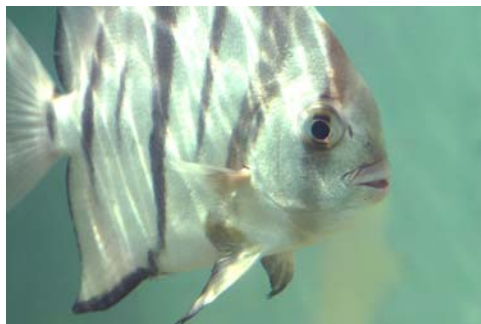


Aquaculture Technology



Carteret Community College
presents the

Program Review
for
Aquaculture Technology



Aquaculture Technology

Executive Summary

The Aquaculture Technology program was developed to introduce and encourage aquaculture in the county and region and to teach the innovative, practical and economically viability of applied aquatic sciences; this program mission is to be accomplished:

- ✓ By combining curriculum courses with hands-on practical training
- ✓ By supporting the development of aquaculture business and research
- ✓ By partnering with other institutions to foster the growth of aquaculture

Aquaculture is the farming and husbandry of aquatic organisms.

The concepts, principles and history for conducting this program along with descriptions of faculty, students, resources and budgets are found in Section 1 beginning on page 3.

To accomplish this mission the definition of aquaculture was expanded to include the farming of organisms for seafood, and for resource enhancement. The definition of husbandry was expanded to include aquatic organisms for recreation, education and marine science. And marine biotechnology was included because of the bio-active compounds produced by marine organisms which cannot be lab synthesized making it imperative to culture these organisms for extraction of the compounds. These four basic areas encompass the definition and embody the skills taught in the program. Beginning on page 13, Section 2 describes the curriculum, course work, innovations and teaching modalities used to meet program goals.

Outcomes are identified and developed with input from advisory board, industry partners and industry history. Administrative, program and program learning outcomes are assessed by combining survey instruments and institutional effectiveness data. Results are determined and used in a system of continuous improvement with the goal of improving learning for students and improving program performance over the long term. Section 3, beginning on page 17 describes the outcome process in detail.

The strengths, weaknesses, opportunities and threats or SWOTs to the program are discussed in a formal setting by a group of industry partners and students. The group is officially moderated and results presented to the program coordinator for analysis. Recommendations from these results add significantly to the process of continuous improvement and strategies for change. The SWOT analysis and need for change is described with recommendations in Section 4, beginning on page 19.

Future issues are examined in Section 5, found on page 22, to study the changes which are not currently needed but which may be needed in the future. Trends are identified in the industry that may or may not require program changes. The overall goal of future issues is to regularly assess, prepare for and maintain the future effectiveness of the program.

Acknowledgement

I would like to thank all who participated in the collection and assessment of information and in the development of this program review document. Without the help of our advisory committees, industry partners, colleagues and students this document would merely be an exercise in manuscript preparation. However, because of all their input it is a useful tool to be used to carry the Aquaculture Technology program forward on a path of certain continuous improvement.

Philip S Kemp Jr, Curriculum Area Coordinator



Aquaculture Technology

Program Review

Table of Contents

Section 1. Program Profile	3
1.A. The Mission / Purpose	
1.B. The Faculty	
1.C. The Students	
1.D. Resources	
1.E. General	
1.F. Analysis	
Section 2. The Program	13
2.A. Definition of Program	
2.B. Curriculum or Coursework	
2.C. External Accreditation	
2.D. Innovations	
2.E. Testing and Remedial Coursework	
2.F. Evaluate Instructional Modalities	
2.G. Funding for curricular changes or offerings	
2.H. Analysis	
Section 3. Outcomes	17
3.A. The Outcome Identification Process	
3.B. Administrative Outcomes Assessment Plan	
3.C. Program Outcomes Assessment Plan	
3.D. Student Learning Outcomes Assessment Plan	
3.E. Follow-up of Student Served	
3.F. Analysis	
Section 4. Need for change	19
4.A. The SWOT Analysis/Focus Group	
4.B. Recommendations	
4.C. Strategies for Change	
4.D. One-Year Follow-up	
Section 5. Future issues	22
5.A. Anticipated future curricular changes and needs	
5.B. Market trends within the program area	
5.C. Equipment, space and faculty needs for future growth or continuation	
5.D. Future plan	
5.E. Review Resources	
<u>Appendix</u>	
Appendix I: Faculty Qualifications	23
Appendix II: Library Resources and Services	25
Appendix III: Aquaculture Technology Library Collection	29
Appendix IV: Outcomes Data and Results	35
Appendix V: Program Review Committee members	39
Appendix VI: Detailed SWOT Results	40

Section 1. Program Profile

Section 1.A The Mission / Purpose

Mission Statement

To introduce and encourage aquaculture in the county and in the region as an innovative, practical and economically viable science of **applied marine sciences**:

- ✓ By combining curriculum courses with hands-on practical training
- ✓ By supporting the development of aquaculture business and research
- ✓ By partnering with other institutions to foster the growth of aquaculture

Aquaculture is the farming and husbandry of aquatic organisms.

Farming includes propagation, spawning, culturing of juveniles and production of marketable products. Career examples: farming flounder, black sea bass, shrimp, catfish, clams, oysters, hybrid striped bass, eels, crawfish, tilapia, golden shiners, koi carp, rainbow trout, culture of nutraceuticals and bioceuticals from marine species

Husbandry includes handling and caring for the organisms during all or a portion of their life cycle. Career examples: soft-shell crab shedding, live flounder sales, aquarium husbandry technology and culturing ornamental species, cultured pearls, biotechnology and bioceutical products, enhancement aquaculture for finfish and shellfish

Aquaculture students completing this program gain the knowledge and ability to work directly in aquaculture and in related fields of applied marine sciences. Graduates of the program are employable on private farms and government hatcheries, or at public aquariums or pet shops. They may also start new businesses in fish, shellfish, or aquatic plant farming, aquatic management services, home/office aquarium or water gardening services.

The CCC Mission:

Carteret Community College will be a leader in improving the quality of life for all citizens of Carteret County and Eastern North Carolina by offering opportunities for lifelong learning through high quality teaching, training, support, and enrichment.

Section 1.B The Faculty

The Aquaculture Technology program employs one full-time faculty to teach all lecture courses and lab practicums. The faculty member is also the Curriculum Area Coordinator and works to maintain the aquaculture facility systems and components and is responsible for reporting maintenance problems in the Howard Building. The faculty is qualified by CCC mandated criteria (see Appendix I for Faculty Qualifications).

Several part-time and a full-time position were funded through aquaculture grant projects during the 2004-2006. Currently one part-time non-instructional position is funded

Aquaculture Technology

through Perkins grant to assist instructor with lab practicums and with facilities needs. There is no guarantee that the part-time assistant will be funded for any specific term.

Section 1.C The Students

The Aquaculture Technology program is composed of students who are very diverse in terms of educational status. The program accepts students directly from high school, transfers from other college programs, transfers from other colleges and “non-traditional” students who may be changing careers or who for other reasons are coming back to college to learn a new trade or skill set. Some students already have their baccalaureate degrees from universities and enroll in the aquaculture program in order to start a business or learn a new discipline. The program has enjoyed tremendous growth over the most recent 4-year timeframe.

Aquaculture students completing this program gain the knowledge and ability to work directly in aquaculture and in related fields of applied marine sciences. Graduates of the program are employable on private farms and government hatcheries, or at public aquariums or pet shops. They may also start new businesses in fish, shellfish, or aquatic plant farming, aquatic management services, home/office aquarium or water gardening services.

Curriculum Standards for Aquaculture Technology are set by the NC Community College System and the program has no other external governing or accrediting body to set standards. The program is open enrollment and has no entrance or admission requirements.

No other programs at CCC require Aquaculture Technology courses; however the AquaTech curriculum does require college transfer courses as found in the curriculum standard.

Under a written bilateral agreement CCC graduates with the AAS in Aquaculture Technology may transfer to UNCW or ECU with junior status as a part of a 2+2 transfer program.

Following is an institutional effectiveness department statistical analysis of the program:

Carteret Community College Program Analysis

Aquaculture (A/C15120) for 2008

I. Description/Purpose

To offer classes in Aquaculture, Applied Marine Sciences and other college transferable classes leading to a certificate, diploma, and/or AAS degree in Aquaculture Technology. BCC was the degree granting institution from 2001-02 until 2005-06. Special circumstances led to retroactive approval for CCC to teach the courses and graduate students during 2004-06. In 2006-07 Carteret Community College was approved to teach Aquaculture Technology as a stand-alone program.

Aquaculture Technology

Under a bilateral agreement CCC graduates with the AAS in Aquaculture Technology may transfer to UNCW or ECU as junior (2+2 program)

II. Program Quality

A. Resources

1. Staffing (*Source: Department*)

	# employees	Avg. years on staff	Range of years on staff	% of classes taught by
Full-time (CCC)	1	5	5	100
*Part-time	1	0		0

* Non-instructional position funded through Perkins grant

2. Program FTE* (*Source: IE Office/Data Warehouse*)

A15120

	Fall	Spring	Summer	Total
2001-02*	2.05	1.14	0.56	3.19
2002-03*	2.81	1.50	0.44	4.31
2003-04*	3.03	3.20	0.82	6.23
2004-05*	2.57	3.00	1.28	5.57
2005-06*	3.37	2.77	2.72	6.14
2006-07	4.53	6.38	1.38	10.91
2007-08	7.32	8.09		15.41

* Note: FTE was shared with BCC during 2001-2006

D15120

	Fall	Spring	Summer	Total
2006-07	0.53	0.91	0.30	1.44
2007-08	0.63	1.06		1.69

C15120

	Fall	Spring	Summer	Total
2005-06		0.28	0.19	0.28
2006-07	0.28	0.66	0.66	0.94
2007-08	1.28			1.28

B. Student Data

1. Demographic (*Source: IE Office/Data Warehouse*)

classification	2002-03	2003-04	2004-05	2005-06	2006-07
Male	71.4%	72.7%	60.0%	58.3%	75.0%
Female	28.6%	27.3%	40.0%	41.7%	25.0%
Full Time	25.0%	28.6%	38.5%	26.7%	9.5%
Part Time	75.0%	71.4%	61.5%	73.3%	90.5%
Day	85.7%	91.7%	100.0%	62.5%	61.5%
Evening	14.3%	8.3%	0.0%	37.5%	38.5%
White	85.7%	100.0%	100.0%	100.0%	95.2%
Non-White	14.3%	0.0%	0.0%	0.0%	4.8%

Aquaculture Technology

2. Number of Completions (*Source: IE Office/Data Warehouse/Datatel*)

Year	Degree	Diploma	Certificate	Total
2002-03*	0	n/a	n/a	0
2003-04*	0	n/a	n/a	0
2004-05*	0	n/a	n/a	0
2005-06*	2	1	n/a	3
2006-07	4	0	0	4
2007-08	4	0	0	4

* Degree conferred by Brunswick Community College (with exceptions)

3. Employment Demand of Graduates of the Program (*Source: Department/Graduate Surveys*)

Year	Graduates	# Employed	% Employed	Unknown
2000-01	n/a	n/a	n/a	n/a
2001-02	0	n/a	n/a	n/a
2002-03	0	n/a	n/a	n/a
2003-04	1	1	100%	0
2004-05	1	1	100%	0
2005-06	3	n/a	n/a	3
2006-07	4	n/a	n/a	4

C. Performance measures with standards compared to actual outcomes, if data is available for the specific program

1. Goal Completion of Completers – number of respondents and percentage who reported complete or partial accomplishment of goals. *Standard: 95% (Source: IE Office/Graduate and Non-Completer Surveys)*

year	completers		non-completers	
	count	percentage	count	percentage
2000-01	n/a	n/a	n/a	n/a
2001-02	0	n/a	0	n/a
2002-03	0	n/a	2	50%
2003-04	0	n/a	0	n/a
2004-05	0	n/a	0	n/a
2005-06	0	n/a	1	100%
2006-07	0	n/a	1	100%

2. Student Satisfaction of Completers and Non-Completers – number of respondents and percentage who reported satisfaction with overall quality of academic program. *Standard: 90% (Source: IE Office/Graduate, Non-completer, and Current Student Surveys)*

Aquaculture Technology

year	completers		non-completers		current students	
	count	percentage	count	percentage	count	percentage
2000-01	n/a	n/a	n/a	n/a		
2001-02	0	n/a	0	n/a	n/a	n/a
2002-03	0	n/a	2	50%	1	100.0%
2003-04	0	n/a	0	n/a	3	100.0%
2004-05	0	n/a	0	n/a	7	100.0%
2005-06	0	n/a	1	100%	n/a	n/a
2006-07	0	n/a	1	100%	n/a	n/a

3. Passing Rates on Licensure/Certification Exams for First-Time Test Takers. *Standard: 80% Aggregate/70% Individual. (Source: IE Office/NCCCS Critical Success Factors Report)*

Not applicable.

4. Program Enrollment – annual unduplicated headcount with three-year average. *Standard: three-year average greater than or equal to 10. (Source: IE Office/Data Warehouse)*

year	enrollment	3-year average
2000-01	n/a	
2001-02	6	n/a
2002-03	7	n/a
2003-04	11	8.0
2004-05	10	9.3
2005-06	12	11.0
2006-07	20	14.0
2007-08	32	21.3

5. Curriculum Student Retention and Graduation. *Standard: 60% (Source: IE Office/System Records)*

Year	enrollment	grads	return	non-completers	retention rate	new program
2001-02	3	0	0	3	0.0%	0
2002-03	6	0	2	4	33.3%	0
2003-04	8	0	3	5	37.5%	1
2004-05	7	0	3	4	42.9%	0
2005-06	9	0	2	5	22.2%	2
2006-07	10	1	4	5	50.0%	1

Trends:

Enrollment in the Aquaculture Technology program has steadily increased every year except one since its inception in 2001. This past year the program increased by over thirty percent. The retention rate has also trended upward from 33% to 50%.

Aquaculture Technology

Recently courses have begun utilizing distance learning technology and some courses have been taught entirely online. Fuel prices and commuting costs are likely to play a role in future enrollment to the program. With that in mind and the general knowledge that seated classes usually have better retention and completion rates, efforts are being made to make the distance courses as user friendly as possible.

Section 1.D. Resources

1. Support personnel for 2004-2008

	# employees	Avg. years on staff	Range of years on staff	% of classes taught by
Full-time	1	5	5	100%
Perm. half time	0	0	0	
Adjunct	0	0	0	
*Part-time	1	0	0	

* Non-instructional assistant position funded through Perkins grant

2. Classroom and Laboratory Facilities

Classes and labs are taught in the Robert B. Howard Building, which was remodeled in 2005 specifically for aquaculture technology and is also referred to as the Aquaculture Building or Mariculture Building. The classroom is fitted with whiteboard and projector and seats approximately 18 students comfortably and up to 30 people for short seminars or special workshops.

The program is heavily weighted toward hands-on applications of the lessons learned in classes and discipline-appropriate skills. These labs are conducted inside the building and outside on the waterfront facility grounds as well as in remote research sanctuaries in Bogue Sound and Newport River. The hands-on labs utilize a 22-ft Jones Brothers bateau complete with collection gear and holding tanks and a pickup truck with live-haul tank all purchased with grant funds. The fish culture systems include recirculating and open flow through aquaria and fiberglass tanks. The systems are divided into several rooms in a simulation of a hatchery environment and include broodstock conditioning room, larviculture room, algae culture room and main aquaculture area. A high-tech marine biotechnology lab was established with grant funds and outfitted with HPLC, Bio-Flo fermenter, lypholyzer, analytical balance, centrifuges, U/V-Vis scanning spectrophotometer, atomic absorption spectrophotometer and laminar flow hood. Compound and dissecting microscopes were purchased through multiple grants and are used for phytoplankton identification and larviculture exercises. Field trips are taken to commercial operations or aquaculture-related facilities such as the NC Aquarium and university marine research facilities.

A. Library Resources and Services (See Appendix II)

Evaluation of Resources and Services by the Aquaculture Curriculum Area Coordinator:

Aquaculture Technology

The library has no databases with information that is appropriate to the aquaculture program mostly because the program has very specific informational needs. The college has subscribed to ASFA (Aquatic Sciences and Fisheries Abstracts) in the past but the cost is prohibitive for the amount that it is used and the nearby Duke Marine Laboratory has allowed CCC students to access the ASFA database through their library.

The library has a sufficient collection of instructional audiovisual materials for aquaculture use. It is up to date and combined with Internet resources and instructor generated material serves the audiovisual teaching needs of the aquaculture program.

Several excellent periodicals are available in the library, which supplement the program and community needs for current and timely information.

The books and reference books collection for aquaculture technology and applied marine sciences is up to date and useful to the program students and faculty. The material in the collection is wide ranging in subject area and includes both narrow and broad approaches to the discipline. The materials are used by students and include only a few gaps, which were discussed with library staff during evaluation and review.

Evaluated: 10/17/2008 by Philip S Kemp Jr, CAC- Aquaculture Tech

B. Library Aquaculture Collection: (See Appendix: III.)

3. Equipment and Supplies:

All aquaculture facility laboratories are currently outfitted adequately due to multiple grants received by the program in the years 2004-2006, however recent cuts in other costs budgets have eroded the ability to replenish supplies and maintain the facilities. Some of the grants were used to purchase first-class and state-of-the-art scientific and laboratory equipment mentioned above which will require upkeep and maintenance in the near future. Live project funds are supplementing state funds for consumables and facility maintenance.

4. The Advisory Committee:

The CCC Aquaculture Tech program has utilized the expertise and input from an advisory board since it's inception in 2001. The advisory board consists of 17 members including chairman, executive secretary, student and an administration representative. The board members are selected from university, state, and industry partners. The committee meets twice per year to discuss regular agenda items and issues minutes for each meeting. The Board has been helpful to the program for locating industry partnerships, which are used for cooperative work experience internships. It has helped brainstorm ideas for program funding activities and championed the AquaTech program's involvement in new state projects. A valuable relationship exists with the advisory board and the members are often called upon informally for spontaneous advice on various subjects.

Aquaculture Technology

5. The Aquaculture Technology program budget:

Program other costs budget was \$4,000 per year for 5 years from 2001-2006 but was cut to \$2,000 for 06-07 and \$3,000 for 07-08 budget years. A \$6,175 budget for 2008-09 reversed the negative funding trend which was for several years inversely correlated to the actual increases in enrollment (see Section 1.C. Students).

Grant funds amounting to \$524,000 from eight projects were obtained by curriculum area coordinator over the 2004-06 time frames and were used to start up the program and to establish actual spending patterns for operation and maintenance of the program. Actual other costs spending pattern for the program over the past two years has been \$6,500. But those levels are not possible to maintain with the current other costs budget.

A live project was recently proposed and approved by the CCC Trustees for the Aquaculture Technology program to involve students in the production process and to sell products generated by the program. It is expected that the live project will require 2-3 years before any significant revenues are available for the program. The first products for sale will be live littleneck clams and live koi carp fingerlings that have been produced in the department. Other products will be developed in the future and sold as they become available.

Section 1.E. General

1. Specific Industries or businesses served by the program:

There are no businesses or industries that have specifically requested training for their employees. However, the NC Aquarium has employed three students from the CCC Aquaculture Technology program. The local marine research university laboratories have hired students to work on short-term grant projects for cooperative work experience internships as well as out-of-class work needs. Several students have started their own businesses and one has obtained a position with a marine biotechnology company in Charleston, SC. As the recognition of the program increases in and outside the state future businesses may seek out students with the training that CCC offers in this program.

2. Institutions to which your current students transfer.

The CCC Aquaculture Technology program has written bilateral agreements for 2+2 transfer program with: UNC-W and ECU. Three agreements have been written; they are with the UNCW Marine Biology Department and the ECU Department of Biology and Dept of Technology Systems.

3. Significant Developments since the last evaluations.

Aquaculture Technology

Enrollment has increased significantly and retention rate has also increased since CCC has offered Aquaculture Technology as a stand-alone program. This may be in part due to the difficulties of the Information Highway that were encountered while the program was collaborative with BCC.

There are some developments in hybrid and distance learning technology at CCC that improves the success rate and retention rates of students in the program. The other costs budget has been cut.

Section 1.F. Analysis

The CCC Aquaculture Technology Program has a mission to introduce and encourage aquaculture in the county and in the region as an innovative, practical and economically viable science of applied marine sciences: by combining curriculum courses with hands-on practical training, by supporting the development of aquaculture business and research, and by partnering with other institutions to foster the growth of aquaculture.

Aquaculture students completing this program gain the knowledge and ability to work directly in aquaculture and in related fields of applied marine sciences. While employment opportunities for traditional food production aquaculture in the county are limited there are additional limited opportunities with the other facets of applied aquatic sciences; and significant employment opportunities are available outside Carteret County. Graduates of the program are employable on private farms and government hatcheries, or at public aquariums or pet shops. They may also start new businesses in fish, shellfish, or aquatic plant farming, aquatic management services, home/office aquarium or water gardening services.

The program mission also serves the CCC Mission: Carteret Community College will be a leader in improving the quality of life for all citizens of Carteret County and Eastern North Carolina by offering opportunities for lifelong learning through high quality teaching, training, support, and enrichment.

The single faculty member is highly qualified to teach the program, however this situation limits the potential for growing and maintaining the quality of the program in the future. Additional faculty or adjunct faculty could assist in the teaching load for core program courses as well as the lab practicum series.

The Aquaculture Technology program is composed of students who are very diverse in terms of educational status. The program accepts students directly from high school, transfers from other college programs, transfers from other colleges and “non-traditional” students who may be changing careers or who for other reasons are coming back to college to learn a new trade or skill set. Some students already have their baccalaureate degrees from universities and enroll in the aquaculture program in order to start a business or learn a new discipline. The program has enjoyed tremendous growth over the most recent 4-year timeframe.

Aquaculture Technology

Due to several grant projects in the initial phase of the program the facility benefited by the acquisition of equipment and learning resources, which has made the learning capabilities almost limitless for this type of program. Additional funding through the establishment of a live project can enhance state funds to maintain the current level of expenses incurred in courses and lab practicums. However, any replacement and repairs to the building or major equipment items will require additional college support.

A high quality advisory board and regular meetings helps to keep fresh ideas circulating and serves to keep the program current.

There is a concern about the lack of local businesses or industries that have specifically requested training for their employees. And there is not an increase in the number or size of aquaculture businesses in Carteret County. Combining these two factors seems to indicate that the program should look to recruit students from other parts of the state or the country. With its unique site and facility, the program should be able to continue its growth rate with new students coming from other areas and seek to place them back in their respective areas after graduation.

Finally, the program has laudable collaborations with UNC-Wilmington and East Carolina University in the 2+2 transfer program. It should continue to use that as a drawing card for transfer students who are interested in pursuing Baccalaureate degrees.

Aquaculture Technology

Section 2: Program Content

Section 2.A Definition of Program

The program is defined by its mission and by the definition of aquaculture, which is “the farming and husbandry of aquatic organisms.” In order to accomplish this mission the basic definition of aquaculture was expanded to include not only the farming of organisms for seafood, but also for resource enhancement. The definition of husbandry was expanded to include that of aquatic organisms for recreation, education and marine science. And the discipline of marine biotechnology was included because there is a large number of bio-active compounds that are produced by marine organisms which cannot be synthesized in the laboratory making it imperative to culture these organisms for extraction of the compounds. These four basic areas encompass the definition and embody the skills taught in the program.

The Aquaculture Technology program prepares individuals to work in commercial seafood culture operations, public and private aquarium facilities, marine science research laboratories and government hatcheries or fishery management agencies as well as biotechnology laboratories that culture marine organisms. Also, the skills taught in this program can prepare individuals for careers in non-profit marine-related educational organizations and other related agencies or facilities.

Admissions policy: The Aquaculture Technology program has no formal admissions policy overriding that of Carteret Community College and it adheres to the “open door policy” of the community college system.

New entrants to the program are emphatically advised to have strong math and verbal skills before attempting the courses and to complete college prep courses before entering the program. Courses are taught at the University level rather than the typical level for applied sciences because of the bilateral agreement for the 2+2 transfer program with UNC-W and ECU. Students can transfer the AAS in AquaTech to these Universities and enter with junior status, however students not wishing to continue on to earn B.S. degrees can enter and complete the AAS degree or complete a Certificate or Diploma option.

Section 2.B Curriculum or Coursework

The following degrees/credentials can be awarded:

- Associate of Applied Science in Aquaculture Technology
- Diploma in Aquaculture Technology
- Certificate in Aquaculture Technology

The core courses offered in the program are:

AQU 111	Aquaculture 1
AQU 112	Aquaculture 2
AQU 220	Aquaculture Facilities

Aquaculture Technology

AQU 230	Fish Genetics and Breeding
AQU 240	Fish Nutrition and Diseases
AQU 251	Hatchery Management 1
AQU 252	Hatchery Management 2
AQU 161	Aquaculture Practicum 1
AQU 162	Aquaculture Practicum 2
AQU 163	Aquaculture Practicum 3
AQU 164	Aquaculture Practicum 4
AQU 165	Aquaculture Practicum 5
AQU 166	Aquaculture Practicum 6
COE 112	Cooperative Work Experience

The curriculum adheres to the guidelines of the state Curriculum Standard for Aquaculture Technology and the Program of Study is annually approved by the state community college system.

Section 2.C External Accreditation

There is no external accreditation required of or sought by the program.

Section 2.D Innovations

The CCC Aquaculture Technology Program has been an innovator in collaborating with and establishing close relationships and industry partnerships with local facilities in this discipline. These facilities and agencies can sponsor students for mini-internships, cooperative work experience or hire graduates as future employees. A partial list of these industry partners includes NCSU Center for Marine Sciences and Technology- CMAST, UNC-CH Institute for Marine Sciences- IMS, Duke University Marine Laboratory- DUML, NOAA National Ocean Services, Beaufort Laboratory, North Carolina Division of Marine Fisheries, North Carolina Aquarium- Pine Knoll Shores, NC Coastal Federation, NC Shellfish Growers Association, Shellfish Growers of North Carolina, East Carolina University- Biology Department / Coastal Studies Institute, UNC-Wilmington- Center for Marine Sciences- CMS, Sturgeon City (Jacksonville, NC), J&B AquaFoods, Inc, Mill Point Aquaculture and Shellfish hatchery, Carolina Flounder Farm, LLC, and NCSU Fish Barn.

Other innovations include the program's efforts to assist community, university and state work in aquatic research by conducting grant-funded projects, which employ and engage students in the learning process. These grants also serve to augment state funds to operate and maintain the program and facility. Previous grant projects partnered with the US Army Corps of Engineers and the Town of Emerald Isle, the NC Rural Center, the Golden LEAF and NCCCS BioNetwork program, NC Sea Grant- Fisheries Research Grant program and Albemarle-Pamlico National Estuary Program.

Section 2.E Testing and Remedial Coursework:

None required

2. F. Evaluate Instructional Modalities

Traditional Instruction modalities are used in the classroom for delivery of lectures and meeting competency requirements. These modalities include classroom instruction, which utilizes teaching tools such as PowerPoint presentations, films and videos on DVD or from streaming Internet connection, slide presentations and standard lecturing from notes. Other modalities include lab practicums and review exercises that include hands on learning and other tools such as games which reinforce student learning. Students also give presentations and posters on various topics as class assignments.

The effectiveness of these modalities is evaluated through course evaluations, course grades and employer survey feedback.

A new instructional modality of online instruction is being implemented for the program. All aquaculture lecture courses are designed to have an online component using Blackboard teaching portal. One course, Aquaculture 1, is currently taught as a fully online as well as traditional seated class. Other courses are offered as independent studies to solve scheduling conflicts for students and the independent student uses the Blackboard to progress through the course; they can also interact with the other students in the seated course through the online Discussion Board.

The effectiveness of these modalities is evaluated in an end-of-semester survey evaluation form that is completed by online students.

The program makes effective use of an aquaculture practicum course series, which is a hands-on modality of instruction involving students in the Aquaculture Tech facility lab as well as working with industry partners.

The effectiveness of this modality is evaluated as very effective because of the nature of the skills that are taught and are evaluated positively through the employer surveys.

The above instructional modalities involve and engage students with different learning styles by utilizing lecture, hands-on, visuals, presentations/research and textbook and reading comprehension.

Following is a description in outline form for the instructional modalities used in the Aquaculture Technology program.

Instructional Modalities

- 1) Traditional Instruction
 - a) Classroom Instruction
 - i) PowerPoint
 - ii) Slide Presentations/ Lecture from notes
 - iii) Lab (Practicums)
 - iv) Review Exercises: Games and in-class debates
 - v) Student Presentations and Posters
 - b) Effectiveness
 - i) Course Evaluations
 - ii) Course Grades
 - iii) Employer surveys
- 2) Online Instruction

Aquaculture Technology

- a) Aquaculture 1: AQU 111
- b) Other AQU courses taught online through Blackboard as independent studies
- 3) Cooperative Work Experience with Industry Partners
 - a) Effectiveness
 - i) Very effective
 - ii) See Employer Surveys

Effectiveness

- o Different Learning Styles
 - o Lecture
 - o Hands-on
 - o Visuals
 - o Presentations/Research
 - o Textbook and Reading Comprehension
- o Instructional Modalities –v- Purpose and Goals of Program
 - o Outcomes: qualified and competent to continue in the discipline
- o Distance Learning: Teacher is a Certified Blackboard Instructor

Section 2.G Funding for curricular changes or offerings:

No changes to the curriculum are planned.

Section 2.H Analysis

The program content is appropriate for training and educating students in the disciplines required for employment opportunities in the area and industry partners needs. As new industries emerge, such as biotechnology of biofuel from algae for example, there may be the need to add courses to the curriculum.

The entry level of math for incoming students should be set to a proficiency level of MAT 080 in order for students to progress through the curriculum in the specified sequence. Students without proper math skills end up taking courses before they are at a college level of proficiency and take longer to progress through the curriculum.

Aquaculture Technology

Section 3: Outcomes

Section 3.A The Outcome Identification Process

Outcomes were identified by combining a review of program requirements, advisory board input, industry history and program review committee discussions. Resources and references included the preferred skills required on industry job applications and those skills that are historically most important to the discipline (see Appendix IV for outcomes data and results).

Section 3.B. Administrative Outcomes Assessment Plan

Administrative outcomes are designed to improve the program, increase its appropriateness to industry needs, increase student success and retention and smooth out the day-to-day operations.

A.O. (1) The Aquaculture Department requires a full-time assistant to help with lab practicums and to maintain facility a daily basis and between semesters.

A.O. (2) The facility is currently maintained on an emergency basis but needs to move toward a preventative maintenance program.

A.O. (3) The program should explore the possibility for including more ornamental and non-food type aquaculture.

A.O. (4) Aquaculture students need to have a certain minimum level of math proficiency before attempting to take aquaculture courses.

Section 3.C. Program Outcomes Assessment Plan

Program outcomes are designed to assess the effectiveness of the program for helping students achieve overall goals. Assessments are related to the major goals identified by most incoming students.

P.O. (1) Students will get a job in aquaculture or applied marine sciences within 6 months of graduation.

P.O. (2) Students will enter the field of aquaculture as entrepreneurs and establish new businesses.

P.O. (3) Students will continue to the university under the 2+2 agreement and continue their education to earn Bachelor of Science degrees.

P.O. (4) Students will achieve their personal goals and complete the purposes for which they entered the program.

Section 3.D. Student Learning Outcomes Assessment Plan

Program Level Learning Outcomes (PLLOs) are incorporated into a capstone course, which is also the final aquaculture practicum. The PLLOs assess what have been identified as the three most important skill sets for graduates. PLLOs are assessed and graded by rubric.

Aquaculture Technology

PLLO (1) Proficiency in Water Quality Analysis

PLLO (2) Practical troubleshooting and problem solving

PLLO (3) Nitrification and recirculation aquaculture systems

Section 3.E. Follow-up of Student Served

Communication is maintained with students and graduates through email and personal telephone contact by program faculty to follow the students' achievements. Surveys are conducted of graduates and non-completers to assess the level of program performance. Both Institutional Effectiveness and department surveys are used in this assessment.

Section 3.F. Analysis (see Appendix IV for outcomes data and results).

The process of collecting outcomes data is affected by the small number of graduates to date. Responses were improved by diligently and repeatedly contacting graduates on a personal level. Much of the data used was collected by the Institutional Effectiveness office. Additional data was collected from the Cooperative Work Experience course employer evaluations, which served effectively as employer surveys. The capstone course and rubric were well designed and functioned extremely well as a measure of Program Learning outcomes.

One low mark surfaced when Skill # 2 of the PLLOs was analyzed. This was due to the lack of proper math skills which was also described in Section 2. The entry level of math for incoming students should be set to a proficiency level of MAT 080 in order for students to progress through the curriculum in the specified sequence. Students without proper math skills end up taking courses before they are at a college level of proficiency and take longer to progress through the curriculum.

Other PLLOs received above grade marks and indicate that appropriate instruction is being used. Employer surveys from COE 112 cooperative work experience indicate very positive responses and strong skill sets for students placed with employers in this course.

Section 4: Need for Change

Section 4.A SWOT Analysis/Focus Group

- Description of the process

A team was developed for evaluating the Strengths, Weaknesses, Opportunities and Threats (SWOT) for the Aquaculture Technology program. The team was entirely composed of individuals external to the program; it included members from industry disciplines, higher education / academic, related state agencies, students, program review committee member and Title III director / facilitator (see Appendix V for Program Review Committee members). The team held a single meeting to discuss the SWOT for Aquaculture Technology. The teaching faculty was not present in the meeting to encourage more direct and open comments. Results were typed as minutes and submitted to the program CAC. Results were discussed and analyzed in a meeting of the program review committee.

- Discussion of the results
Summarized results follow (see Appendix VI for Detailed SWOT Results):

Strengths

- The primary strength of the program is the instructor because he is a well known, experienced professional in the field and has excellent qualifications to teach. Other strengths are the instructor's ability to recruit, knowledge of the subject, hands-on approach and industry contacts, ability to make do with limited resources, breadth of knowledge and ability to impart knowledge to students.
- Graduates excel in their ability to conduct appropriate tasks.
- The aquaculture facility is well equipped with system technologies and study resources and is in an excellent location.
- Distance learning offerings and flexibility of the entire program.
- The very high quality of program advisory board is a unique strength.
- 2+2 program with Universities (also seen as an Opportunity)
- Exposure to a wide range of discipline-related opportunities and jobs.
- Strength of commercial fishing as a heritage industry in this area.

Weaknesses

- Budget is limited for the size and depth of the facility and program.
- Lack of support personnel and teaching assistant.
- Risk of instructor "burn out" and resultant loss of CAC.
- Need for more consistent PR and outreach; need personnel to carry this out.
- Lack of administration understanding of the amount of maintenance required.
- Expectation from previous history of grant awards that grants will continue.

Opportunities

- Future growth of aquaculture including business, research and agency elements.
- Increasing per capita seafood consumption and population growth.

Aquaculture Technology

- Distance learning can grow the program outside Carteret County.
- Various funding options for adding support personnel including county maintenance funds, grant funding, cost sharing with an agency, academic or industry partner.
- Marine biotechnology and non-food related aquaculture growth and development is advancing rapidly.
- New state projects coming on line such as the research hatchery at UNCW.
- Short programs could increase exposure, enrollment and foster new businesses.
- Slow demise of commercial fishing industry
- 2+2 program with Universities (also seen as a strength)
- University students could take a hands-on summer semester for credit.

Threats

- Lack of sufficient local job market
- Lack of commitment by the college leading to instructor fatigue.
- Core Sound shellfish lease ban; offshore aquaculture regulations not developed
- Cheap imports and slow demise of commercial fishing industry.
- Overall negative sentiments by the existing commercial fishing industry
- Brunswick CC taking on biotech.

Section 4.B. Recommendations

Feedback and recommendations from various assessment instruments included below:

Based on SWOT analysis:

- Continue to seek support personnel; may require creative funding / cost-sharing with maintenance department or other county proposal.
- Operate within program budget seek a larger budget from the college; grant writing should not be expected or required.
- Pursue a grant anyway since this seems the most assured way to obtain funding.
- Continue to develop and implement the distance learning modality for the program.
- Add NCSU to 2+2 partners with a written bilateral agreement.
- Expand live project to include ornamentals and non-food related products; eco-tourism and collecting cruises on program vessel.

Based on graduate surveys:

Continue to have as much hands-on opportunities as possible.

Based on cooperative work experience evaluations:

Continue to make this course available and flexible to accommodate students' interests. Completely satisfactory program for preparation and placement of students. Enroll only students who have completed all coursework and no overlapping courses. Begin planning early to couple students with industry partners for summer internships.

Based on I.E. surveys:

Grade and return homework and assignments in a timelier manner.

Aquaculture Technology

Based on employer surveys:

Keep sending quality students; you have a great program!

Based on Outcomes analysis:

- Continue to efforts to seek support personnel as an I.E. annual goal.
- Continue increasing the number of preventative maintenance tasks that are conducted on a schedule. Assess results yearly for progress.
- Continue good work of adding non-food species and mix of aquaculture systems.
- Confer with CAPS and SER about not registering students unless they have the appropriate math skills.

Based on PLLO assessments:

- Emphasize to new students the need for math proficiency before enrolling in the program.
- Establish an in-house MAT 070 proficiency level for new students and Aquaculture Facilities course.
- Create more opportunities for students to practice water quality testing in lab practicums.
- Continue the good work of education about nitrification in aquatic systems

Section 4.C. Strategies for Change

Based on the preceding recommendations there are several areas that can be addressed as changes to the program. Three of the most important are prioritized here:

1. Concentrate on improving the math proficiency of students through additional exercises and instruction in classes. Additionally, develop a local prerequisite of MAT 080 for new students, which would eliminate the unintentional enrollment of students who are unprepared for this college-level program.
2. Continue to seek a larger other costs budget to maintain the aquaculture facility and seek additional funding or creative partnerships or other ways to obtain a full-time assistant to the aquaculture instructor who can work with students and maintain the operational status and security of the aquaculture facility.
3. Develop outreach methods to extend the advertising and promotion of the program and the availability of the curriculum to areas outside Carteret County. Distance learning options should be developed and assessed to compare the results with traditional learning methods for this very hands-on type of program.

Section 4.D. One-Year Follow-Up

A one-year follow-up report to the VP for Instruction on the progress of C above (due April 15th each year following the review); first follow-up due April 15, 2010.

Aquaculture Technology

Section 5: Future issues

Section 5.A Anticipated future curricular changes and needs

The program does not anticipate changes to the curriculum within the short-term as the single instructor would not be able to teach additional courses. For the long-term if enrollment continues to increase then additional faculty can be hired and changes to the curriculum could be considered.

The program will continue to seek collaborations and bilateral agreements with additional universities both in North Carolina and outside the state. Students can transfer the AAS in AquaTech to these Universities and enter with junior status.

Section 5.B Market trends within the program area

The trend toward new aquaculture businesses producing seafood in North Carolina is slow in the marine sector. Offshore saltwater aquaculture may develop if planned collaborative projects come together and couple with favorable regulations. Freshwater aquaculture is growing more rapidly and back-yard aquaculture projects are becoming more popular as user-friendly systems are developed. The public aquarium sector is growing very rapidly, which brings in many out-of-state industry partners, and the marine science research sector is growing rapidly as well. NC is the third leading state in the discipline of biotechnology and the state is expending large amounts of funds to attract and support biotechnology in NC.

Section 5.C Equipment, space and faculty needs for future growth or continuation

There is no need for additional equipment at current student levels; rather the existing equipment requires annual maintenance and repair or occasional replacement of minor equipment. The Howard Building contains sufficient space for future growth. If enrollment continues to increase the program will need to hire adjunct faculty.

Section 5.D Future plan

The CCC Aquaculture Technology Program has been an innovator in collaborating with and establishing close relationships and industry partnerships with local facilities in this discipline. Other innovations include the program's efforts to assist community, university and state work in aquatic research by conducting grant-funded projects, which employ and engage students in the learning process. These efforts will be continued and expanded as opportunities arise such as biotechnology of biofuel production from algae, for example. Online courses can extend the reach of the Carteret County-based program so that is made available to students across North Carolina and outside the state.

Faculty Information
Instructional Program Review

Appendix I: Faculty Qualifications

Name: Philip S Kemp Jr

Education

Degree	Year	Institution	Subject Area
HS	1973	Southern Wayne Senior High	
AA			
BS/BA	1977	Auburn University	Biology/Fisheries
MS/MA	1982	Auburn University	Aquaculture
PH.D/Ed.D			
Other			

Professional Development

A. Related Continuing Education - College or University courses taken (last three years).

Term	Course Number	Credit hours	Grade
2006	Carteret Leadership Academy		
2008	National Ocean Sciences Bowl		

B. Related Continuing Education - Other Sources

Date	Course Name	Offered By	Contact Hrs
2007	Title III- Distance Learning Pioneer	Carteret Community College	
2007	Blackboard Bootcamp	Carteret Community College	
2008	Blackboard follow-up training	Carteret Community College	

B. Related Conferences Attended

Date	Location	Sponsoring Organization	Contact Hrs
2004-08	Atlantic Beach Sheraton	NC Aquaculture Conference	
2006	Greensboro	NCCCS Conference	

Faculty Information
Instructional Program Review

Scholarship Activity:

A. Related Publications

Date	Name of Publication / Title of Article	Authors
2007	Jour NC Acad Sciences/Key to Opisthobranchs of NC	Fernando and Kemp
2007	Oyster Hatchery Manual / Legislative project report	Kemp
2006	Aquaculture Restoration of Donax / USACE project	Kemp, et al
2006	Oyster Gardening- Sustaining a Resource / APNEP	Kemp
2005	Culturing Oysters in NC / NC Sea Grant Blueprint	Swartzenberg and Kemp

B. Related Conference Presentations / Papers

Date	Conference Sponsor	Title of Presentation	Authors
2004-06	NC Aquaculture Conference	Aquaculture in Education	Kemp
2006	AFS Tidewater Chapter	Donax Research	Penny and Kemp
2006	ECU/Phi Kappa Phi	Collaborations with 4-yr Univ.	Kemp

Related College / Community Service Activity

Name of Committee	Position	Title of Presentation	Authors
Oyster Restoration Plan	NCCF	committee member	Kemp
Oyster Hatchery Program	NC AQMs	committee member	Kemp
Hoop Pole Creek Committee	NCCF	committee member	Kemp
Marinc Sci Task Force	UNC	committee member	Kemp

Related Teaching / Training (unpaid)

Date	Course Taught	Agency or Institution	Hours (including prep)

Appendix II: Library Resources and Services

RESOURCES

Databases

The library has the following databases:

SIRS—SIRS consists of three databases with full-text articles that cover a wide variety of topics. These topics include social issues, government documents and the arts.

NC Live— Multiple databases with full-text magazine and professional journal articles that cover many disciplines, national and local newspapers, reference sources and research materials.

Liebert Online—It is an electronic access to peer-reviewed journals, all full-text searchable and linked to external bibliographic databases.

Magill's Medical Guide Online—it is an up-to-date and easy-to-use compendium of medical information suitable for student research as well as use by general readers, including patients and caregivers.

New England Journal of Medicine—New England Journal of Medicine is available for indexing and abstracts. It can be accessed from the library and the patron's home or other remote location. A password is not needed.

The other databases are available anywhere on campus. NC Live and SIRS are also accessible from home, using a password. The passwords are available through the library.

Instructional Audiovisual Materials

The library has a large collection of instructional audiovisual materials for faculty or staff use. These are located in the closed stacks area behind the circulation desk. Faculty and staff are welcome to go into this area to find what they need. The materials are arranged by subject on the shelves. A list of these materials may also be viewed by subject in our library catalog. All instructional AV materials must be checked out on your library account. Instructional AV materials for Aquaculture are grouped under the Aquaculture (AQUA) heading.

Library Collections

The library collection includes both reference and circulating materials. The Library of Congress call numbers for Aquaculture are the following:

SH—Aquaculture. Fisheries. Angling.

GC9—Oceanography.

QL120-121 & QL614-625—Marine Biology.

Library Website

Library services and resources can be accessed online through the library's website at: www.carteret.edu/library

Periodicals

The library has subscriptions to various magazines, newspapers, and professional journals. The latest issues can be found in the reading area of the library. Back issues are

also available for many titles. (See also Databases) The library has current subscriptions to the following:

[Aquaculture Magazine](#)
[Commercial Fisheries News](#)
[Fish Farming News](#)
[Hatchery International](#)

Research Guides

Research guides are available on the library webpage for the subject areas covered by classes and curriculums here at Carteret Community College. Research guides are listings of books, reference materials, journals and online sites available through the library. An **Aquaculture Research Guide** (Exhibit Section 1-D-3-1) has been provided in this packet.

SERVICES

Bibliographic Services

The library provides bibliographic services upon request for any faculty member needing a list of library books, videos, periodicals, etc. in their subject area. Please contact the library if you need such a list for program re-accreditation, program review, library collection evaluation, or personal use. A **Collection Usage Request Form** (Exhibit Section 1-D-3-2) is available for requesting a circulation report for the individual curriculums and programs.

Collection Development and Evaluation

The library accepts requests from faculty and staff for new library materials. Requests for curriculum materials receive first priority in purchasing. All new purchases are subject to available funding. After new materials are received and processed, notifications are sent via e-mail. To make a request for purchasing new books and AV materials, please contact the Librarian/Acquisitionist. Please prioritize multiple purchase requests. A **Library Materials Request Form** (Exhibit Section 1-D-3-3) is available for requesting materials.

Curriculum Area Coordinators, or their designee, are responsible for regularly evaluating the library's collections for their subject area. This involves reviewing the library's books, reference books, instructional videos, and periodicals to determine if the materials are up-to-date and meet curriculum needs. Once the collection is evaluated, a **Library Collection Evaluation Form** (Exhibit Section 1-D-3-4) should be completed and returned to the library. Requests for new materials to strengthen any weak areas in the collection may be made at this time. Out of date materials may also be withdrawn from the collection. Evaluations may be done by examining the materials in the library, or by reviewing a list of the materials provided through our bibliographic services. Contact the Librarian/Acquisitionist for more information.

Distance Learning Services

The following services are available to the college's distance learning students:

- Access to computers for login to Blackboard, word processing, research and student email

- Remote access to library catalog and online databases
- E-mail reference service: library@carteret.edu
- Mailing service to check out library materials
- Electronic Interlibrary Loan Request form & Patron Registration form
- Access to general library information, Magazine Indexes, library handouts and research guides via the library's website
- Online library tutorials and library skills exercise

Extended Checkout Periods for Faculty/Staff

Faculty and staff may check out books from the library's main book collection for six weeks. Instructional AV materials may also be checked out for six weeks. If a longer checkout period is needed for books or instructional AV, please contact the Library Technical Assistant and a semester or a year checkout can be arranged. Reference books may be checked out for one day. Checkout periods on all other library materials, such as best sellers, movies, and audio books, are the same as for all library patrons.

Interlibrary Loan (ILL) Services

The library borrows materials from other libraries for your personal or professional interests through interlibrary loan. An **ILL Agreement Form** (Exhibit Section 1-D-3-5) must be completed prior to requesting materials for the first time, and an **ILL Request Form** (book form-Exhibit Section 1-D-3-6 and periodical form-Exhibit Section 1-D-3-7) is completed for each item being requested. These should be submitted to the Library Technical Assistant.

Library Skills Classes

The library provides class instruction in the use of the library's online catalog, electronic databases, and general library use. To schedule your class for an instruction session, contact the Librarian. Please provide your name and phone number, the course name and number, number of students, proposed date and time for the session, which resources you wish to have taught, and if the library skills exercise is desired. The library skills exercise provides independent practice on the concepts and skills taught in the class session. You may schedule one or two sessions for your students and classes may be customized to fit your subject area. Please contact the library at least two days in advance to schedule your class. Classes are also welcome in the library for study and research when scheduled in advance.

Online Tutorials

Online tutorials can be accessed via the library's website at www.carteret.edu/library

There are tutorials on the following topics:

- Searching the Library Catalog
- Using the Library of Congress Classification System
- Searching NC Live and SIRS
- Evaluating Websites
- Citing Electronic Sources
- Citing Using the APA and MLA Formats

Reserve Materials

Faculty may place library or personal materials on reserve for student use. Reserves are held at the circulation desk. To place items on reserve, a **Reserve Request Form** (Exhibit Section 1-D-3-8) must be completed at the circulation desk for each item, and the item and form submitted to the Library Technician. Please allow 48 hours for processing reserves.

EVALUATION OF RESOURCES AND SERVICES

By the Aquaculture Curriculum Area Coordinator

The library has no databases with information that is appropriate to the aquaculture program mostly because the program has very specific informational needs. The college has subscribed to ASFA (Aquatic Sciences and Fisheries Abstracts) in the past but the cost is prohibitive for the amount that it is used and the nearby Duke Marine Laboratory has allowed CCC students to access the ASFA database through their library.

The library has a sufficient collection of instructional audiovisual materials for aquaculture use. It is up to date and combined with Internet resources and instructor generated material serves the audiovisual teaching needs of the aquaculture program.

Several excellent periodicals are available in the library, which supplement the program and community needs for current and timely information.

The books and reference books collection for aquaculture technology and applied marine sciences is up to date and useful to the program students and faculty. The material in the collection is wide ranging in subject area and includes both narrow and broad approaches to the discipline. The materials are used by students and include only a few gaps, which were discussed with library staff during evaluation and review.

Evaluated: 10/17/2008 by Philip S Kemp Jr, CAC- Aquaculture Tech

Appendix III: Aquaculture Technology Library Collection

Books

	Titles	Call No.
	Invitation to oceanography / Paul R. Pinet.	GC11.2 .P55 1998
	Oceanography, an introduction to the planet Oceanus / Paul R. Pinet.	GC11.2 .P56 1992
	The oceans / Ellen J. Prager with Sylvia A. Earle.	GC11.2 .P74 2000
	The sea around us / Rachel Carson ; introduction by Robert D. Ballard ; afterword by Brian J. Skinner.	GC21 .C3 2003
	Mysteries of the deep / edited by Joseph J. Thorndike, Jr.	GC21 .M97 1980
	The Ocean book : aquarium and seaside activities and ideas for all ages / Center for Marine Conservation.	GC21.5 .O28 1989
	Careers for aquatic types & others who want to make a splash / Blythe Camenson.	GC30.5 .C36 2008
	Marine science : marine biology and oceanography / Thomas F. Greene.	GC31 .G74 1998
	Seamounts, islands, and atolls / Barbara H. Keating ... [et al.], editors.	GC87.6 .S4 S42 1987
	Introduction to marine chemistry [by] J. P. Riley and R. Chester.	GC98 .R52 1971
	Wave of destruction : the stories of four families and history's deadliest tsunami / Erich Krauss.	GC222 .I45 K73 2006
	El Niño in history : storming through the ages / César N. Caviedes.	GC296.8 .E4 C39 2001
	El Niño, 1997-1998 : the climate event of the century / edited by Stanley A. Changnon ; contributors, Gerald D. B	GC296.8 .E4 E54 2000
	Floods, famines, and emperors : El Niño and the fate of civilizations / Brian Fagan.	GC296.8 .E4 F34 1999
	Tides, by D. H. Macmillan.	GC301.M3 1966
	A guide to estuaries of the Albemarle-Pamlico region, North Carolina / by Judith A. Gale ; illustrations by Whiting	GC512 .N8 G35 1989
	Drowning the North Carolina coast : sea-level rise and estuarine dynamics / by Stanley R. Riggs and Dorothea V	GC512 .N8 R54 2003
	The Sargasso Sea / by John and Mildred Teal ; illustrated by Leslie Morrill.	GC535 .T42 1975
	Endangered oceans : opposing viewpoints / Louise I. Gerdes, book editor.	GC1018 .E53 2004
	The shoresaver's handbook / Tucker Coombe.	GC1085 .C668 1996
	Environmental hazards : marine pollution / Martha Gorman.	GC1085 .G67 1993
	The drama of the oceans.	QH91.B66 1975
	The edge of the sea. With illus. by Bob Hines.	QH91.C3 1955
	The silent world, by J. Y. Cousteau, with Frédéric Dumas.	QH91.C66 1953
	Undersea explorer; the story of Captain Cousteau. With a message to young people by Captain Jacques-Yves C	QH91 .D75 1957
	The open sea: its natural history [by] Alister Hardy.	QH91 .H292 1970
	Marine biology : an ecological approach / James W. Nybakken.	QH91 .N9 1997
	The living ocean : understanding and protecting marine biodiversity / Boyce Thorne-Miller ; foreword by Sylvia E	QH91 .T45 1999
	Water light time / David Doubilet.	QH91.17 .D6827 1999
	Florida Keys National Marine Sanctuary : draft management plan/environmental impact statement.	QH91.75 .F56 F58 1995
	Florida Keys National Marine Sanctuary : draft management plan/environmental impact statement.	QH91.75 .F56 F58 1995
	Florida Keys National Marine Sanctuary : draft management plan/environmental impact statement.	QH91.75 .F56 F58 1995
	Aquagenesis : the origin and evolution of life in the sea / Richard Ellis ; with illustrations by the author.	QL121 .E579 2001
	The erotic ocean; a handbook for beachcombers. Illus. by Ingrid Niccoll.	QL121.R83 1971
	Sand rivers / Peter Matthiessen ; photos. by Hugo van Lawick.	QL337.T3M37 1981
	Invertebrate animals collection and preservation / compiled by Roger J. Lincoln & J Gordon Sheals.	QL362.8.I578 1979
	A guide to common freshwater invertebrates of North America / J. Reese Voshell, Jr. ; illustrated by Amy Bartlett	QL365.4 .A1 V67 2002
	Common jellyfish and comb jellies of North Carolina / Frank J. Schwartz ; illustrated by Leslie Barling.	QL377.5 .S3 1979
	Earthworms for ecology & profit [by] Ronald E. Gaddie and Donald E. Douglas.	QL391.04 .G2
	The world of seashells / Patrick Hook.	QL404 .H66 1998
	Sea shells common to North Carolina / Hugh J. Porter, Jim Tyler ; illustrations by Mrs. Carolyn Hoss and Mrs. Dc	QL404 .N6 P6 1981
	All colour book of seashells / by J.M. Clayton.	QL405 .D322 1974
	The collector's encyclopedia of shells, edited by S. Peter Dance. Photos. by Ian Cameron.	QL405 .D34 1974
	How to find, clean and collect shells / by Bob Tutelman.	QL405 .T88 1975
	Octopus and squid, the soft intelligence [by] Jacques-Yves Cousteau and Philippe Diolé. Translated from the Fre	QL430.3.O2C6813 1973
	The eastern oyster : Crassostrea virginica / edited by Victor S. Kennedy, Roger I.E. Newell, Albert F. Eble.	QL430.7 .O9 E37 1996
	Land hermit crabs in nature and as pets / by Edwin S. Iversen and Renate H. Skinner.	QL444 .M33 I93 1977
	Fundamentals of entomology / Richard J. Elzinga.	QL463 .E48 1997
	Insects.	QL467.U52 1952
	Secret weapons : defenses of insects, spiders, scorpions, and other many-legged creatures / Thomas Eisner, M	QL496 .E42 2005
	A field guide to Atlantic Coast fishes of North America / C. Richard Robins, G. Carleton Ray ; illustrations by John	QL621.5 .R63 1986
	McClane's field guide to saltwater fishes of North America : a project of the Gamefish Research Association / edi	QL625 .M32 1978

Ken Schultz's guide to saltwater fish / by Ken Schultz.	QL625 .S42 2004
The saltwater fish identifier / Al Ristori.	QL627 .R57 1991
Sharks! : the mysterious killers / Downs Matthews.	QL638.9 .M43 1996
Sharks / consultant editor, John D. Stevens.	QL638.9 .S454 1999
Living amphibians of the world. With photos. by Robert S. Simmons, and others.	QL641.C6 1961
Amphibians and reptiles of the Carolinas and Virginia / Bernard S. Martof ... [et al.] ; photographs by Jack Dermic	QL653 .N8 A4 1980
Biology and conservation of sea turtles / edited by Karen A. Bjorndal.	QL666 .C536 W65 1995
Voyage of the turtle : in pursuit of the Earth's last dinosaur / Carl Safina.	QL666 .C546 S24 2006
Crocodiles and alligators / consulting editor, Charles A. Ross ; illustrations by Tony Pyrzakowski.	QL666 .C9 C76 1989
Frogs / text by David Badger ; photography by John Netherton.	QL668 .E2 B274 1997
The birds of America [by] John James Audubon; with an introduction and descriptive text by William Vogt.	QL674 .A9 1965
Making birdhouses & feeders / Charles R. Self.	QL676.5 .S37 1985
Silence of the songbirds / Bridget Stutchbury.	QL676.7 .S88 2007
Handbook of North American birds.	QL681 .P35 1962
A field guide to the birds : a completely new guide to all the birds of eastern and central North America / text and	QL681 .P45 1980
A birder's guide to coastal North Carolina / John O. Fussell, III.	QL684.N8F87 1994
Winter birds of the Carolinas and nearby states / by Michael A. Godfrey.	QL684.N8G6 1977
World of the shorebirds / by Harry Thurston.	QL696 .C4 T48 1996
Eye of the albatross : visions of hope and survival / Carl Safina.	QL696 .P63 S24 2002
Penguin life : surviving with style in the South Atlantic / Andy Rouse & Tracey Rich.	QL696 .S473 R68 2007
The singing life of birds : the art and science of listening to birdsong / Donald E. Kroodsma ; drawings by Nancy I	QL698.5 .K76 2005
Why birds sing : a journey through the mystery of bird song / David Rothenberg.	QL698.5 .R68 2005
The atlas of bird migration : tracing the great journeys of the world's birds / general editor Jonathan Elphick.	QL698.9 .A88 1995
Mammals of the sea; biology and medicine. Edited by Sam H. Ridgway.	QL713.2.R53 1972
Mammals of the Carolinas, Virginia, and Maryland / Wm. David Webster, James F. Parnell, and Walter C. Biggs,	QL719 .M54 W43 1985
Born free, a lioness of two worlds.	QL737.C2A38 1960
The whale, mighty monarch of the sea [by] Jacques-Yves Cousteau and Philippe Diolé. Translated from the Frer	QL737.C4C6913 1972
Whale : giant of the ocean / Eric S. Grace.	QL737 .C4 G6 1996
Seals / text by Eric S. Grace ; photographs by Fred Bruemmer.	QL737 .P6 G73 1991
The apes: the gorilla, chimpanzee, orangutan, and gibbon; their history and their world.	QL737 .P9 R48 1971
Selected from In the shadow of man / Jane Goodall ; supplementary material by Edward Lavitt and the staff of Li	QL737 .P96 L37 1992
In search of the red ape [by] John MacKinnon.	QL737.P96M32 1974
Animal behavior : an evolutionary approach / John Alcock.	QL751 .A58 1998
Inside the animal mind / George Page.	QL785 .P225 1999
Never cry wolf.	QL795 .W8 M6 1963
From egg to adult : what worms, flies, and other creatures can teach us about the switches that control human de	QL951 .H6 1992
An introduction to embryology [by] B. I. Balinsky.	QL955 .B184 1970
Developmental biology / Scott F. Gilbert.	QL955 .G48 1997
The history of four-footed beasts and serpents and insects. With a new introd. by Willy Ley.	QL41.T68 1967
The history of four-footed beasts and serpents and insects. With a new introd. by Willy Ley.	QL41.T68 1967
The history of four-footed beasts and serpents and insects. With a new introd. by Willy Ley.	QL41.T68 1967
Reader's digest fascinating world of animals; a unique "safari" through our strange and surprising animal kingdor	QL50.R29 1971
Care of the wild feathered & furred; a guide to wildlife handling and care, by Mae Hickman [and] Maxine Guy. Co	QL83.2.H5 1973
Attack and defense.	QL121 .C67 1973
Sea of Cortez; a leisurely journal of travel and research, with a scientific appendix comprising materials for a sou	QL138.S82 1971
Tropical marine invertebrates of southern Florida and the Bahama Islands.	QL169.Z44 1974
Nature guide to the Carolina coast : common birds, crabs, shells, fish, and other entities of the coastal environme	QL196 .M49 1991
Joy Adamson's Africa.	QL337.K4A3 1972
The invertebrates : a new synthesis / R.S.K. Barnes, P. Calow, P.J.W. Olive ; with a chapter contributed by D.W.	QL362.B26 1993
Invertebrate zoology / Robert D. Barnes.	QL362.B27 1980
Kingdom of the seashell, by R. Tucker Abbott.	QL403.A22 1972
A collector's guide to seashells of the world / by Jerome M. Eisenberg ; consulting editor, William E. Old, Jr.	QL403.E35 1981
Shells [by] Roderick Cameron.	QL405.C35 1972
The spell of the shell / Martha Keeling Hodgson.	QL405.H62 1975
Field guide to seashells of the world / Gert Lindner ; translated and edited by Gwynne Vevers.	QL405.L5313 1978
The world's shells : a guide for collectors / by S. Peter Dance.	QL406.5.D32 1976

American seashells; the marine molluska of the Atlantic and Pacific coasts of North America [by] R. Tucker Abbo QL411.A19 1974

The American Museum of Natural History guide to shells--land, freshwater, and marine, from Nova Scotia to Flor QL416.E43 1976

The world of butterflies. Photos. by Eric Storey. QL542.D5 1972

On the track of unknown animals. Translated and abridged by Richard Garnett. With 78 drawings by Monique W; QL605.H413 1965

Marine ecology and fisheries / D.H. Cushing. QL618.3.C87 1975

Dynamic geography of marine fish populations / Alec D. MacCall. QL620.M33 1990

Wondrous world of fishes. [Editor-in-chief, Melville Bell Grosvenor. QL625.N33 1965

The reptiles, by Archie Carr and the editors of Life. QL644.C3 1963

The last of the ruling reptiles; alligators, crocodiles, and their kin, by Wilfred T. Neill. QL666.C9N45 1971

The great book of birds / John Gooders ; foreword by Roger Tory Peterson. QL673.G58 1975

Handbook of birds of eastern North America, with introductory chapters on the study of birds in nature, by Frank QL681.C46 1966

The Atlantic flyway / by Robert Elman ; photography by Walter Osborne. QL681.E4 1972

North American game birds of upland and shoreline / Paul A. Johnsgard. QL681.J64 1975

Waterfowl of North America / Paul A. Johnsgard. QL696.A5J62 1975

Gulls : a social history / Frank Graham, Jr. ; photos. by Christopher Ayers. QL696.C46G7 1975

The nightwatchers, by Angus Cameron and Peter Parnall. QL696.S8C35 1971

North American big-game animals / text by Byron W. Dalrymple ; photos by Erwin Bauer. QL715.D33 1985

Dolphins, whales, and porpoises : an encyclopedia of sea mammals / David J. Coffey ; American consultant edit QL737 .C4 C56 1976

Sea guide to whales of the world / Lyall Watson ; illustrated by Tom Ritchie. QL737 .C4 W36 1981

Diving companions: sea lion, elephant seal, walrus [by] Jacques-Yves Cousteau and Philippe Diolé. Translated fr QL737.P6C6813 1974

Encyclopedia of aquarium & pond fish / David Alderton. SF456.5 .A43 2005

Complete encyclopedia of the freshwater aquarium / John Dawes. SF456.5 .D39 2001

Exotic marine fishes / Herbert R. Axelrod, Cliff W. Emmens. SF457 .A92 1969

Marine fish / by Herbert R. Axelrod and Warren E. Burgess. SF457 .A94 1979

BSAVA manual of ornamental fish. SF457 .B73 2001

Focus on freshwater aquarium fish / Geoff Rogers, Nick Fletcher. SF457 .R63 2004

The complete aquarium / Peter W. Scott ; photography by Jane Burton and Kim Taylor. SF457 .S38 1995

Complete encyclopedia of the saltwater aquarium / Nick Dakin ; foreword by Julian Sprung. SF457.1 .D349 2003

The marine aquarium problem solver : practical & expert advice on keeping fish & invertebrates / Nick Dakin. SF457.1 .D36 1996

Marine ornamental species : collection, culture, & conservation / edited by James C. Cato, Christopher L. Brown. SF457.1 .M36 2003

An essential guide to choosing your marine tropical fish / Dick Mills. SF457.1 .M549 2001

Saltwater aquariums for dummies / by Gregory Skomal. SF457.1 .S58 2002

The complete book of saltwater aquariums; how to equip and maintain your marine aquarium and understand its SF457.1.S72 1974

Your first marine aquarium : everything about setting up a marine aquarium, aquarium conditions and maintainen SF457.1 .T867 1998

Aquatic systems engineering : devices and how they function / P.R. Escobal. SF457.3 .E88 2000

Setting up a tropical aquarium week-by-week / Stuart Thraves. SF457.3 .T57 2004

Clownfishes : a guide to their captive care, breeding & natural history / Joyce D. Wilkerson ; with a foreword by T SF458 .A45 W55 1998

Salt-water tropical fish in your home / by Gail Campbell. SF457.1 .C35 1976

Keeping live corals and invertebrates / Robert P. L. Straughan. SF457.1 .S75 1975

Engineering aspects of intensive aquaculture : proceedings from the Aquaculture Symposium, Cornell University SH34 .E54 1991

Modern methods of aquaculture in Japan / edited by Hiromu Ikenoue and Takeichir{014D} Kafuku. SH109 .M63 1992

Fundamentals of aquaculture : a step-by-step guide to commercial aquaculture / by James W. Avault, Jr. SH135 .A985 1996

Aquaculture science / Rick Parker. SH135 .P37 2002

Sustainable aquaculture : global perspectives / B.B. Jana, Carl D. Webster, editors. SH135 .S88 2003

Aquaculture water reuse systems : engineering design and management / edited by Michael B. Timmons, Thom; SH137 .A786 1994

Fish culture in undrainable ponds : a manual for extension / by Dilip Kumar. SH137.4 .K86 1992

Design and operating guide for aquaculture seawater systems / John E. Huguenin, John Colt. SH138 .H84 2002

Fish and shellfish farming in coastal waters [by] P. H. Milne. SH138 .M54 1972

Intensive fish farming / edited by C. Jonathan Shepherd and Niall R. Bromage. SH150 .S54 1988

The freshwater aquaculture book : a handbook for small scale fish culture in North America / by William McLarne SH159 .M438 1984

Freshwater aquaculture : a handbook for small scale fish culture in North America / by William McLarney. SH159 .M438 1998

Principles and practices of pond aquaculture / edited by James E. Lannan, R. Oneal Smitherman, George Tchob SH159 .P67 1986

Marine fish culture / by John W. Tucker, Jr. SH163 .T835 1998

Conditioning, spawning and rearing of fish with emphasis on marine clownfish / by Frank H. Hoff ; edited by Mart SH167 .A75 H63 1996

The Aquaculture of striped bass : a proceedings / Joseph P. McCraren, technical editor. SH167 .B3 A68 1984

National Fish Strain Registry-Trout : species tables of reported strains and broodstocks / Harold L. Kincaid ... [et SH167 .T86 1997

Fish medicine / [edited by] Michael K. Stoskopf ; original illustrations by Timothy H. Phelps and Brent A. Bauer. SH171 .S78 1992

Mollusc diseases : guide for the shellfish farmer / Ralph A. Elston. SH179 .S5 E44 1990

Atlantic Ocean fisheries. Joint editors: Georg Borgstrom [and] Arthur J. Heighway. SH213 .A8 1961

Inland fisheries management in North America / edited by Christopher C. Kohler and Wayne A. Hubert. SH328 .I54 1993

A history of the federal biological laboratory at Beaufort, North Carolina 1899-1999 / by Douglas A. Wolfe. SH332.2 .N8 W6 2000

Fish, markets, and fishermen : the economics of overfishing / Suzanne Iudicello, Michael Weber, and Robert Wie SH334 .I84 1999

Swimming in circles : aquaculture and the end of wild oceans / Paul Molyneaux. SH334 .M65 2007

Raising hybrid striped bass in ponds / written by Ronald G. Hodson and Jennifer Jarvis. SH351 .B3 H63 1990

North Carolina Blue Ribbon Advisory Council on Oysters : final report on studies and recommendations. SH365 .N67 F73 1995

Using remote setting to produce seed oysters in Louisiana and the Gulf Coastal region / John Supan. SH365 .S87 U8

Small-scale oyster farming / by George C. Matthiessen. SH367 .M38 1989

Intensive marine bivalve cultivation in a controlled recirculating seawater prototype system / editor, Ellis T. Boltor SH370 .I58 1982

Shellfishing the mid and southern North Carolina coast / Jim Swartzenberg. SH370 .S93

An international compendium of scallop biology and culuture : a tribute to James Mason / editors: Sandra E. Shu SH372 .I58 1991

Scallop and queen fisheries in the British Isles / James Mason. SH372 .M37 1983

Investing in commercial hard clam culture : a comprehensive guide to the South Atlantic states / by Charles Adar SH373.2 .A33 1991

Manual for growing the hard clam Mercenaria / by Michael Castagna and John N. Kraeuter. SH373.2 .C37 1984

A manual for the culture of the hard clam Mercenaria SPP. in South Carolina / Nancy H. Hadley, et al. SH373.2 .H33 1997

Clam gardening : a manual for the small-scale clam operation in North Carolina / [written by Phillip S. (Skip) Kem SH373.2 .K46 1991

Clam mariculture in North America / edited by J.J. Manzi and M. Castagna. SH373.2 .N7 C57 1989

Guide to Manila clam culture in Washington / Derrick R. Toba ... [et al.]. SH373.2 .U5 T63 1992

The lobster chronicles : life on a very small island / Linda Greenlaw. SH380.2 .U6 G74 2002

Marine shrimp culture : principles and practices / edited by Arlo W. Fast and L. James Lester. SH380.6 .M36 1992

Whaling on the North Carolina coast / Marcus B. Simpson, Jr., and Sallie W. Simpson. SH383.2 .S57 1990

Handbook of microalgal culture : biotechnology and applied phycology / edited by Amos Richmond. SH389 .H37 2004

A guide to soft shell crabbing. SH400.5 .C7 G85 1984

Fishing widows. SH441.L94 1974

The complete book of light-tackle fishing / Mark Sosin. SH441 .S735 2000

The Field & stream tackle care and repair handbook / C. Boyd Pfeiffer. SH447 .P464 1999

Successful ocean game fishing [by] Frank T. Moss. With selections by Nelson Benedict [and others] SH457 .M63 1971

Surf fishing the Atlantic coast / Eric B. Burnley ; foreword by George Reiger. SH464 .A85 B87 2006

Carolina Flare : Outer Banks boatbuilding & sportfishing heritage / Neal, John & Jim Conoley ; edited by Larry E SH531 .C66 2007

Coastal fishing in the Carolinas : from surf, pier, and jetty / Robert J. Goldstein. SH531 .G63 2000

Trout talk : an A to Z of trout fishing / Lesley Crawford. SH687 .C73 2004

The hungry ocean : a swordboat captain's journey / Linda Greenlaw. SH691 .S8 G689 1999

Fishing for weakfish and sea trout / William A. Muller. SH691 .W4 M8 1985

Introduction to aquaculture / Matthew Landau. SH135 .L36 1991

CRC handbook of mariculture / edited by James P. McVey. SH138 .C73 1993

Farming the edge of the sea [by] E. S. Iversen. SH163 .I9 1968

Diseases of fish; papers by Lionel E. Mawdesley-Thomas, Kenneth Wayne Burris, Joseph L. Knuckles, et al. SH171 .D57 1974

The Pathology of fishes : proceedings of a symposium / sponsored by the Registry of Comparative Pathology, th SH171 .P38 1975

The encyclopedia of marine resources. Edited by Frank E. Firth. SH201 .F56 1969

Sailing trawlers; the story of deep-sea fishing with long line and trawl, by Edgar J. March. SH255 .M324 1970

The book of the lobster; an informal account of what he is and what he is not, how he is caught, and how he is cc SH380.2 .U6 D83 1973

Beautiful swimmers : watermen, crabs, and the Chesapeake Bay / by William W. Warner ; drawings by Consuelc SH380.45 .U5 W37 1976

Frontiers of shrimp research / edited by P.F. DeLoach, W.J. Dougherty, M.A. Davidson. SH380.6 .F76 1991

Successful crabbing / Ernest J. Cottrell, Frank L. Mellaci, John B. Cottrell. SH400.5 .C7 C67 1976

Fiberglass rod making. SH452 .C53 1974

Salt-water fly-fishing handbook. SH456.2 .N57 1973

The saltwater fisherman's bible / Erwin A. Bauer. SH457 .B38 1991

Pier fishing in North Carolina / Robert J. Goldstein ; drawings by Bruce Tucker. SH457 .G618 1978

Offshore fishing from Virginia to Texas / Robert J. Goldstein. SH464 .S68 G65 1988

Coastal fishing in the Carolinas : from surf, pier, and jetty / by Robert J. Goldstein. SH531 .G63 1986

Successful bluefishing. SH691 .B55 L92 1974

Successful striped bass fishing [by] Frank T. Moss. With selections by Mark J. Sosin [and others] SH691 .S7 M67 1974

Reference

Title	Call No.
The Facts on File dictionary of marine science / [edited by] Barbara Charton.	REF GC9 .D53 1988
Encyclopedia of marine sciences / Hanneke (J.)G. Baretta-Bekker, Egbert K. Duursma, Bouwe R. Kuipers, (r	REF GC9 .E56 1998
The Encyclopedia of aquatic life / edited by Keith Banister and Andrew Campbell.	REF QL120 .E53 1998
The new encyclopedia of aquatic life / edited by Andrew Campbell and John Dawes.	REF QL120 .N49 2004
The new encyclopedia of aquatic life / edited by Andrew Campbell and John Dawes.	REF QL120 .N49 2004
SeaLife : a complete guide to the marine environment / edited by Geoffrey Waller ; principal contributors, Mic	REF QL121 .S43 1996
Marine invertebrates : 500+ essential-to-know aquarium species / Ronald L. Shimek.	REF QL122 .S55 2004
A field guide to coral reefs : Caribbean and Florida / Eugene H. Kaplan ; drawings by Susan L. Kaplan.	REF QL125 .K36 1982
Seashore animals of the Southeast : a guide to common shallow-water invertebrates of the southeastern Atl	REF QL135 .R87 1988
The Audubon Society field guide to North American seashore creatures / Norman A. Meinkoth.	REF QL151 .M44 1981
Common jellyfish and comb jellies of North Carolina / Frank J. Schwartz ; illustrated by Leslie Barling.	REF QL377.5 .S3 1979
Seashells of North Carolina / Hugh J. Porter & Lynn Houser.	REF QL404 .N6 P67 1997
American seashells; the marine molluska of the Atlantic and Pacific coasts of North America [by] R. Tucker A	REF QL411.A19 1974
Carolina seashells / Nancy Rhyne ; [cover illustration and text illustrations by Steve Baldwin].	REF QL415 .N8 R48 1989
A field guide to shells : Atlantic and Gulf coasts and the West Indies / R. Tucker Abbott and Percy A. Morris ;	REF QL416 .A22 1995
The Encyclopedia of insects / edited by Christopher O'Toole.	REF QL462.3 .O86 1995
A field guide to the insects of America north of Mexico, by Donald J. Borror and Richard E. White. Color and	REF QL464 .B65 1970
A field guide to eastern butterflies / Paul Opler ; illustrated by Vichai Malikul.	REF QL551 .E16065 1998
A field guide to western butterflies / Paul Opler ; illustrated by Amy Bartlett Wright.	REF QL551 .W3065 1999
A field guide to the beetles of North America : text and illustrations / by Richard E. White.	REF QL581 .W47 1983
Illustrated dictionary of tropical fishes. [Translation by A. Viggo W. Schultz]	REF QL614.7 .F7 1961
Early stages of Atlantic fishes : an identification guide for the western central North Atlantic / edited by Williar	REF QL621.2 .E27 2006
Early stages of Atlantic fishes : an identification guide for the western central North Atlantic / edited by Williar	REF QL621.2 .E27 2006
Fishes of the Atlantic Coast : Canada to Brazil, including the Gulf of Mexico, Florida, Bermuda, the Bahamas	REF QL621.5 .G66 1985
A field guide to Atlantic Coast fishes of North America / C. Richard Robins, G. Carleton Ray ; illustrations by	REF QL621.5 .R63 1986
Reef fish identification : Florida, Caribbean, Bahamas / Paul Humann ; edited by Ned DeLoach.	REF QL621.65 .H8 1994
National Audubon Society field guide to fishes. North America / Carter R. Gilbert, James D. Williams.	REF QL625 .G56 2002
McClane's Field guide to freshwater fishes of North America / edited by A.J. McClane ; ill. by Frances Watkir	REF QL625 .M3 1978
Ken Schultz's field guide to freshwater fish / by Ken Schultz.	REF QL625 .S38 2004
Ken Schultz's guide to saltwater fish / by Ken Schultz.	REF QL625 .S42 2004
Freshwater fishes of the Carolinas, Virginia, Maryland, and Delaware / Fred C. Rohde ... [et al.] ; photograph	REF QL627 .F7 1994
A field guide to freshwater fishes : North America north of Mexico / Lawrence M. Page, Brooks M. Burr ; illus	REF QL627 .P34 1991
National Audubon Society field guide to tropical marine fishes of the Caribbean, the Gulf of Mexico, Florida, I	REF QL637.5 .S55 1997
A field guide to reptiles & amphibians : eastern and central North America / Roger Conant and Joseph T. Co	REF QL651 .C65 1998
A field guide to western reptiles and amphibians : field marks of all species in western North America, includi	REF QL651 .S783 1985
The original water-color paintings by John James Audubon for The birds of America, reproduced in color for	REF QL674 .A9 1966
A field guide to birds' nests of 285 species found breeding in the United States east of the Mississippi River /	REF QL675 .H37 1975
A field guide to advanced birding : birding challenges and how to approach them / text and illustrations by Kε	REF QL681 .K38 1990
A field guide to the birds : a completely new guide to all the birds of eastern and central North America / text	REF QL681 .P45 1980
A field guide to western birds : a completely new guide to field marks of all species found in North America w	REF QL683 .W4 P4 1990
A birder's guide to coastal North Carolina / John O. Fussell, III.	REF QL684 .N8 F87 1994
Birds of the Carolinas / Eloise F. Potter, James F. Parnell, and Robert P. Teulings, in association with the Cε	REF QL684 .N8 P67 1980
A field guide to hawks, North America / William S. Clark ; illustrations by Brian K. Wheeler.	REF QL696 .F3 C59 1987
Guide to marine mammals of the world / National Audubon Society ; illustrated by Pieter A. Folkens ; written	REF QL713.2 .N37 2002
A field guide to the mammals : field marks of all North American species found north of Mexico / text and ma	REF QL715 .B8 1976
Whales, dolphins and porpoises / consultant editor, Mark Carwardine.	REF QL737 .C43 1999
A field guide to animal tracks. Text and illus. by Olaus J. Murie.	REF QL768 .M87 1974
Nature guide to the Carolina coast : common birds, crabs, shells, fish, and other entities of the coastal envirc	REF QL196 .M49 1991
Fishes of the world : an illustrated dictionary / Alwyne Wheeler ; line drawings by Annabel Milne and Peter Si	REF QL614.7.W47 1975
Marine fishes / Scott W. Michael.	REF SF457.1 .M52 2001
Freshwater fish culture in China : principles and practice / edited by Sifa Li, Jack Mathias.	REF SH105 .F74 1994
Marine aquaculture / Tadashi Tamura.	REF SH138 .T36 1966
Marine aquaculture / Tadashi Tamura.	REF SH138 .T36 1966
Marine aquaculture / Tadashi Tamura.	REF SH138 .T36 1966
Encyclopedia of aquaculture / [edited by] Robert R. Stickney.	REF SH20.3 .E53 2000
Aquaculture; the farming and husbandry of freshwater and marine organisms [by] John E. Bardach, John H.	REF SH135 .B37 1972

Aquaculture
Commercial Fisheries News
Fish Farming News
Hatchery International

Periodical Titles

Issues Kept

Current 2 years on display.
Current year on display.
Current year on display.
Current year on display.

Instructional AV Titles

Call No.

The beaches are moving. SCI AV 001 VHS 1990
Aquaculture SCI AV 017 VHS 1992
Beneath the North Atlantic Oceanic Research Group. SCI AV 019 VHS 1993
Physical oceanography produced by Scott Resources ; written and directed by Herb Saperstone. SCI AV 020 VHS 1990
Careers in marine science a diversity of opportunities / produced for NAML by Harbor Branch, Oceanogr. SCI AV 023 VHS 1996
Remote setting on micro cultch. SCI AV 028 VHS 1999
Oceans of life producer, Paul Cadieux ; director, Harold Arsenault ; Les Productions Bord de Mer Inc. SCI AV 037 VHS 2001
The amazing oyster / North Carolina Sea Grant. SCI AV 047 DVD 2004
The fragile reef coral in peril / [produced by] Infonation ; written & directed by Ron Blythe. SCI AV 048 VHS 2002
Volcanoes of the deep sea a production of The Stephen Low Company and Rutgers University. SCI AV 055 DVD 2005
The blue planet seas of life / a BBC/Discovery Channel co-production ; series producer, Alastair Fothergi SCI AV 056 Pt. 1 DVD 2002
The blue planet seas of life / a BBC/Discovery Channel co-production ; series producer, Alastair Fothergi SCI AV 056 Pt. 2 DVD 2002
The blue planet seas of life / a BBC/Discovery Channel co-production ; series producer, Alastair Fothergi SCI AV 056 Pt. 3 DVD 2002
The blue planet seas of life / a BBC/Discovery Channel co-production ; series producer, Alastair Fothergi SCI AV 056 Pt. 4 DVD 2002
Cultivation and farming of marine plants A.T. Critchley, M. Ohno, editors. SCI AV 061 CD 2001
World seaweed resources an authoritative reference system. SCI AV 062 CD 2006

FILM Titles

Call No.

Discovery diving at the Aeolus by Dale A. Hansen ; produced and edited by Optune.com FILM 457
Discovery diving at the Askhabad by Dale A. Hansen ; produced and edited by Optune.com FILM 458
Discovery diving at the Atlas by Dale A. Hansen ; produced and edited by Optune.com FILM 459
Discovery diving at the Caribsea by Dale A. Hansen ; produced and edited by Optune.com FILM 460
Discovery diving at the Hutton by Dale A. Hansen ; produced and edited by Optune.com FILM 461
Discovery diving at the Indra by Dale A. Hansen ; produced and edited by Optune.com FILM 462
Discovery diving at the Nancy Lee by Dale A. Hansen ; produced and edited by Optune.com FILM 463
Discovery diving at the Papoose by Dale A. Hansen ; produced and edited by Optune.com FILM 464
Discovery diving at the Portland by Dale A. Hansen ; produced and edited by Optune.com FILM 465
Discovery diving at the Schurtz by Dale A. Hansen ; produced and edited by Optune.com FILM 466
Discovery diving with sharks by Dale A. Hansen ; produced and edited by Optune.com FILM 467
Discovery diving at the Suloide by Dale A. Hansen ; produced and edited by Optune.com FILM 468
Discovery diving at the U-352 by Dale A. Hansen ; produced and edited by Optune.com FILM 469

Name of Program:

Aquaculture Technology

Appendix IV: Outcomes Data and Results

Administrative Outcomes

Number of program faculty & staff participating in the development of the outcomes:

1 F/T Faculty 1 P/T Faculty 4 Staff

Outcome	Outcome Indicator/ Assessment	Target/ Benchmark	Results	Use of Results	Person Responsible
The Aquaculture Department requires a full-time assistant.	Count the number of full-time assistants each year.	One full-time assistant hired for the AquaTech Program to help with lab practicums and to maintain facility a daily basis and between semesters.	One part-time assistant hired on Perkins grant	Continue to include this outcome as an I.E. annual goal	Aquaculture Technology Instructor

Proposed date of assessment: **Annually, Fall semester** Does this assessment require survey data? (Y/N) **Y**

Outcome	Outcome Indicator/ Assessment	Target/ Benchmark	Results	Use of Results	Person Responsible
The facility is currently maintained on an emergency basis but needs to move toward a preventative maintenance program.	Establish a Preventative Maintenance (PM) schedule and log the maintenance as it is performed.	25% of scheduled preventive maintenance completed by due date	Preventative maintenance items listed in spreadsheet format. Began scheduled maintenance.	Continue increasing number of PM tasks on schedule. Assess results next year.	Aquaculture Technology Instructor

Proposed date of assessment: **Annually, Fall semester** Does this assessment require survey data? (Y/N) **Y**

Outcome	Outcome Indicator/ Assessment	Target/ Benchmark	Results	Use of Results	Person Responsible
The program should explore the possibility for including more ornamental and non-food type aquaculture.	Document the addition of ornamental and non-food aquaculture material to courses.	one ornamental or non-food aquaculture item added to Aquaculture program	Added neon gobies, koi carp and algae culture for oil as biotechnology.	Continue good work and continue improving.	Aquaculture Technology Instructor

Proposed date of assessment: **Annually, Fall semester** Does this assessment require survey data? (Y/N) **Y**

Outcome	Outcome Indicator/ Assessment	Target/ Benchmark	Results	Use of Results	Person Responsible
Aquaculture students need a minimum math proficiency level before taking aquaculture courses.	Screen incoming students better and advise for a minimum proficiency of MAT 080.	70% of incoming students have proficiency in MAT-070	Interviewed students for math proficiency and review placement testing.	Conferenced with CAPS and SER about not registering students unless they have the appropriate math skills.	Aquaculture Technology Instructor

Proposed date of assessment: **Annually, Fall semester** Does this assessment require survey data? (Y/N) **Y**

Name of Program:

Aquaculture Technology

Program Outcomes

Number of program faculty & staff participating in the development of the outcomes:

1 F/T Faculty **1** P/T Faculty **4** Staff

Outcome	Outcome Indicator/ Assessment Method	Target/ Benchmark	Results	Use of Results	Person Responsible
Eighty percent of students will accomplish one of the three following goals: 1) get a job in aquaculture or applied marine sciences within 6 months of graduation, 2) enter the field of aquaculture as entrepreneurs and establish new businesses, 3) transfer to the university under the 2+2 agreement and continue their education to earn Bachelor of Science degrees.	Survey graduates	80%	90%	continue to help students find work opportunities; notify by email list and personal follow-up	Aquaculture Technology Instructor

Proposed date of assessment **Fall semester, annually** Does this assessment use a rubric? (Y/N) **N**

Outcome	Outcome Indicator/ Assessment Method	Target/ Benchmark	Results	Use of Results	Person Responsible
Students will achieve their personal goals and complete the purposes for which they entered the program.	Survey graduates	70%	100%		Aquaculture Technology Instructor

Proposed date of assessment **Fall semester, annually** Does this assessment use a rubric? (Y/N) **N**

Name of Program:

Aquaculture Technology

Program Level Learning Outcomes

Number of program faculty & staff participating in the development of the outcomes:

1 F/T Faculty 1 P/T Faculty 4 Staff

Outcome	Outcome Indicator/Assessment Method	Target/Benchmark	Results	Use of Results	Person Responsible
Proficiency in Water Quality Analysis: Students will demonstrate ability to test and analyze water samples.	Water quality parameters must be tested using a variety of methods and equipment. Potential uses for and evaluation of the water will be addressed. A written report will be turned in for assessment for AQU 166- Aquaculture Practicum 6.	90% of AQU students will score at least 70 of 100 on scored assessment rubric	75% (three of four students) scored over 70%	Create more opportunities for students to practice water quality testing in lab practicums.	Aquaculture Technology Instructor

Proposed date of assessment: **summer semester** Does this assessment use a rubric? (Y/N) **Y**

Outcome	Outcome Indicator/Assessment Method	Target/Benchmark	Results	Use of Results	Person Responsible
Practical troubleshooting and problem solving: Students will demonstrate ability to convert actual aquaculture problems to a series of mathematical calculations and compared with actual values.	Problem solving scenarios will be presented to students and analysis and report will be completed during the capstone course: AQU 166- Aquaculture Practicum 6.	80% of AQU students will score at least 70 of 100 on scored assessment rubric	50% (two of four students) scored over 70%	Establish a local prerequisite of MAT 080 for Aquaculture Facilities course.	Aquaculture Technology Instructor

Proposed date of assessment: **summer semester** Does this assessment use a rubric? (Y/N) **Y**

Outcome	Outcome Indicator/Assessment Method	Target/Benchmark	Results	Use of Results	Person Responsible
Nitrification and recirculation aquaculture systems: Students will demonstrate knowledge of "nitrification cycle" by performing analysis of nitrification cycle for a recirculation system and present results graphically.	Students will start a new recirculation system and graph the water quality changes. Analysis and report will be completed during the capstone course: AQU 166- Aquaculture Practicum 6	90% of AQU students will score at least 70 of 100 on scored assessment rubric	75% (three of four students) scored over 70%	This learning outcome had the highest average score. Continue current level of instruction.	Aquaculture Technology Instructor

Proposed date of assessment: **summer semester** Does this assessment use a rubric? (Y/N) **Y**

**AQU 166- Aquaculture Practicum 6
Outcome Assessment Rubric**

(A) Proficiency in Water Quality Analyses

(B) Practical Aquaculture Scenario Troubleshooting and Problem Solving

(C) Nitrification and Recirculation Aquaculture Systems

Assessment Level	Unsatisfactory	Satisfactory	Proficient	Outstanding
Grading Criteria	5 points	10 points	15 points	20 points
1. Introduction to and understanding of skills and concepts	Descriptions of concepts vague and incomplete. Assignment flawed indicating lack of sufficient knowledge of concepts.	Describes concepts adequately with few gaps indicating acceptable knowledge of subject material.	Describes concepts accurately. Descriptions are sufficient to convey good understanding of concepts.	Describes concepts in clear, concise terms conveying complete understanding of principles. Adds examples and extra material to emphasize clarity of explanations and understanding.
2. Proper analysis and critical thinking	Uses improper tests or improper methods. No thought to replication of problems or testing.	Uses mostly correct testing apparatus and methods. Completes all tests adequately but leaves gaps in methods descriptions. No replication of tests or methods.	Uses all correct testing apparatus and methods. Explains methods and some potential errors. Replicates some tests or makes only a single analysis.	Uses all correct testing apparatus and problem solving techniques. Fully explains methods and describes all possible and actual errors and calibrations. Validates answers by replication of all tests and/or methods. Uses critical thinking to analyze errors or inconsistencies.
3. Accuracy of results	Results mostly inaccurate.	Results mostly adequate or close but not exact. No attempt to explain potential errors.	All results accurate or close. Inaccuracies or inconsistencies and errors mostly addressed and explained.	All results accurate and validated with replicated testing. Inconsistencies replicated or fully explained with examples. Obvious extra effort to obtain correct values and data.
4. Graphics and illustrations	Graphics lacking or sloppily and hastily prepared.	Graphics adequate to convey results.	Graphics neat and sufficient to explain concepts and illustrate results.	Graphics professional quality with extra effort to portray material in a studious and understandable way. Variety of graphics used to improve report clarity.
5. Neatness and appearance	Overall sloppy with no attention to detail or neatness.	Report fairly clear and readable.	Report neat with outlined presentation.	Report very neat and professional appearing. Much attention to detail. Report sections and outlines added to increase readability and overall presentation.

Appendix V: Program Review Committee members

AQ Tech Program Review Committee 2008-09

The CCC aquaculture technology program review committee advisory board reviews and discusses the items in the Program Review outline and assembles the required information to complete the plan. The committee meets in person as needed and maintains email correspondence as appropriate to complete the review. The committee includes representation from external faculty, program faculty, library, curriculum committee, SER, and Title III director. Program faculty assumes role of chair; creates the documents, sets agenda and requests meetings as needed. Minutes are informally recorded and distributed.

Curriculum Committee

Penny Hooper

External faculty

Sean Prendergast

Student Enrollment Resources

Lori Wrenn

Library

Annette Davis

Title III director

Don Staub

Program faculty

Skip Kemp

Appendix VI: Detailed SWOT Results

Aquaculture SWOT

September 18, 2008

Facilitator: Don Staub

Program Review Team participant: Penny Hooper

Participants:

Jim Swartzenberg (NC Shellfish Growers Association)

Stuart May (NC Aquarium- PKS)

Craig Hardy (NC Division of Marine Fisheries)

James Morris (NOAA)

Martin Posey (UNC-W faculty)

Trent Boyette (student)

Cindy McCoy (student)

Strengths

- Skip, himself and his ability to recruit
 - He is “outstanding in the field”
 - He is “great at education”
 - His ability to impart his knowledge
 - His ability to problem solve with minimal resources
 - Skip is very “hands-on”
 - His breadth of knowledge of aquaculture; from shellfish to finfish
 - His knowledge of how to set up systems
- Students who complete the program “know how to do everything.”
 - Using microscopes, Fixing tanks
 - Record-keeping; using spreadsheets
 - Using fiberglass, laminates, plumbing
- The facility: its location – on Bogue Sound (at the center of the marine research community), and the infrastructure w/in
- The Lab courses he offers
- The distance learning offerings
- Providing a flexible program through distance learning
- One of the students commented that he learned a great deal about systems: open, closed, semi-closed; Skip exposed the students to different facilities and different systems. He also mentioned that he learned a lot about a wide variety of species, and about husbandry.
- Commercial fishing as a heritage industry in this area
- 2+2 programs (this was also seen as an opportunity)

Weaknesses

- Budget (lack of funding for supplies and personnel)
- Lack of support personnel
- The chance that Skip may get burned out (“It’s one person doing it by sheer will.”)
- Skip is spread too thin
- Skip not being able to do what he’s best at...he has to do it all
- Skip doesn’t have the means to teach and clean pumps at the same time

- That the administration does not understand that this is a very high maintenance field – 24/7/365
- “I’m not sure someone could replace Skip.”
- Need more consistent public relations (to show the public what the program is doing); need more output for the community to be aware (outreach has varied over time and should be more consistent)
- The expectation that Skip write grants

Opportunities

- Future growth of aquaculture in Eastern North Carolina
- Growth through Distance Learning – more students can be served through this modality (i.e. a broader audience to tap into)
- A new president may be supportive of the program
- County funding of a maintenance person (as opposed to seeking a full-time assistant through state funding)
- The shellfish hatchery that will be opening at Morris Landing will have 3-4 positions available
- Department of Marine Fisheries has ongoing (potentially growing) needs
- Carteret County Economic Development Council can support aquaculture as an economic growth opportunity
- Non-food related mariculture (i.e. diversify offerings):
 - Fuels and Pharmaceuticals
 - Ornaments (e.g. fish for aquariums)
- State-funded shellfish grower programs that require training (see Florida’s retraining program)
- Short programs (e.g. 2-3 day courses); there is a broad market of individuals that need hands-on training; especially at universities
- Focus on recruiting local students; employers like to see the hands-on training that the students receive in this program; a lot of students have this when they come to the school
- 2+2 programs (this was also seen as a strength)
- UNC-W summer students; they can attend courses of varying lengths (e.g. one-week, a couple of weeks, full summer)
- NCSU, UNC-CH, Duke students in the summer
- Could partner with Davidson CC (and their aquarium tech program) – a partner close to the ocean

Threats

- Lack of a sufficient job market
- Lack of commitment of the College; this leads to a slow deterioration of Skip’s energy level, “increasing fatigue.”
- The moratorium on shellfish leases
- Cheap imports
- Shellfish sold in NC that is coming from Chesapeake and Florida
- Overall demise of the commercial fishing industry

Brunswick CC taking on biotech



Aquaculture Technology

Aquaculture Technology teaches students the technical skills for managing and operating aquaculture operations. This includes producing high-quality seed stock for recreational stocking and for stocking into food fish production facilities as well as for raising market-size finfish and shellfish for human consumption.

For more information, call Skip Kemp at 222-6114 or via email at: kemps@carteret.edu

The image is a collage. At the top left, a pufferfish is shown against a blue background. To its right, a hand holds several oysters, with another hand holding a small pile of shells above them. The main part of the image shows a group of people, including students and staff, working in an aquaculture facility. They are gathered around a large black tank filled with oysters. One person is using a net to transfer oysters from a smaller tank. In the foreground, a woman is pouring a yellow liquid from a black bucket into a tank. Several people are holding cameras, suggesting a media event or a public demonstration. The background shows rows of large black tanks in an outdoor setting.