Open Ocean Aquaculture Telephone Survey: Summary Report

Robert A. Robertson, Erika L. Carlsen, and Mary A. Robertson

INTRODUCTION

The development of a significant and sustainable marine aquaculture industry in Northern New England is largely dependent on the ability of the coastal resource managers and planners, aquaculturalists, and the scientific community to design and develop the marine aquaculture industry in such a way as to represent the interests and values of the public. To fully represent these interests, there is a need for scientific data that allows for an understanding of coastal residents perceptions of marine aquaculture. This study sought to provide important and useful information for coastal managers and planners, developers, environmental groups, and policy makers on coastal communities residents salient beliefs about the potential advantages and disadvantages of marine aquaculture. Towards that end, this study assessed the behaviors, attitudes, and knowledge of three New England communities regarding open ocean aquaculture. In addition, to support specific future research endeavors, the salient beliefs of residents from New Hampshire's Seacoast region regarding open ocean aquaculture were also identified.

STUDY OBJECTIVES

The purpose of this study was to determine New Hampshire Seacoast residents' salient beliefs about open ocean aquaculture, as well as their attitudes towards aquaculture development. It also sought to explore where residents get their information about aquaculture, their potential interest in learning more about aquaculture in the future, and their method of preference for obtaining information. Two additional communities outside the New Hampshire seacoast region were also included in the survey to provide comparisons.

The specific objectives of the study were to:

1. Collect relevant demographic information and make comparisons between residents in the three New England communities included in the survey from statistically representative sample ;

2. measure preferences for the future development of the open ocean;

3. identify Seacoast residents' salient or prominent beliefs about open ocean aquaculture; and

4. determine the residents' knowledge, interests, and attitudes toward open ocean aquaculture.

SURVEY METHODS

Survey Implementation. Three New England communities were included in the survey. The primary study area was the New Hampshire Seacoast region including the towns of Newmarket, Exeter, Newfields, Madbury, Dover, Rollinsford, Stratham, Greenland, Newington, Portsmouth, Rye, Hampton, Hampton Falls, Seabrook, North Hampton, Durham, and New Castle (n=430). For comparison, two additional communities were also surveyed: the town of Rockland, Maine (n=160) and the town of Worcester, Massachusetts (n=163). A total of 753 households were surveyed from the three sampling sites.

A sample of households in each area was selected by a procedure known as *random digit dialing*, where a computer randomly selects the telephone numbers to be dialed. First, one of three-digit telephone area codes (e.g., 603) is selected. Next, one of the three-digit telephone exchanges which are currently used in the area (e.g., 772) is randomly selected. The computer then randomly selects one of the "working blocks"--the first two of the last four numbers in a telephone number (e.g., 64)--and attaches it to the randomly selected exchange. Finally, the computer program generates a two-digit random number between 00 and 99 (e.g., 57) which is attached to the previously selected prefix (772), and the previously selected working block (64) resulting in a complete telephone number (i.e., 772-6457). This procedure is repeated numerous times to generate the needed number of telephone numbers. The end result is that each household in the area in which there is a telephone has an equally likely chance of being selected into the sample.

The random sample used in this survey was purchased from Genesys Sampling Systems, Fort Washington, Pennsylvania. Genesys screens each selected telephone number to eliminate non-working numbers, disconnected numbers, and business numbers to improve the efficiency of the sample, reducing the amount of time interviewers spend calling non-usable numbers.

Each of the randomly generated telephone numbers was called by an interviewer at the University of New Hampshire (UNH) Survey Center. If the number called was not a residence, it is discarded and another random number was called. If it was a residential number, the interviewer then randomly selected a member of the household by asking to speak with the adult currently living in the household who has had the most recent birthday. This selection process ensures that every adult (18 years of age or older) in the household has an equally likely chance of being included in the survey. No substitutions are allowed. If, for example,

sanctuaries. Overall, participants were supportive of all uses with exception of resource extraction and coastal community economic development. Participants were overwhelmingly supportive of the use of the ocean for marine sanctuaries with over 84% of all participants indicating such use as "good". Participants were also supportive of fish farming, recreational and commercial fishing, and tourism development.

Community comparisons. Comparisons of attitudes between participants from each community, the Seacoast, Rockland, and Worcester, were completed using one-way analysis of variance (ANOVA) and are shown in Table 3b. Significant differences were noted between the communities across several of the potential future open ocean uses. Rockland participants were more supportive of coastal community economic development than both Seacoast and Worcester participants. Alternatively, Seacoast and Worcester participants were more supportive of fish farming, resource extraction, and marine sanctuaries than Rockland participants.

Table 3b: Community comparisons for future use of open ocean

Potential Use	Seacoast	Worcester	Rockland
Fish Farming[a]	4.05	4.01	3.82
Resource Extraction[a]	2.71	2.97	2.65
Coastal Community Economic Development[b]	2.81	2.84	3.23
Marine Sanctuaries[b]	4.42	4.19	3.97

[a] significant at the .05 level
[b] significant at the .001 level

Seafood consumption and knowledge of aquaculture. Participants were asked about their seafood consumption patterns as well as their knowledge of the marine fishery and aquaculture industries. Participants were frequent seafood consumers, with 37.4% purchasing seafood weekly and a median purchase frequency of once a month. Almost half (48.4%) of the participants were aware of whether their seafood purchased was farm-raised or wild-caught. Just under 37% stated that they purchased farm-raised seafood products, while only slightly less (36%) indicated that they did not, with the remainder indicating they were unsure of whether they purchased farm-raised seafood products. Most participants thought that the total yearly catch in New England fisheries was decreasing and a large majority, over 74%, agreed with the statement, "the New England Fishery is in crisis". When asked to estimate the percent of the world's seafood that is farm-raised, participants indicated an average of about 28%. In addition, most participants (68%) indicated they were "not at all" or "not very" knowledgeable about open ocean aquaculture and only 18.7% had heard of the UNH Open Ocean Aquaculture Demonstration Project. The results of these questions are summarized in Table 4a.

Table 4a: Seafood consumption and knowledge

Frequency of seafood purchases

Never	7.9%
Rarely to Biannually	11.3%
Quarterly to Monthly	27.6%
Biweekly	15.4%
Weekly	37.4%

Knowledge of whether seafood purchased farm-raised or wild-caught

Yes, I Know	48.4%

Do you purchase of farm-raised seafood?

Yes	36.9%
No	36.0%
Don't Know	27.1%

Percent of seafood that is farm-raised

Mean	27%

Trend of seafood catch in New England fisheries

Decreasing	60.0%
About the Same	22.3%
Increasing	17.8%

New England marine fishery is in crisis

Disagree	9.8%
Neutral	15.6%
Agree	74.7%

Level of knowledge on open ocean aquaculture

Not at all Knowledgeable	24.7%
Not Very Knowledgeable	43.3%
Somewhat Knowledgeable	28.4%
Very Knowledgeable	3.6%

Heard about UNH Open Ocean Aquaculture Project

Yes	18.7%

Community comparisons. Comparisons between the three different communities were completed using both chi squared (χ^2) and one-way ANOVA tests. Results indicate that Rockland participants were much more likely to know whether the seafood they purchased was wild-caught or farm-raised than both Seacoast and Worcester participants. In addition, Rockland residents were more likely to say that they purchased farm-raised seafood than participants from either of the other two communities and indicated a higher level of self-reported knowledge on aquaculture. Not surprisingly, New Hampshire Seacoast participants were more likely to have heard about the UNH Open Ocean Aquaculture Demonstration Project, than either of the other two communities. They also indicated a higher level of knowledge on open ocean aquaculture than the Worcester participants. These results are summarized in Table 4b.

Table 4b: Community comparisons for seafood consumption and knowledge

Chi squared (χ^2)			
Knowledge of whether seafood purchased is farm-raised or wild-caught[a]			
	Seacoast	Worcester	Rockland
Yes, I know	47.9%	25.2%	72.5%
Do you purchase of farm-raised seafood products?[a]			
Yes	36.3%	31.9%	43.4%
No	31.3%	39.6%	44.8%
Don't Know	32.4%	28.5%	11.7%
Heard about UNH Open Ocean Aquaculture Project[a]			
Yes	25.6%	7.1%	11.7%
ANOVA			
Level of knowledge on open ocean aquaculture[a]			
Mean	1.11	0.90	1.32

[a] significant at the .001 level.

BELIEFS ABOUT OPEN OCEAN AQUACULTURE

A number of open-ended questions that allowed participants to provide answers in their own words were included in the telephone survey. Open-ended questions can be insightful to a researcher, allowing ideas and concepts to emerge. Three open-ended questions were included in this survey to get an idea of the participants' salient beliefs of open ocean aquaculture. They were (1) How would you define saltwater or open ocean aquaculture?; (2) What do you see as the potential advantages of open ocean aquaculture?; and (3) What do you see as the some of the disadvantages of open ocean aquaculture?.

Due to future research goals, only the responses collected from Seacoast participants were analyzed. Their responses to the three open-ended questions were analyzed using TextSmart 1.0 (SPSS Inc.). Themes emerged in two fashions, by respondents using a similar word, or words, to describe an idea (i.e. aquaculture being "unnatural," or "not natural"), or by the researcher's decision that the words used to answer a question may be different between respondents (i.e. aquaculture causing "pollution," or the "destruction of resources") but the words are related to the same issue. In this example, the issue being raised is a concern for natural resource protection.

The results from the analysis of the three questions are listed below. The reader should keep in mind that this was a telephone survey and respondents were not given advance notice or time to think about the questions or their responses. Therefore, their responses are initial thoughts and valuable from a research standpoint because they describe the level of knowledge about aquaculture at a given time, Spring 2000, and with limited information available to the general public.

Question 1: "How would you define saltwater or open ocean aquaculture?" Nine categories were created from the results of asking respondents to define open ocean aquaculture. The most popular answer involved the concept of *farming fish* or other resources from the ocean. Terms, other than *farming*, that respondents also used included *growing, raising, cultivate, agriculture* and *harvesting*. Forty percent of the respondents' answers fell into this category. Two-thirds of these responses were unique, meaning that these respondents defined aquaculture only in these terms. The other one-third went further in their definitions and were placed in other categories as well.

Examples of *farming fish, etc. in the ocean* theme:
  "Some sort of farming process, but in the open ocean."
  "It would be, I expect, using the resources of the open ocean for fish agriculture."
  "Using saltwater to grow and cultivate products, the same for open ocean aquaculture."
  "Using the habitat for the farming of aquatic life."

The second most common response to this question was, "I don't know." Thirty percent of the respondents felt they were unable to define open ocean aquaculture. Another seven percent did not respond or refused to answer the question. This results in over one-third of the sample not providing a definition of open ocean aquaculture.

Study/research/control was another category derived from the data. Twelve percent of the sample thought that open ocean aquaculture involved some type of study, research or experiment that may or may not have to do with seafood.

Examples of *study/research/control* theme:
  "Study of the ocean."
  "Study of the use of productivity of fish; just to keep an idea of what is going on."
  "The study of the habitat as well as probably trying to do some farm raising."
  "The study of salt water."
  "Research water and contaminants as well as marine life."

Some structural aspect to open ocean aquaculture was mentioned by nearly 10 percent of the respondents. *Pens, containment* or *controlled environment* were commonly used terms by these respondents. The majority of these responses fell into more than one category, for example pens used in raising fish includes two categories, *farming* and *pens*.

Examples of *structural/pens/etc.* theme:
  "It's a penned in area in the ocean, the fish are fed to a certain extent."
  "Growing shellfish, clams, salmon, etc, in closed pens."
  "They set up big pens and they grow fish in the pens."
  "Any species that is in a salt water environment and the containment of those species."
  "Raising fish in a confined area."

Over five percent of the respondents mentioned an aspect of protection or management of resources in their definitions. This category is labeled, *protection/management/regulating/controlling.*

Examples of *protection/management/regulating/controlling* theme:
"I would imagine the preservation of sea life."
"It would be farming of the ocean to keep it environmentally safe."
"Go out to the ocean and study the fish and see if they're living or dying and see if they're living in filthy water-is the water polluted-is there oil in the water?"
"Fish farms, habitat care, fishing limits, taking care of the ocean."

Five percent of the respondents were under the impression that open ocean aquaculture encompasses all ocean resources. Nearly half of these respondents did not cite any other aspect to their definitions.

Examples of *encompasses all ocean resources* theme:
"Fish that live in the ocean."
"Anything living in salt water."
"Whatever living organisms are in the ocean and support the cycle."
"Helping the ocean do it's natural job but on a bigger scale."
"Water in the ocean."
"Ecosystem of the ocean."

Only three percent of the respondents mentioned a location as an aspect of their definition. This ranged from "far enough away from the shore," or "three miles out from the shore," or "near the coast." The final category, also containing three percent of the responses, were opinions given about aquaculture. This was the first of the open ended questions asked and it appears as if this small percent jumped at the opportunity to give an opinion. See Table 5

Table 5: Question 1: "Define open ocean aquaculture"

Response Category	#	%
Farming fish, etc., in the ocean.	176	40
I don't know.	136	30
Experiment/study/research is involved.	50	12
Structural/pens/containment of fish in the ocean.	39	9
No answer or missing	32	7
Protecting/management/regulating/controlling in the ocean environment.	30	6
Encompasses all ocean/salt water resources	23	5
The location in the ocean as an aspect to raising fish.	16	3
Opinions about aquaculture given rather than defining aquaculture.	13	3

for the number and percentages of responses by each category.

Immediately after the participants answered Question 1, they were provided with the following definition of open ocean aquaculture:

"We define open ocean aquaculture as the cultivation or farming of fish and shellfish species in containment structures, in the open ocean, out of sight from the seashore."

Question 2: "What do you see as the potential advantages of open ocean aquaculture?" The most common response regarding advantages of open ocean aquaculture, 33 percent of the responses, was to replenish the fish stock in the ocean. Fifty percent of these particular responses did not get categorized further as to a purpose for the replenishment. The other 50 percent had additional comments making another category possible, such as replenishing the fish population for general resource protection or to increase the seafood supply.

Examples of *replenish fish population* theme:
"To allow the normal supply of fish to be replenished."
"It can increase the supply without decreasing the wild population."
"The potential is unlimited, the more pens you build the more fish you can raise without limiting natural fish."

Thirty-one percent of the respondents believed that an advantage to open ocean aquaculture was an increase in the quantity of seafood. Quality of seafood was a less popular category with only 11 percent of the respondents mentioning that an advantage would be that quality of seafood would improve with open ocean aquaculture. Three percent of the sample mentioned the price of seafood being positively impacted by open ocean aquaculture.

Examples of *seafood quantity* theme:
"Very helpful because the fishing industries need more limits on the amount of fish that can be caught; aquaculture would supply more fish."
"Advantages would include an increase in the amount available."
"Provide seafood without endangering native species or over-fishing of species."

Examples of *seafood quality* theme:
"Raising more product, and a better product for the consumer."
"Control over the quality of the product and quantity. Likely to escape diseases and organisms. Quality control."
"The benefits are incredible - high protein kelp to different kinds of fish that would be able to feed the population. It's better for you than all the fast foods around."

The term *control* was used by approximately 11 percent of the respondents. A small portion of these were unclear about what type of control. The majority of these respondents used the term *control* to indicate the need to have some sort of intervention in order to either produce more or a better seafood product, or to protect ocean resources. Another 10 percent of the respondents more specifically cited that an advantage to open ocean aquaculture was to protect natural resources.

Examples of *control* theme:
"Lots of space, less expensive than to create artificial one, environment is more controllable."
"It would help prevent depletion of fish species, there would be more control."
"The protection of and the control of species of fish or shell fish."

Examples of *general resource protection* theme:
"Environmentally sustainable utilization of resources."
"Less commercial interference with the environment."
"It allows the natural resources to maintain a natural balance."

Economic benefits such as jobs were identified by 10 percent of the respondents. This category does not include prices of seafood which would benefit the consumer; only three percent of the respondents mentioned this as a benefit.

Examples of *economic/jobs/benefits* theme:
"Greater supply of seafood and aiding to the commercial fishermen."
"Help fishing industry, and prices, and protect fish."
"Not depleting natural resources, increased availability of seafood, and create jobs."

Table 6: Advantages of open ocean aquaculture

Response Category	#	%
Replenish fish population	145	33
Seafood quantity increases	135	31
Control resources better	50	11
Seafood quality improves	47	11
Economic/jobs/benefits improve	46	10
General resource protection	46	10
I don't know	44	10
No answer or missing	40	9
Study/research	21	5
Price of seafood decreases	15	3

There were fewer "I don't know" answers to this question than to the first question, define open ocean aquaculture. Ten percent of the respondents felt that they did not know an advantage to open ocean aquaculture while another nine percent were missing or refused to answer.

Study/research, is a theme in this question as it was in the definition question. It is considered an advantage to open ocean aquaculture by three percent of these respondents. See Table 6 for the number and percentages of responses by each category.

Question 3: "What do you see as the some of the disadvantages of open ocean aquaculture?" Approximately 40 percent of the respondents did not identify disadvantages to open ocean aquaculture. Seventeen percent of those sampled believed there were no disadvantages to open ocean aquaculture. Another eighteen percent of the respondents said, "I don't know," about disadvantages to open ocean aquaculture and another eight percent of the respondents did not answer the question.

Of those who mentioned one or more disadvantages, the most popular response, 21 percent, centered around the idea of aquaculture being "unnatural." This theme includes comments regarding negative impacts on the natural environment in general.

Examples of *unnatural - general* theme:
"Disturbs the natural environment."
"It is not natural - it is controlled by man."
"It can affect the natural ocean cycles."
"The impact machinery and humans have on the environment."

Effects on jobs and other economic factors were considered disadvantages by 13 percent of the respondents while tampering with native fish was considered a disadvantage by only 10 percent of the sample.

Examples of *jobs/economic* theme:
"Question of hurting the local fishermen and putting them out of work"
"Limiting for people that have livelihoods that depend on the ocean for their income."
"Harmful to local fishing economies, assume this is run by large corporation, thus affecting the local fishing economy."

Examples of *tampering with native fish* theme:
"Somehow you can create fish who could propagate a weak gene and if they escape then "They could put this gene back into the nature."
"Probably not right to breed animals like livestock"
"Takes away from natural beauty of ocean, destruction of large population of fish if anything goes wrong, interruption of natural evolution of fish species, destroying natural defense mechanisms of fish."

Another 10 percent of the sample believed that the disadvantages had to do with consumer and public interests. These comments included increases in seafood prices and decreased public access to the ocean. Over-fishing and disease were mentioned by a small portion of the sample, three percent and one percent respectively. See Table 7 for the number and percentages of responses by each category.

Table 7: Disadvantages of open ocean aquaculture

Response Category	#	%
Unnatural	90	21
I don't know	79	18
None (no disadvantages)	74	17
Jobs/economic impacts	57	13
Tampering with native fish	43	10
No answer or missing	37	8
Lack of control/too difficult	27	6
Bad for consumer interests	27	6
Bad for public interest	19	4
Over-fishing	14	3
Diseases	7	1

Examples of *consumer interest* theme:
"Limits the number of species of fish available to the consumer."
"Spread of disease and farm raised fish don't taste as fresh."
"Probably the danger and destruction of the products by weather and natural habitats of the water."

Examples of *Public interest* theme:
"If it interferes with sport fishing or other activities of the general public."
"Taking up area for fishing uses."
"Might take up the shoreline."

Summary of salient beliefs. The respondents understand that open ocean aquaculture has to do with fish farming in the ocean. Beyond that there is some confusion as to the other major issues involved. The majority believe that the main purpose for it is to replenish native fish stocks, which may increase seafood availability.

That 21 percent of the respondents see open ocean aquaculture as "unnatural" is significant. This seems driven mostly by the idea of genetic mixing between farm raised fish and native fish. There were mixed feelings about how this may effect seafood quantity and quality, and the current system for fishing. The data indicates that people need better information about open ocean aquaculture in terms of how it differs from traditional fishing, why fishing has

evolved to aquaculture, and what it means for seafood quantity, quality, price and environmental integrity.

IMPORTANCE AND ATTITUDES

Several questions were included to assess how important aquaculture issues were to the survey participants and what their attitudes towards aquaculture development were. In addition, participants interest in learning more about aquaculture and their current and preferred sources of information were also collected.

Importance of aquaculture issues. All participants were asked to indicate how important open ocean aquaculture and state and federal decisions about aquaculture is to them personally. In addition, participants were asked how important it is to them to know about aquaculture issues in Northern New England (NNE). Answers were provided on a five-point Likert-type scale of "extremely unimportant", "unimportant", "neutral", "important", and "extremely important". These were collapsed into 3 groups of "unimportant", "neutral", and "important". The results are shown in Figure 1. Participants overwhelmingly felt that aquaculture, state and federal decisions on aquaculture, and NNE aquaculture issues were important to them personally. For example, over 78% of participants felt that aquaculture issues in NNE were important to them personally. Similarly, over 75% of participants felt that state and federal decisions about aquaculture were important to them personally.

Figure 1: Importance of aquaculture issues
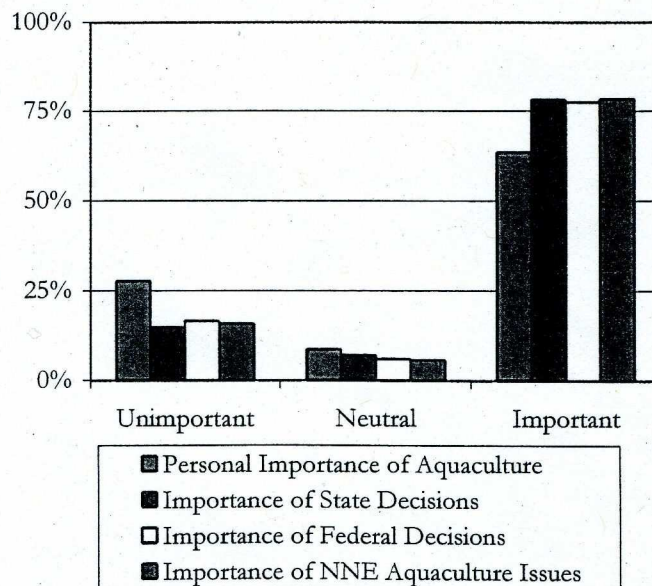
Community comparisons. Significant differences were noticed between the communities regarding how important aquaculture and NNE aquaculture issues were to them personally (see Table 8). Rockland and Seacoast community participants were slightly more likely than Worcester participants to feel that aquaculture and NNE aquaculture issues

are important to them personally. Rockland participants felt most strongly about NNE issues while Seacoast residents felt most strongly about the importance of aquaculture.

Table 8: Community comparisons for personal importance of aquaculture

	Seacoast	Worcester	Rockland
Importance of aquaculture[a]	3.53	3.27	3.36
Importance of NNE issues[a]	3.89	3.67	3.92

[a] significant at the .05 level.

Attitudes towards aquaculture development. Participants were asked three questions that sought to measure their attitudes towards aquaculture development in New England. Participants were asked to indicate whether they thought the development of aquaculture in New England was a GOOD or BAD idea on a five-step Likert scale of "extremely bad", "somewhat bad", "neither bad nor good", "somewhat good", and "extremely good". Participants were also asked whether they thought that aquaculture development was a HARMFUL or BENEFICIAL idea and a FOOLISH or WISE idea using the same scale for both measurements. The percentage of respondents in each category for the three questions are shown in Figure 2.

Participants were overwhelmingly supportive of aquaculture development in New England, with over 85% of participants indicating that they thought it was a good idea, a beneficial idea, and a wise idea. The mean value for all participants for the GOOD/BAD measure was 4.13 and for HARMFUL/BENEFICIAL and FOOLISH/WISE it was 4.12 and 4.16, respectively. These results show that participants were supportive of aquaculture development, with the largest portion indicating that it was moderately good, beneficial and wise.

Figure 2: Attitudes towards aquaculture development
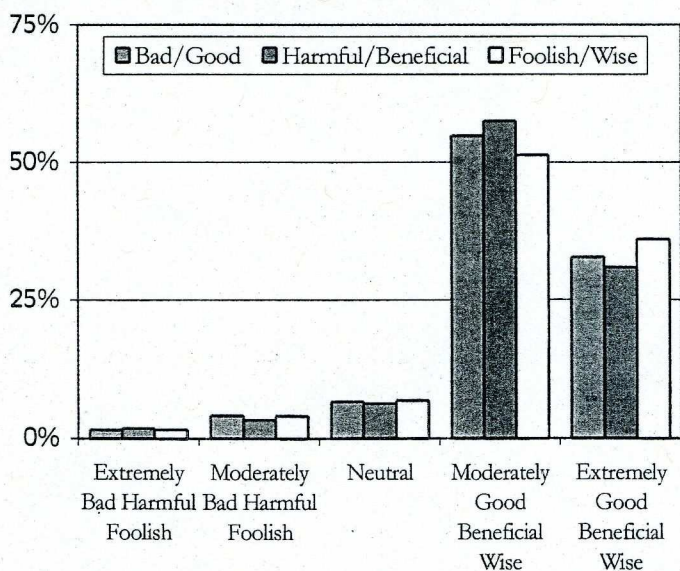
In addition to the three attitude questions, participants were asked to indicate how certain they were of their attitudes on a scale of 1 to 5 for each question. Participants certainty for the BAD/GOOD measurement was 3.59. Their certainty for HARMFUL/BENEFICIAL and WISE/FOOLISH was 3.71 and 3.73, respectively. This indicates that participants were between neutral and somewhat certain about the soundness of aquaculture development in New England.

Community comparisons. One-way ANOVA was used to compare participant attitudes across the three communities, however no significant differences were found. This indicates that the participants from each community held similar attitudes towards aquaculture development despite other differences, i.e. geographical location, mean income, knowledge of aquaculture.

Information interests and sources. All participants were asked if they were interested in learning more about aquaculture, employment and investment opportunities in the aquaculture industry, environmental consequences of aquaculture, potential benefits of aquaculture, relationship between the fishing industry and aquaculture, and aquaculture products. A large majority of participants (74.2%) were interested in learning more about aquaculture. Other information that many of the participants were interested in obtaining included environmental consequences of aquaculture (71.6%), potential benefits of aquaculture (70%), relationship between fishing industry and aquaculture (62.9%), and aquaculture products (58.5%).

Table 9a: Information about aquaculture

Information	Percent Interested
Interest in learning about Aquaculture	74.2%
Employment Opportunities	18.3%
Investment Opportunities	23.9%
Environmental Consequences	71.6%
Potential Benefits	70.0%
Relationship between fishing industry & aquaculture	62.9%
Aquaculture Products	58.5%

Preference of Information Sources	Portion Interested
Video	14.1%
Internet	21.0%
Newspaper	32.5%
Magazine	23.3%
Presentation	3.6%
Personal Contact	4.5%
Telephone Contact	1.0%

Current Information Sources	
Member of water-related club	9.9%
Member of Environmental Organization	14.8%
Subscription to Newspaper	59.6%
Subscription to Magazine	69.8%

University of New Hampshire
Open Ocean Aquaculture Demonstration Project

The open ocean aquaculture demonstration project is a multi-year project that will attempt to determine whether it is biologically, technologically, economically, and socially feasible to grow finfish in containment structures in the open ocean. The project has developed a commercial-scale test site, complete with infrastructure, for applying the culture and grow-out protocols developed in research efforts. The goal is to test the economic viability and overall feasibility of open-ocean aquaculture, or fish farming.

The demonstration site is located in a fairly remote area near the Isles of Shoals, within sight of the New Hampshire and Maine coast. Fish pens held summer flounder until October. Mussels are still being grown in that area.

The specific objectives for the initial phase of the demonstration project included:

- The development of partnerships between cage manufacturers, commercial fishermen, aquaculturists, regulatory personnel, and university scientists who will jointly participate in commercial-scale projects at the demonstration site.

- Holding a planning meeting to review the concept of the project, outline the ideas that have been developed by UNH, have a discussion of those ideas and modify them as needed, and develop a long-term plan for use of the site (other species, other containment structures, etc.).

- Selecting and characterizing the demonstration site.

- Obtaining all required aquaculture permits by synthesizing and representing all site information, and all proposed biological and technical methods, in the appropriate format and level of detail to the necessary regulatory agencies.

- Developing a site monitoring program of hydrography (temperature, salinity, dissolved oxygen, and transmissivity profiles), water quality (turbidity, suspended sediments, chlorophyll and nutrients), and benthos.

- Evaluate and select containment structures.

- Identify the fish and shellfish species most appropriate for the demonstration projects using several criteria.

- Demonstrate summer flounder and blue mussel production in an open ocean aquaculture site. A thorough evaluation of production of these two model species, ranging from the hatchery phase through harvest and marketing, will allow us to begin to evaluate the efficacy of offshore aquaculture, and will set the stage for future projects.

For more information visit:
http://ekman.sr.unh.edu/AQUACULTURE/

Sea Grant