticeship program and government funding support. The development of any new aquaculture apprenticeship program should involve full coordination with the government of Newfoundland and Labrador to ensure funding opportunities for both apprenticeship students and the supporting employers are included in the overall design of the program.

2. Create More On-Line Learning Aquaculture Options - Post-Secondary Aquaculture Training Must Continue to Evolve, and Begin a Larger Scale Migration to On-Line Learning

Online course enrolments constituted approximately sixteen percent (16%) of all course enrolments in Canadian universities in 2015, and twelve percent (12%) in colleges outside Québec[7]. Online courses can be found in every subject area, with online courses in business, education and health (including nursing) being the most frequently offered. Fully online programs are offered in most subject areas in all types of public post-secondary institutions in Canada with some face-to-face teaching being replaced by online study.

The aquaculture programs examined provincially and nationally remain primarily class-room based with work related placement. In comparison to other programs, aquaculture training programs are not keeping pace with creating options for online learning in Canada. The major benefit of online learning perceived by respondents was that it results in greater access and more flexibility for students, although almost all of the post-secondary trainers interviewed saw it as a way to increase enrollments and therefore was very or extremely important for their institutions future.

Predicted benefits and workforce outcomes of recommendation:

- Increased flexibility in learning;
- Increased enrollments in aquaculture programs; and
- Larger uptake of continuous learning.

[7] file:///C:/Users/Owner/AppData/Local/Packages/Microsoft·MicrosoftEdge_[8]wekyb[3]d[8]bbwe/TempState/Downlo ads/technicalreport_[2017-10-10].pdf

3. Big Data Means Big Opportunity - The Need for Better Aquaculture Educational Data

Throughout the duration of this project, accessing data on student enrollment in aquaculture training programs was a challenge. Very few of the post-secondary trainers engaged made this information publicly available on their website. Aggregate data on enrollment was found in annual reports and enrollment strategies but it was impossible to discern aquaculture specific data from these resources. Anecdotally, the post-secondary trainers interviewed knew whether enrollment had gone up or down, but this information was not publicly available or easily accessible. Specific numbers, especially historical data, had to be searched out and compiled, with much of the requested data never being received.

Examining the internal data management processes and predictive analytics and modelling of post-secondary institutions falls outside the scope of this review but as a general observation, having more easily accessible public information on enrollment and success rates for potential students would be of great benefit to the recruitment and retention efforts of the aquaculture industry. From a student's perspective, big data and predictive analytics for workforce attachment and success can be used to create a shortlist of industries and colleges that best fit the applicant's profile.

OPPORTUNITIES FOR DEVELOPMENT - EMPLOYERS – STRUCTERED ON THE JOB TRAINING

Background

Strengthening the entire aquaculture learning continuum is critical in achieving the targets set forth for the industry within Newfoundland and Labrador. The transfer of skill can be achieved through conventional training, however, creating a comprehensive skills training structure that utilizes various means for skills transfer is required to close the skills divide. To this end, this project examined the existing reality of workplace-based training, including OJT and leadership development programs and the requirements needed for the future.

Key Findings

A. One hundred percent (100%) of employers interviewed stated they have unstructured job-related training (e.g. job shadowing, mentoring, etc.);
B. Thirty percent (30%) of employers interviewed indicated they have certain components of their OJT that is structured and standardized and is monitored and measured on an ongoing basis;
C. Twenty percent (20%) of employers interviewed indicated they have formalized internal leadership development programs (that includes training) to develop high performers within their organization;
D. Over ninety percent (90%) of employees surveyed believed they had the skills required for their position. However, fifty percent (50%) of those surveyed indicated they had a high level of interest in receiving additional training for their position;
E. Eighty-seven percent (87%) of employees feel their position makes good use of their skills; and
F. Sixty percent (60 %) of employees interviewed indicated they had learned their skills via OJT.

CREATING STRUCTURED ON THE JOB TRAINING (SOJT)

On-the-job training (OJT) involves teaching skills, knowledge, and competencies needed for employees to perform a specific job within the workplace and work environment. OJT can utilize a variety of means, uses regular workplace documents, equipment, knowledge, and skills necessary for an employee to learn to effectively perform his or her job. Oftentimes, OJT occurs via job-shadowing or coaching. Based on our observations and feedback from employers, and employees, the aquaculture industry within Newfoundland and Labrador relies heavily on OJT for transfer of skills and knowledge. However, most of the OJT being utilized is informal and unstructured. Unstructured or informal OJT, though very valuable, also has drawbacks:

- OJT can be disruptive to an organization's production;
- Meeting production needs can also be a distraction to the training function, especially if meeting work needs receives higher priority;
- There can also be more production waste involved when OJT is utilized[8].;
- Although supervisors should be and sometimes are the trainers, their workloads and responsibilities mean the responsibility of training a new employee is often given to incumbent, less experienced employees; and
- In most organizations, neither supervisors nor incumbent employees have been trained to be a trainer.

All these factors can impact the efficiency of the transfer of skills to the new employee. Historically if OJT was not effective, the skills could simply be taught over and over and through time, the employee would pick up the skill but in today's agile aquaculture operations, worker accuracy, consistency and flexibility are more important than ever. Couple this with the rapid rate of changing technology and the lack of skill can have catastrophic impacts on the organizations bottom line. Learning is less effective, and transfer of knowledge is only temporary when trainees just learn by watching another worker or through informal instruction. With structured on the job training (SOJT), the training becomes purposeful, intentional, and permanent. SOJT can also be linked to the use of standardized work practices in which the outcome of work is highly specified.

The implementation of SOJT will also help facilitate aquaculture companies in achieving the workplace-based standards and processes necessary to achieve industry certifications (BAP, MSC, ASC, LEAN, etc.). As the aquaculture industry continues to develop, these certifications will become increasingly important and will yield increasing economic returns. A standardized work system that consists of well-written procedures, work instruction packages and job-aids provide a road map for consistent, sustained knowledge creation and learning.

[8] file:///C:/Users/Owner/AppData/Local/Packages/Microsoft.MicrosoftEdge_8wekyb3d8bbwe/TempState/Downloads/CLUSKEYMARY1992.pdf

Priority Action Item

1. Create an Industry Steering Committee to develop a SOJT Model that Would Result in Consistent Methods for Conducting OJT Within the Newfoundland and Labrador Aquaculture Industry

The mandate of this committee would be to establish a model for SOJT in the aquaculture industry within Newfoundland and Labrador and to create a standard set of Standard Operating Systems (SOPs') for priority aquaculture positions. Once complete, a series of SOJT activities/training be undertaken in a small sampling of operations. The SOJT activities/training should be evaluated both quantitatively and qualitatively. This pilot and the subsequent knowledge and results from it, would be shared with other companies in the Newfoundland and Labrador aquaculture industry.

OPPORTUNITIES FOR DEVELOPMENT - NEWFOUNDLAND AND LABRADOR AQUACULTURE INDUSTRY ASSOCIATION

Background

In an era where people can instantly access vast amounts of information on mobile devices, or gather together in real-time virtual spaces, industry associations have a role to play in educating key stakeholders within their industry. Not unlike post-secondary educators, industry associations have an opportunity to redefine their role in education and continue to evolve, to grow and to offer a vast array of stakeholders a more creative approach to learning. Digital learning is a crucial part of fulfilling this vision. An industry association can now play a critical role in supporting the self-directed learning of students, employees, employers, training institutions, government, etc. The more information the stakeholders have around the aquaculture industry, the more successful the expansion of the industry will be.

Within the aquaculture industry in Newfoundland and Labrador there is a diverse range of stakeholders who want to learn about the industry:

- K- 12 students, who want to learn about aquaculture with an eye as to whether they would want to pursue a profession within the industry;
- Employers, who are always trying to keep abreast of the newest processes, or emerging technologies;
- Government officials who want to see the trends, data, and activities so they are better able to inform policy;
- Supply chain companies or potential investors who want to see the opportunities for business development;
- The general public who want to better understand the benefits and concerns of the industry; and the list goes on.

What is common to all however, is their desire to learn about the sector. The question then becomes whether there is benefit in coordinating and curating information around the aquaculture industry and housing it in one portal.

To set about answering this question, a series of ten (10) telephone interviews were conducted with industry association's in North America. Five (5) of these associations were non-aquaculture (construction, manufacturing, hospitality, mining and transportation) and five (5) were aquaculture associations.

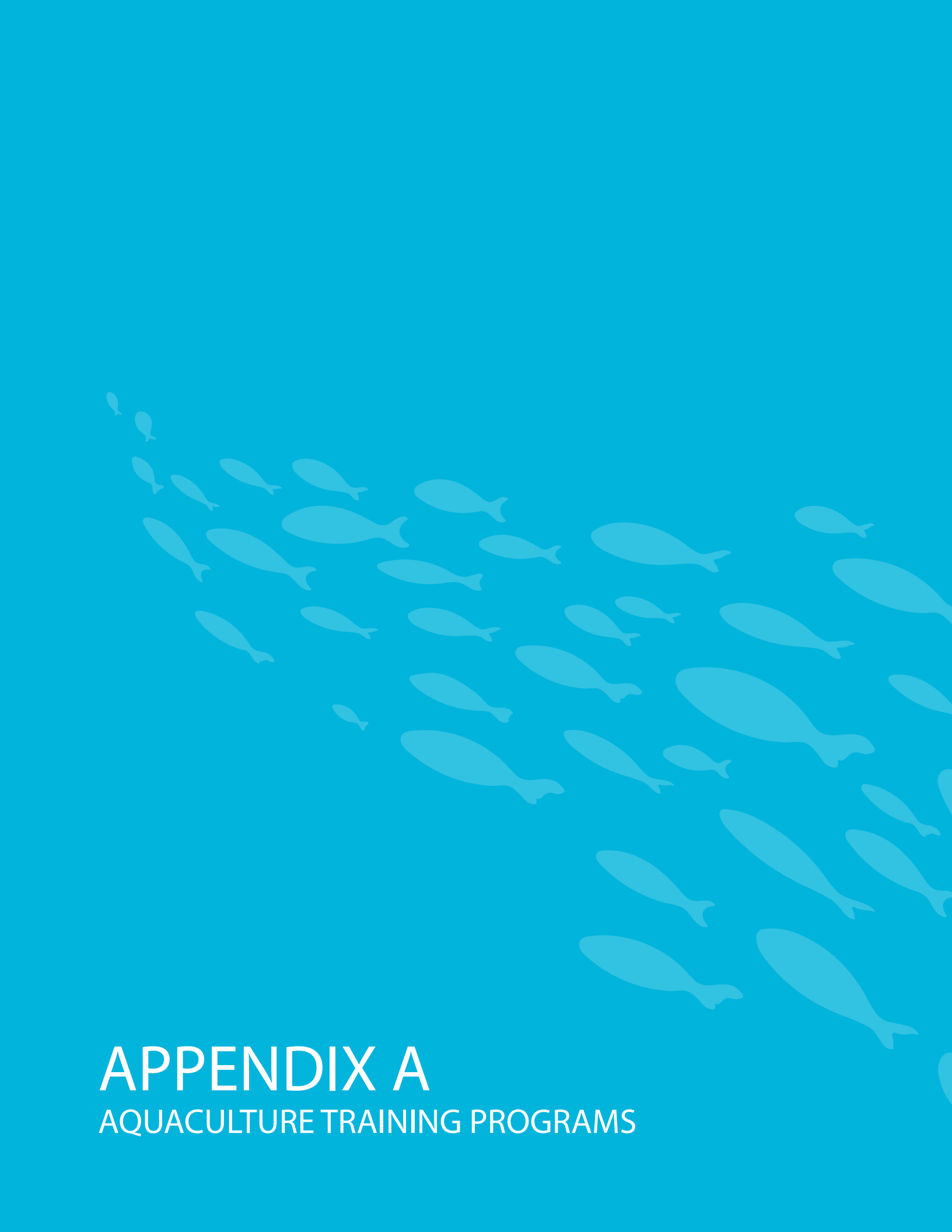
- One hundred percent (100%) of the associations interviewed had websites and a presence on social media;
- Eighty percent (80%) of the non-aquaculture industry associations have undertaken or are undertaking the development of a targeted learning strategy and are offering various levels of learning opportunities to their membership. This learning is also being targeted to the strategic directions of the organizations; and
- None of the five (5) aquaculture industry associations have begun development of a similar learning strategy for their industry, despite awareness and lack of education about their sector being identified as one of the biggest challenges.

Priority Action Item:

1. Create an Industry Learning Strategy for the Newfoundland and Labrador Aquaculture Industry.

   This strategy would identify key stakeholders (public, high school students, teachers, employers, employees, university/college students, post-secondary trainers, etc.) and the strategic learning targets for each group. It would also identify the structural requirements to support this strategy. A potential opportunity would be to create an industry level Learning Management System (LMS) with various access points. The individual interfacing with this system could select their stakeholder group (high school student, employer, employees, public, etc.) and could either self-direct their learning within the system or the LMS could populate a continuum of learning for them based on their stakeholder group. It could include micro-videos, articles, webinars, links to free on-line learning opportunities, etc.

Effective digital curation of existing material on the aquaculture industry provincially, nationally and internationally would easily allow the creation of learning dashboards for a diverse group of stakeholders. This structured approach to learning at the industry level, would support awareness of the aquaculture sector and in doing so, would not only help with recruitment and retention, but would support the targeted growth of the industry.



APPENDIX A
AQUACULTURE TRAINING PROGRAMS

Program Name:
Technical Certificate in Aquaculture (Salmonid or Mussel)

Program Location:
Marine Institute of Memorial University of Newfoundland, St. John's, NL

Years Running: 11 years

Length of Program: 12 weeks with a minimum of a 20-day work term

Program Overview: The Technical Certificate in Aquaculture (Salmonid or Mussel) is designed to enhance the skills of the existing workforce and train new workers for entry into the salmon and mussel sector.

For entry into this program, applicants must possess the equivalent of a Grade 9 education or be eligible for entry under mature student status. The method of instruction and course delivery is a combination of practical and theory utilizing classrooms for community-based instruction and access to local farm sites for some practical components.

The core courses under the Salmond program include:

- Marine Basic First Aid
- Salmonid Biology and Husbandry
- Salmonid Feeds and Feeding
- Salmonid Health and Biosecurity
- Same Vessel Operator Proficiency
- Aquaculture Work Experience (25 days)

Students choose 1 elective from the following safety courses:

- Marine Emergency Duties for Small Vessels
- Restricted Operator's Certificate – Maritime Commercial
- Basic Farm Safety
- Oil Spill Response Awareness

Students then choose six courses from the following electives:

- Basic Farm Safety
- Marine Emergency Duties (MED A3)
- Oil Spill Response Awareness
- Restricted Operator's Certificate – Maritime Commercial
- Ropework
- Salmonid Cage Maintenance
- Salmonid Harvesting, Handling, and Processing
- Salmonid Hatchery and Recirculation Technology
- Salmonid Site Maintenance

- Small Diesel Repair and Maintenance
- Basic Mathematics for Aquaculture Workers
- Outboard Motor Maintenance
- Basic Boat Skills
- Vessel Maintenance
- Farm-Based Quality Certification
- Marine Hydraulics

The core courses under the Mussel program include:

- Marine Basic First Aid
- Mussel Spat Collection and General Biology
- Mussel Farm Stocking Capacity
- Music Harvesting, Handling, and Processing
- Small Vessel Operator Proficiency
- Aquaculture Work Experience (25 days)

Students then choose one of the following safety courses:

- Basic Farm Safety
- Marine Emergency Duties for Small Vessels (MED A3)
- Oil Spill Response Awareness
- Restricted Operator's Certificate in Maritime Commercial (ROC-MC)

Students then choose six of the following elective courses:

- Basic Boat Skills
- Basic Farm Safety
- Basic Mathematics for Aquaculture Workers
- Farm-Based Quality Certification
- Marine Emergency Duties for Small Vessels (MED A3)
- Marine Hydraulics
- Mussel Marketing and Management
- Mussel Site Maintenance
- Oil Spill Response Awareness
- Outboard Motor Maintenance
- Restricted Operator's Certificate Maritime Commercial (ROC-MC)
- Ropewalk
- Small Diesel Repair and Maintenance
- Vessel Maintenance

Program Name:
Technical Certificate-Aquaculture Management

Program Offered:
Community Based Education Delivery, Marine Institute of Memorial University of Newfoundland. This training is offered at locations close to major aquaculture farming regions to accommodate the aquaculture facilities.

Years Running: 1 year

Length of Program: 12 days

Program Overview: This program is designed to provide aquaculture farm managers with the necessary skills to effectively manage the day-to-day operations of an aquaculture operation. The courses span a wide range of aquaculture management skills and include topics such as human resources, project management, farm management, communications, regulations and policy, and computer skills. For entry into this program, students must possess the equivalent of a grade nine education and industry experience acceptable to the admissions committee.

This 12-day program consists of two required courses and two elective courses. Students must complete both of the following core courses:

- Aquaculture Human Resource Management; and
- One of the following: Aquaculture Project Management or Sea-based Salmonid Farm Management.

Students must then complete two electives from the following list:

- Aquaculture project management (if not chosen as a core course)
- Sea-based Salmonid Farm Management (if not chosen as a core course)
- Calculations in Aquaculture
- Computer Skills
- External Communications for Aquaculture Farm Managers
- Salmonid Aquaculture Regulation and Policy

Program Name:
Advanced Diploma in Sustainable Aquaculture

Program Location:
Marine Institute of Memorial University of Newfoundland, St. John's, NL

Years Running: 30 years

Length of Program: 1 year

Program Overview: This program is designed to provide students, from a wide range of academic disciplines, with the education, training and management level skills required to participate in aquaculture development. The goals of this program are to provide students with:

- Education and training for employment in a wide variety of fish and shellfish culture vocations; and
- Management level training needed to ensure the logical & sustainable development of aquaculture industries.

This course consists of two semesters' in the classroom and a three-month work term placement. For acceptance into this program, students must have an appropriate degree (a three-year diploma of technology), or a combination of work experience and formal education acceptable to the Admissions Committee.

This program is divided into three terms. In term 1 students receive training in business-related topics such as marketing and research proposal development. Students visit local aquaculture sites for study tours and participate in several practical field sessions.

The following are the courses offered during term 1:

- Aquaculture Seminar Series
- Shellfish Culture
- Finfish Culture
- Site Selection
- Practical Facility Maintenance and Animal Husbandry
- Marketing Aquaculture Products
- WHMIS
- Statistics
- Technical Report
- Work Term Preparation Seminar

During the second term students complete an in-depth, industry relevant research project designed to develop skills in experimental design, fish handling and aquaculture systems operations. Students also complete practical aquaculture courses which are designed to develop skills in net making, boating safety, seamanship

Courses offered during term 2 include:

- Handling and Processing Aquaculture Products
- Fish Health
- Fish Nutrition
- Aquaculture and the Environment
- Aquaculture Engineering
- Site Selection
- Business Management
- Technical Report
- Ropework and Net Mending
- First Aid
- Small Vessel Operator Proficiency
- MED A3

During term 3 students complete a 13-week aquaculture work term. Students work on finfish and shellfish farms or within laboratories and support agencies.

Program Name:
Technology Management (Aquaculture Technology)

Program Location:
Marine Institute of Memorial University of Newfoundland, St. John's, NL

Years Running: Information not available

Length of Program: Delivered online, 24 credit hours for Major Paper option (delivered online), 30 credit hours for Comprehensive Course option (delivered online)

Program Overview: This program focuses on strategic planning, decision-making, aquaculture technology management and the structure and operations of technology-based organizations. The courses included as part of the Master of Technology Management (Aquaculture Technology) program are technology- and business management-based. The program's elective options allow students the opportunity to focus on specific areas within aquaculture technology.

The program's 10 courses translate to 30 hours of credit hours of course work to be completed by students. There are two course options: two compulsory courses with eight electives (at least one from Category A and at least three from Category B) or two compulsory courses with six electives (at least one from Category A and three from Category B) and an aquaculture management project. For acceptance into this program, applicants must possess:

- A post-graduate aquaculture credential, aquaculture focus in a completed undergraduate degree, or significant professional experience in the aquaculture industry.

The core courses under this program are:

- Overview of Technical Operations; and
- Managing Technological Innovation.

Electives under category A include:

- Communication and Conflict Resolution in a technical environment
- Strategic Planning, Policy, Participation and Management in Technical Operations
- Quality Systems
- Project Management in the Offshore, Health, Fisheries and Engineering Technology Environment
- Risk Analysis and Operations in the Engineering Technology Sector
- Sustainable and Environment Responsibility
- Management of Intellectual Property
- Management of International Development

Electives under category B include:

- Management of Aquaculture Technology
- Animal Husbandry Management
- Aquaculture Site and Operational Assessment
- Aquaculture Engineering Technology Management

Memorial University has led the development of the aquaculture industry in Newfoundland and Labrador. Aquaculture activity in the province has its origins at Memorial University of Newfoundland's Marine Sciences Research Laboratory, the precursor of the Department of Ocean Sciences. Memorial's pioneering activity continues through aquaculture research at the Department of Ocean Sciences and the Marine Institute of Memorial University of Newfoundland, Canada's most comprehensive centre for education, training, applied research, and industrial support for the ocean industries.

Research activities involve the development of new species for aquaculture in the province. Faculty expertise exists in a wide range of scientific and practical areas, including feed development and analysis, marine larviculture, fish husbandry, commercial scale feeding trials, design of grow-out systems for fish and shellfish culture, optimizing shellfish farm production, international links and consultancy, bivalve larvae, and spat monitoring.

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Program Name:
Master of Science in Aquaculture

Program Location:
Memorial University of Newfoundland, St. John's, NL

Years Running: Information not available

Length of Program: 2 years

Program Overview: The MSc Aquaculture is an interdisciplinary program designed to instruct students in research using principles from a wide range of disciplines including Behaviour, Biochemistry, Biology, Ecology, Food Science, Genomics, Nutrition, and Physiology. Research problems may include field and/or laboratory studies of one or more species of marine or freshwater flora and/or fauna. The Aquaculture group consists of faculty members from the Fisheries and Marine Institute of Memorial University of Newfoundland and the Departments of Biology, Biochemistry, and Ocean Sciences of Memorial University of Newfoundland. Research scientists at other institutions, e.g., Fisheries and Oceans Canada, complement the group in offering advice, facilities, and expertise to students in the program.

To be considered for admission to the Master of Science in Aquaculture, an applicant shall normally hold one of the following: at least a second class Honours degree, or an equivalent both in achievement and depth of study, from an institution recognized by the Senate, or successful completion of the Advanced Diploma in Sustainable Aquaculture offered by the Fisheries and Marine Institute of Memorial University of Newfoundland, with academic standing deemed appropriate by the Aquaculture Administrative Committee.

For successful completion of this program students must fulfill the following:

1. The Master of Science Degree requires the successful completion of a program of courses and of a thesis embodying original research.
2. All candidates will be required to take 6 credit hours in graduate courses which will normally include at least one of the following: AQUA 6000 - Shellfish Culture and Enhancement, AQUA 6100 - Finfish Aquaculture, or AQUA 6200 - Aquaculture and the Environment.
3. Candidates who do not hold the Advanced Diploma in Sustainable Aquaculture may be required to successfully complete a selection of its component courses.
4. Further courses may be required depending on the background of the individual student.
5. Before the thesis is submitted, the student shall present an open seminar on the topic of investigation to the appropriate academic units, as recommended by the Administrative Committee. Any serious deficiencies in the thesis noticed at this stage should be carefully considered, in consultation with the Supervisor, for rectification.
6. The student will be required to comply with all other regulations governing the graduate Degree of Master of Science.

Program Name:

Bachelor of Science with minor in Sustainable Aquaculture and Fisheries Ecology (SAFE)

Program Location:
Memorial University of Newfoundland in conjunction with Marine Institute of Memorial University of Newfoundland, St. John's, NL

Years Running: Not available

Length of Program: 4 years

Program Overview: The Bachelor of Science with a minor in Sustainable Aquaculture and Fisheries Ecology exposes students to aquaculture and fisheries management practices and helps prepare them for a career in applied marine fields. This is an interdisciplinary program administered by the Department of Ocean Sciences in consultation with the Marine Institute of Memorial University of Newfoundland. It is intended primarily for students in the Faculty of Science but is open to students in other faculties. This minor in Sustainable Aquaculture and Fisheries Ecology (SAFE) exposes students to aquaculture and fisheries management practices and help prepare them for a career as a developer, technologist, or researcher.

Students who take a minor in Aquaculture and Fisheries will complete 24 credit hours as follows:

- Ocean Sciences 1000, 2001, 3000, 3002;
- Biology 4750 or geography 4300;
- One of Ocean Sciences 2000, 4000, 4122, 4601;
- One of Biology 2122, 3401, 3640, 3715, 4251, 4605; and
- One of Biochemistry 3107, 3402, 4002, 4101, 4104, 4105, 4200, 4201.

Course prerequisites stipulated in the course descriptions shall apply to a minor in Sustainable Aquaculture and Fisheries Ecology.

Program Name:
B. Sc. (Agriculture) in Aquaculture

Program Offer:
Dalhousie University, Truro, NS

Years Running: 23 years

Length of Program: 4 years

Program Overview: An Aquaculture education at the Dalhousie Faculty of Agriculture combines classroom, laboratory, project and field work.

In this program, students are exposed to a range of subjects related to fish production and aquatic ecosystems. Some of the required courses include Fish Health, Shellfish Production, Aquacultural Engineering, and Physiology of Aquatic Animals. Students learn about all aspects of aquatic life, including fish breeding, health and nutrition, animal and plant biology and facilities management.

Aquaculture graduates can look forward to careers such as:

- Algologist
- Aquaculture marketing and sales
- Aquaculture technician
- Aquarist
- Feed manufacturing and sales
- Equipment manufacturing and sales
- Animal health product development
- Food safety
- International development

Program Name:
Oceans Resources – Fisheries and Aquaculture

Program Offered:
Nova Scotia Community College, Shelburne, NS

Years Running: Information not available

Length of Program: 1 year

Program Overview: This program provides students with a comprehensive understanding in fisheries science, fishing practices, fish biology and disease control, economics of the fisheries, seafood processing, sustainable harvesting, fish husbandry and disease control, quality control, waste management in fishing production, eco-certification requirements and food science. At the end of this program students complete an applied entrepreneurship or capstone project and develop knowledge and skill to address critical issues and future opportunities in the fisheries and aquaculture sector.

This program provides students with a solid understanding of scientific and business challenges and trends for the seafood harvesting, seafood processing and aquaculture sector. Courses focus on seafood harvesting, marine and freshwater aquaculture, seafood processing and seafood (water) quality issues. The goal is to provide skills in the fisheries sector, supported by a base in science and business required to respond to current industry needs for productivity, competitiveness and sustainability.

Courses under this program include:

- Introduction to the Seafood Industry
- Safety I – Industry
- The Seafood Industry – History, Management, and Future Trends
- Marine Biology I – Basics in Marine Biology
- Aquaculture I – The Aquaculture Industry and Fish Husbandry
- Seafood Processing I
- Business I – Introduction the Seafood Business Environment
- Safety II – Seamanship
- Seamanship Skills and Gear
- Seafood Quality I Food Safety
- Essential Workplace Communication Skills
- Applied Learning I
- Socio-economic Policies and Industry Organization
- Professional Development
- Applied Entrepreneurship
- Applied Learning II
- Introduction to WHMIS
- Introduction to NS OH&S Act

Program Name:
Aquatic Resources

Program Offered:
St. Francis Xavier University, Antigonish, NS

Years Running: 20 years

Length of Program: 4-year dual major program

Program Overview: The Aquatic Resources Program uses an interdisciplinary approach - combining natural and social science perspectives - to motivate student engagement and foster understanding of important water resource issues, how water permeates our lives, shapes our world and sustains living organisms.

Students enrolled in the Aquatic Resource Program develop a keen understanding of topics that impact our planet, such as water resource and access issues, resource privatization, conservation, fisheries food procurement, indigenous rights, climate change, desertification, environmental stewardship, policy development, energy production, aquaculture and other food production techniques and industries, among others. Students are well-positioned to understand global resources issues, especially those involving water that occur between countries, cultures, cities and rural communities, and between regions within countries.

Students majoring in Aquatic Resources may complete a Bachelor of Arts or a Bachelor of Science degree. The Aquatic Resources program offers a core set of courses, specific to Aquatic Resources major students - AQUA 100, 201, 202, 325, 400 and 450 - that provide a broad background in water-related topics ranging from freshwater and marine ecosystem resource management to environmental policy development, the challenge of a changing climate, with all that implies, and opportunities to delve into topics of specific individual interest.

This program relies heavily on experimental learning - students participate in a variety of field trips, interact with guest speakers, network at local and international conferences, participate in academic exchanges and service learning trips, and they each complete a required work term that provides an opportunity to 'test' possible career options while gaining valuable experience.

Program Name:
Master of Veterinary Science

Program Offered:
University of Prince Edward Island, Charlottetown, P.E.I

Years Running: 29 years

Length of Program: 2 years

Program Overview: The MVSc degree at the University of Prince Edward Island is a two-year, non-thesis (professional) Master's-track program to enhance scholarship and competitiveness of veterinarians in one of the broad disciplines of pathology, microbiology, or clinical sciences. The program is designed to provide advanced training in the disciplines, and to develop teaching and communication skills. In addition, a student successfully completing the program may spend an extra year of residency in their selected discipline to be eligible for certification by specialty groups that require three years of residency training. Success in the program is attested by the achieving of satisfactory standings in the minimum number of graduate courses required, the completion of a research project, and the writing of a project report suitable for publication in a refereed journal.

The graduate students will register in one of the academic departments listed below and in one of the designated areas of specialization:

- Department of Companion Animals
- Small Animal Medicine
- Small Animal Surgery
- Cardiology
- Diagnostic Imaging
- Department of Health Management
- Large Animal Medicine
- Large Animal Surgery
- Theriogenology
- Population Medicine
- Aquatic Food Animal Medicine
- Equine Clinical Sciences
- Food Animal Clinical Sciences
- Department of Pathology and Microbiology
- Morphologic Pathology
- Wildlife Pathology
- Clinical Patholotgy
- Parasitology
- Virology
- Bacteriology
- Public Health
- Immunology
- Aquatic Animal Health
- Biosecurity

Program Name:
Environmental Technology

Program Offered:
New Brunswick Community College, Miramichi, NB

Years Running: Not available

Length of Program: 2 years

Program Overview: Environmental Technologists focus on the conservation of natural resources (fish and wildlife, habitat and ecosystems, agriculture, etc.) and work to heal some of the damage we have caused to the environment. Through this program, students will learn how to operate laboratory, field and monitoring equipment to sample, evaluate and analyze data collected from air, water, groundwater and soil. Upon completion of this program, students find work on field sites or in research and communications departments of government and business.

The courses included in this program include:

- Environmental Biology
- Environmental Chemistry
- Organic Chemistry
- Technical Writing and Research
- Formal Technical Report
- Applied Writing Skills
- Environmental Management Skills
- Environmental Restoration
- Environmental Remediation
- Industry and the Environment
- Ecology
- Air Quality
- Sampling Methodologies
- Water Quality
- Practicum: Environmental Technology
- Ecotoxicology
- Environmental Education
- Ecological Assessment
- Professional Ethics for Engineering Technologies
- Senior Technical Project for Engineering and Science-Based Technologies
- Hydrogeology
- Geology
- Fundamentals of Geographic Information Systems
- Hydrology
- Environmental Law
- Math Fundamentals
- Geographic Orientation
- Oceanography
- Strategies for Seeking Employment
- Orientation to Community Service
- Environmental Physics
- Project Management
- Basic Computer Applications
- Soils
- Environmental Field Skills
- Work Safely
- Statistics
- Waste Management

Program Name:
Aquaculture Operations

Program Offered:
New Brunswick Community College, St. Andrew's, New Brunswick

Years Running: Not available

Length of Program: 12 weeks

Program Overview: The aquaculture operations program is a twelve-week program designed to better prepare employees to meet the growing and diverse needs of the aquaculture industry. The program is aimed at current employees who want to build upon their aquaculture knowledge, technical skill, and ability as well as prospective employees who have an interest in pursuing a career in the aquaculture program. Subjects range from technical knowledge and skills such as salmonid biology and husbandry, the aquaculture production cycle, feeding and nutrition regimes, regulations and policy to important soft skills such as leadership, teamwork and communication skills enabling graduates to be upwardly mobile in their jobs.

Program Name:
Aquaculture Co-op Program, Post Graduate Certificate

Program Offered:
Fleming College, Peterborough, Ont.

Years Running: 5 years (Originally offered as a two-year program that was discontinued in 2003)

Length of Program: 1 year

Program Overview: The aquaculture co-op post graduate certificate program combines:

- Significant hands-on operational experience;
- Numerous field trips to experience aspects of the aquaculture industry such as trout farming and conservation stocking; and
- Business training so that graduates can both promote the industry and understand the diverse challenges facing aquaculture enterprises.

During the first semester, students will address aquaculture fundamentals. Most of the program will take place in the campus hatchery facilities, which include an Atlantic salmon hatchery and a muskellunge hatchery. The focus during the second semester is on operational and business practices, and internship planning. The final semester is an 8 week off, off site, paid co-op experience, enabling students to specialize in their area of interest.

To be accepted into this program, students must have an undergraduate degree or Ontario College diploma in an environmentally relate field, such as fish and wildlife, conservation, environmental studies, biology, ecology, forestry, and geography.

Program Name:
Renewable Resource Management

Program Offered:
Lethbridge College, Lethbridge, AB

Years Running:

Length of Program: 2 years

Program Overview: This two- year diploma program prepares students for a wide variety of environmental and natural resource management career opportunities, such as:

- biological technician;
- field research technician;
- environmental technician; and
- resource management technician.

In the program, students will be trekking out into fields, forests and rivers to study animals and their environment. Focused on biology, this intensive two-year diploma primarily deals with fish and wildlife and learning how to preserve their habitat for generations to come. If students want to continue their education, the program ladders directly into our Ecosystem Management – Bachelor of Applied Science degree. Students get out into the fields, forests, mountains, lakes and rivers that will one day be your office. Extensive field exercises put students in the thick of things, where they gain practical experience assessing fish populations, monitoring the movements of wildlife, interpreting grazing patterns and so much more.

During term one of the first-year, students complete the following courses:

- Botany
- Zoology
- Physical Geology
- Introduction to Environmental Law
- Spatial Information Techniques

During the second term of the first year, student complete the following course:

- Plant Systematics
- Ecology
- Scientific and Technical Writing
- Geographic Information Systems
- Descriptive Statistics

During the first term of second year, students complete the following course:

- Rangeland Management
- Principles of Wildlife Biology
- Principles of Fishery Science
- Forest Management
- Conservation Biology

During the second term of the second year, students complete the following course:

- Water Resources
- Soil Resources
- Wildlife Habitat Management
- Fish Habitat Management
- Fire Management

Program Name:
Fisheries and Aquaculture (2-year diploma)

Program Offered:
Vancouver Island University, Nanaimo, BC

Years Running: 35 years

Length of Program: 2 years

Program Overview: The program is designed to develop well-rounded technologists with a broad background in the practical and academic skills of fish and invertebrate culture, fisheries habitat and fish stock assessment, wild stock management, business management, and environmental control and planning. For this program, students spend approximately 25 percent of their time on "hands-on" fisheries and aquaculture projects on- and-off campus.

The first year provides a foundation in such basic conceptual areas as statistics, biology, English, habitats of fish and fish rearing methods. There is a weekly practicum, in which students are sent into the field for a day of work in various aquacultural or fisheries facilities (salmonid hatcheries, spawning channels, wild fish projects, oyster farms, invertebrate hatcheries and others), and students also work one half day each week on aquaculture or fisheries field projects on campus (trout farm), or in nearby satellite University facilities (wild salmon hatchery, sturgeon and algae labs). Many courses also involve significant field experience. Over the two years this practical work experience exposes students to a wide variety of activities, and introduces them to the facilities, organizations and personnel important in their future careers.

Students either work in fisheries or aquaculture summer jobs between their first and second year. Students receive credit for the summer practicum courses on completion of required written reports and oral presentation. There is also a co-operative education option that provides additional work experience.

In the second year, students are exposed to more advanced and specialized topics in fisheries and aquaculture. These include engineering courses for both fisheries (hydrology with a stream surveying component) and aquaculture (e.g., hydraulics and hatchery design), as well as special courses in aquaculture. There is a special field course on practical limnology in which students work and live, for a week, on the shores of a remote lake under flycamp conditions.

This program is limited to a maximum of 26 full-time students per year, of which 14 can be co-operative education students. The one-year program is a limited-entry option for university graduates with degrees in biology, zoology or related sciences. In this case, students complete the requirements for the diploma in one year, plus one summer practicum.

The courses covered during year 1 include:

- Introductory Field Trip
- Fish Husbandry II or Salmonid Husbandry
- Biology of Fishes or Ichtyology
- Aquatic Habitats
- Shop Skills
- Aquaculture Practicum I
- Aquaculture Practicum II
- Preparation for Co-operative Education Employment
- Co-Operative Education Placement
- Project in Husbandry I
- Project in Aquaculture II
- Aquatic Plant Ecology and Culture
- Life History and Management of Salmonids
- Fish Husbandry I
- Introduction Zoology or Concepts in Biology
- University Writing and Researching
- Into to Statistics

Special Session:

- Work Experience

The courses covered in year 2 include:

- Invertebrate Zoology
- Trout Culture
- Larval Rearing & Invertebrate Culture
- Introduction to Fisheries Management
- Warm Water Culture or Advanced Fish Culture
- Fish Health or Disease of Fish and Shellfish
- Fisheries Engineering I – Hydrology or Applied Hydrology
- Fisheries Engineering II – Hydraulics II
- Aquaculture Practicum III
- Aquaculture Practicum IV
- Preparation for Co-operative Education Employment I
- Co-operative Education Placement II
- Fisheries Field Techniques
- Project in Aquaculture III
- Protect in Aquaculture IV
- Fish Habitat Assessment and Rehabilitation

Program Name:
Bachelor of Science Degree in Fisheries and Aquaculture

Program Offered:
Vancouver Island University, Nanaimo, BC

Years Running: 35 years

Length of Program: 4 years, 2 years if combining with the Fisheries & Aquaculture Technology Diploma

Program Overview: The B.Sc. in Fisheries & Aquaculture is designed to offer students a great deal of flexibility, and there are several options available to complete this program. Students may begin in year one and complete the program at the end of year four, or they may enter at year two or three from Vancouver Island University or from other institutions. They may also complete the two-year Fisheries & Aquaculture Technology diploma program and then proceed to the B.Sc. with up to two years (60 credits) of advance credit. Some students elect this pathway after completing the Technology program and then working in industry for a few years.

The Bachelor of Science in Fisheries & Aquaculture is an applied technology degree program. Upon completion of this course, graduates are well schooled in scientific principles, have an understanding of the philosophical and ethical underpinnings of science, and be trained in the practical skills required to enter employment in industry or government.

The Bachelor of Science in Fisheries & Aquaculture degree program is a four-year degree program requiring 130 credits of study. Of these 130 credits, a minimum of 42 must be upper-level. Students will take the core program (109 credits), a minimum of six credits of Fisheries or Aquaculture electives, plus a minimum of six non-science elective credits. The variety of elective courses allow students to create a program suitable to their interests.

This degree is closely tied to the Bachelor of Science, Major in Biology. Students take core courses in Biology and are encouraged to take upper-level electives in Biology. Students may switch between the two degrees if their areas of interest change.

In the fourth year, students may choose to complete an Undergraduate Research Project in Fish 491. For this course, students will have a Faculty Project Advisor (in some cases faculty may be from another institution) and will carry out their research under the direction of this advisor. Students not wishing to pursue a research career may take a Directed Study Fish 490 and one upper-level science elective or two upper-level science electives.

Program Name:
Fisheries and Aquaculture (Post Degree Diploma 1 year)

Program Offered:
Vancouver Island University, Nanaimo, BC

Years Running: 35 years

Length of Program: 1 year

Program Overview: This is popular program for students that already have a B.Sc. in a related biological/ environmental science. Students take applied, lab-oriented courses in fisheries and aquaculture. These courses are taught in conjunction with weekly practicum (work) placements in a wide range of situations (government research labs, fisheries habitat and management agencies, shellfish and finfish aquaculture hatcheries & farms, salmon enhancement hatcheries, environmental consulting firms, etc.). Graduates find the knowledge, practical skills and work experience gained to be excellent direct gateways to careers and graduate school.

The post degree diploma is comprised of a subset of courses offered in the 2-year diploma and B.Sc. programs. The specific subset of courses taken is tailored to meet individual student's career interests, usually with either a fisheries management or aquaculture emphasis. Students must complete a total of 30 credits which must include 2 semesters of practicum and 2 semesters of AQUA 191T Husbandry Project I.

Program Name:
Aquaculture Technician 1

Program Offered:
North Island College, Courtenay, BC

Years Running: This program is being redeveloped. Tentatively scheduled to be offered in fall 2019.

Length of Program: Information not applicable

Program Overview: Aquaculture Technician I certificate provides students with in demand skills to support aquatic food production for marine, freshwater and land-based systems. This includes the production of fish, shellfish (bivalves and crustacea), aquatic plants (seaweeds, kelps), as well as upcoming species such as sea cucumbers, urchins and crayfish. Students will learn production techniques to produce a broad range of aquaculture foods including fish, shellfish, seaweeds and more. Curriculum includes technical aspects of production, with a primary focus on juvenile rearing, transferring to on-growing systems, harvesting and processing.

To complete this program, you will need to hold or complete valid industry certifications in Occupational First Aid Level 1, WHMIS, Small Vessel Operator Proficiency Training, Small Non-Pleasure Craft Marine Emergency Duties and Restricted Operator's Certificate - Maritime. During studies, students apply these certificate skills to the aquaculture farm setting, so you can gain hands-on knowledge of standard operating protocols, emergency response procedures and routine record-keeping.

This program provides students with 345 hours of instruction and hands on training, with an additional 53 hours of industry certifications delivered over four months.

The courses offered under this program include:

- Introduction to Aquaculture
- Invertebrates & Seaweed Husbandry
- Finfish Husbandry
- Aquaculture Health and Safety
- Strategies for Success
- Field School Finfish I
- Field School I – Practicum
- Small Non-Pleasure Crat Marine Emergency Duties
- Small Vessel Operators Proficiency Training
- Restricted Operator Proficiency – Maritime
- WHMIS
- Occupational Fist Aid Level 1

Program Name:
Aquaculture Technician Program

Program Offered:
Excel Career College, Courtenay, BC

Years Running: 8 years

Length of Program: 25 weeks (23 weeks of classroom training and a 2-week practicum placement)

Program Overview: The aquaculture technician program is ideal for those who want to be a technician without years of academic study. Upon completion of this course students will be able to gain employment:

- Working in fish farms, fishing guiding operations, hatcheries, stream restoration, processing plants, fisheries observation, shellfish cultivating and harvesting
- Feeding aquaculture stocks, vaccinating stocks, performing culling and marking or branding; techniques and ensuring the healthy growth of stocks
- Water sampling and testing
- Record keeping on water flow and stock samples
- Grading and weighing stocks
- Preparing stocks for market
- Operating boats in marine operations;
- Operation and maintenance of pumps, filters, tanks and other aquaculture equipment and enclosures

The courses offered under this program include:

Computer Modules

- Intro to Technology and Keyboarding
- Microsoft Word
- Microsoft Excel
- Microsoft Outlook

Aquaculture Technician Skills

- Introduction to Aquaculture
- Shellfish Aquaculture
- Biology of Salmonids
- Health and Husbandry
- Feeding and Nutrition
- Farm Operation and Maintenance
- Hatchery Operation and Maintenance

Job Search Skills

- Resumes, cover letters, interviews
- Networking with employers
- Aquaculture-specific HR issues
- Camp Life and Team Dynamics

Certification Courses and Equipment

- Forklift Operator's Certificate
- Marine First Aid w/CPR Level C & Transport
- Small Vessel Operator's Proficiency (SVOP)
- Marine Emergency Duties A# (Med-A3)
- Restricted Radio Certificate – Maritime
- WHMIS
- Confined Space Awareness (CSA)
- Transportation of Dangerous Goods Certification (TDG

Students must then complete a practicum that is either 2 shifts in a camp setting or a minimum of 80 hours if not.

ONLINE
AQUACULTURE PROGRAMS

Program Name:
Sustainable Aquaculture, Undergraduate Certificate

Program Offered:
St. Andrew's University, Scotland

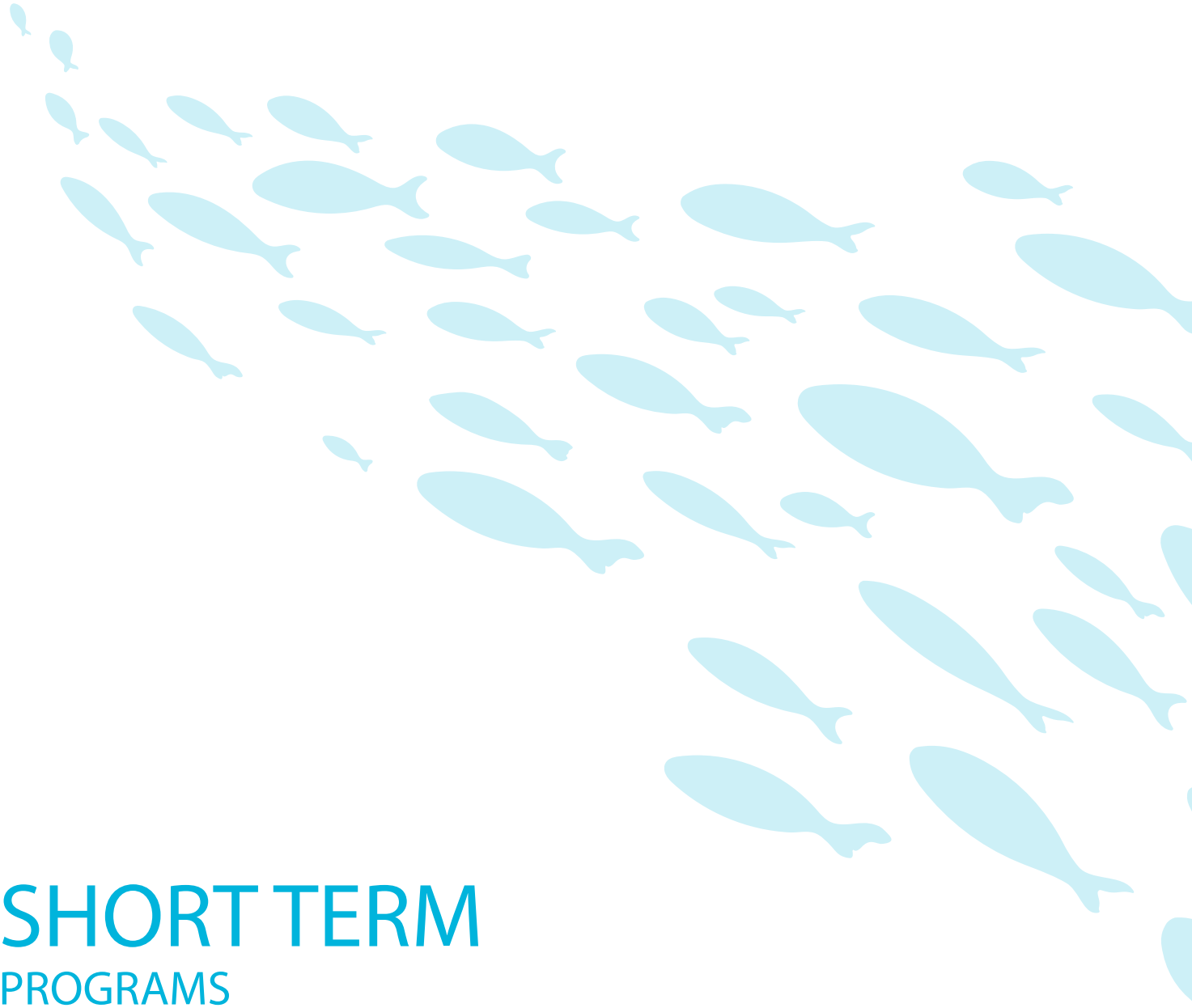
Length of Program: Online Program

Program Overview: This program has three modules:

- The global aquaculture industry
- Fish and invertebrate biology
- Aquaculture: products and markets

Each module is divided into a series of topics with associated assessments, tutorials and case studies. There will be a monitored online examination at the end of each module. Each topic requires around 4 hours study time, a new topic is published each week, but does not necessarily need to be completed that week. Each module takes 12 weeks to complete, including a 3 week break for exam revision in between.

For entry into this program, students must have gained SQA Standard grade (1 or 2) or GCSE (A or B) or equivalent in English and Mathematics along with at least two higher (H) or at least one GCE A Level or equivalent in the following subjects: Biology, Chemistry, Computing, Geography (or Geology), Mathematics, Physics or Psychology. In line with the University's drive to widen access, additional evidence of relevant professional experiential learning (RPEL) may be taken into account for entry.



SHORT TERM
PROGRAMS

Program Offered:
Workshops in Health and Husbandry of Aquatic Laboratory Animals and Advanced Aquatic Animal Care and Husbandry

Institution Offering:
The Canadian Aquaculture Institute

Program Overview: The Canadian Aquaculture Institute offers the following workshops:

- Health and Husbandry of Aquatic Laboratory Animals
- Advanced Aquatic Animal Care and Husbandry

These workshops are offered at the Atlantic Veterinary College, University of Prince Edward Island, Charlottetown, PEI under the leadership of Dr. Jonathan Spears, Clinical Laboratory Animal Veterinarian. The target audience for these workshops includes Attending, Clinical or Consulting Veterinarians, Facility Managers, Aquatic Facility Technicians, and Animal Care Committee Members working with academic or research institutions that house laboratory aquatic animals and/or review animal care protocols involving manipulating fish in the wild. The workshops provide hands-on experience in procedures for aquatic laboratory animals.

These workshops are designed to fulfill the requirements of Continuing Education for Attending, Clinical or Consulting Veterinarians, Facility Managers and Facility Technicians as required by the Canadian Council on Animal Care.

Program Name:
Experimental Fish

Program Offered:
The Canadian Aquaculture Institute

Program Overview: As fish become increasingly important as experimental animals, there is a growing need for training "users" in the principles of laboratory animal science and the proper care and handling techniques associated with these animals.

The Canadian Aquaculture Institute (CAI) has designed this online training program to comply with the recommendations outlined by the Canadian Council on Animal Care Institutional Animal User Training Program with special reference to aquatic animals and the specific needs of these animals in a laboratory setting. This program also provides participants with an overview of the regulatory and ethical issues involved in experimental animal care and the practical aspects of aquatic animal care. The Experimental Fish course is designed for individuals and organizations that "use" fin in research, teaching and testing applications.

CAI's continuous intake allows participants to register and begin the course at any time throughout the year. Participants can expect to receive their online login/password information by email within 2 business days of registering for the course.

The online course takes approximately 5 hours to complete. Participants have up to one month from the date of registration to complete the course, unless otherwise specified.

The course contains seven (7) modules. At the end of each module participants are required to complete a short-quiz directly related to that module's content. The minimum acceptable passing grade for each module's quiz is 80%.

Upon completion of the modules and successful completion of the accompanying quizzes, participants receive a certificate of completion from the Canadian Aquaculture Institute. This document will certify that the participant has completed the core components as outlined in the Canadian Council on Animal Care National Institutional Aquatic Animal user training syllabus.

The Experimental Fish course is available in two versions:

- Canadian Version – available in English and French and
- The United States Version

The course is divided into 7 modules and covers the following topics:

- Regulation of Experimental Animal Care and Use
- Ethical Issues of Experimental Animal Use
- Fish as a Research Animals
- Aquatic Animal Facilities

- Aquatic Animal Care
- Fish diseases, Anesthesia, and Euthanasia
- Occupational Health and Safety in Aquatic Animal Facilities

The Experimental Fish will instruct participants on:

- The role and structure of the Canadian Council on Animal Care (Canadian Version)
- The regulations, policies and guidelines that oversee the care, handling and human treatment of animals in the United States (US Version)
- The ethical issues surrounding experimental animal use
- Factors (e.g. stress, disease, husbandry) affecting research
- Anesthesia and euthanasia for fish
- Considerations of selection and set-up of laboratory holding systems
- Water quality parameters
- Feed and nutrition for fish
- Aquatic animal identification and monitoring
- Recognizing pain, stress and distress in aquatic animals
- Interdependence of health factors for aquatic animals
- Humane endpoints
- Physical, chemical and biological hazards in aquatic animal facilities

ON-LINE LEARNING PORTHOLES

https://thefishsite.com/

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TRAINING WORKS
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