

MINUTES
of the
Stakeholder Meetings on the
Report of the JSA Shrimp Virus Work Group

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PREFACE

New, highly virulent viruses have been documented in foreign shrimp aquaculture, and evidence suggests that these viruses could cause widespread disease in shrimp raised in aquaculture and in wild shrimp in the Gulf of Mexico and southeastern Atlantic coastal regions. To assess the risks associated with these emerging viral pathogens, the Joint Subcommittee on Aquaculture (JSA), which is under the auspices of the President's Office of Science and Technology Policy, formed the interagency Shrimp Virus Work Group. Four Federal agencies are represented on the Work Group: the National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (USFWS), the U.S. Animal and Plant Health Inspection Service (APHIS), and the U.S. Environmental Protection Agency (EPA).

On June 5, 1997, the Work Group submitted a report to the JSA entitled *An Evaluation of Potential Shrimp Virus Impacts on Cultured Shrimp and Wild Shrimp Populations in the Gulf of Mexico and Southeastern U.S. Atlantic Coastal Waters* (Shrimp Virus Report). The report contains a review of available literature and is a first step toward the goal of assessing the risks associated with the introduction and spread of nonindigenous shrimp viruses to the wild shrimp fishery and shrimp farming industries. During July 1997, the EPA's National Center for Environmental Assessment (NCEA), in cooperation with the JSA, sponsored a series of public meetings to gather stakeholder input on the Shrimp Virus Work Group's report and the shrimp virus issue.

This document contains the minutes of the stakeholder meetings that served as a review of the Shrimp Virus Report as well as the original Shrimp Virus Report (Appendix D). Eastern Research Group, a contractor for NCEA, conducted the stakeholder meetings and prepared the summary. NCEA believes that this interagency effort contains useful background information for further discussion of the issues surrounding the shrimp virus problem and provides an appropriate foundation for planning future risk assessment activities.

1. BACKGROUND

New, highly virulent viruses have been documented in foreign shrimp aquaculture. Evidence suggests that these viruses could cause widespread disease in shrimp raised in aquaculture and in wild shrimp in the Gulf of Mexico and southeastern Atlantic coastal regions.

The Joint Subcommittee on Aquaculture (JSA), which is under the auspices of the President's Office of Science and Technology Policy, formed the interagency Shrimp Virus Work Group to assess the risks associated with these emerging viral pathogens. Four Federal agencies are represented on the Work Group: the National Marine Fisheries Service (NMFS), the U.S. Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service (USFWS), and the U.S. Animal and Plant Health Inspection Service (APHIS).

On June 5, 1997, the Work Group submitted a report to the JSA entitled *An Evaluation of Potential Shrimp Virus Impacts on Cultured Shrimp and Wild Shrimp Populations in the Gulf of Mexico and Southeastern U.S. Atlantic Coastal Waters* (shrimp virus report, Appendix D). The report is a first step toward the goal of assessing the risk of disease, and the financial and economic risks associated with the introduction and spread of nonindigenous shrimp viruses to the wild shrimp fishery and shrimp farming industries.

Although it is not an actual risk assessment, the report is organized by elements of the risk assessment process. Risk assessment is a process that evaluates the likelihood that adverse effects may occur or are occurring as a result of exposure to one or more stressors. Risk assessments can help identify environmental problems, establish priorities, and provide a scientific basis for management and regulatory actions. The report provides the JSA with a basis for discussion and for selecting among a range of options for conducting a risk assessment.

During July 1997, these Federal agencies and JSA sponsored a series of public meetings to gather stakeholder input on the shrimp virus issue and the Shrimp Virus Work Group's report. Stakeholders include individuals from the wild shrimp fishery industry, the shrimp aquaculture industry, the shrimp processing industry, environmental organizations, regulatory and resource management agencies, and the general public.

Public meetings were held in the following locations:

- Charleston, South Carolina (July 15, 1997)
- Mobile, Alabama (July 21, 1997)

- Brownsville, Texas (July 23, 1997)
- Thibodaux, Louisiana (July 25, 1997)

2. INTRODUCTION

Each stakeholder meeting followed a similar format. Dr. Charles Menzie, who facilitated the meetings, opened with remarks explaining the purpose of the meetings. Dr. Kay Austin, a member of the JSA Shrimp Virus Work Group, provided an overview of the shrimp virus report. Presentations were made by local representatives of several stakeholder groups. Following these presentations, the floor was opened to questions and public comments. The agendas for each of the meetings are attached as Appendix A. Attendees of each meeting are listed in Appendix B.

These minutes contain the following sections:

- **Introductory Remarks and Overview of the Shrimp Virus Work Group Report**

This section describes Dr. Menzie's introductory remarks, Dr. Austin's overview of the Shrimp Virus Report, and questions from all four meetings about Dr. Austin's presentation. This section also includes a summary of discussions that occurred at each meeting about the management goal and key assessment endpoints as defined in the Shrimp Virus Report.

- **Stakeholder Presentations and Public Comments**

This section contains summaries of presentations made at each of the four meetings by local representatives of stakeholder groups. This section also contains summaries of public comments made by attendees at each of the four meetings. Written comments received on the Shrimp Virus Work Group Report appear in Appendix C.

3. INTRODUCTORY REMARKS AND OVERVIEW OF THE REPORT OF THE SHRIMP VIRUS WORK GROUP

At each meeting, Dr. Charles Menzie explained his role as meeting facilitator. He reviewed the meeting agenda, process, and ground rules. He stated that JSA specifically sought input from and the viewpoints of stakeholders on the following matters:

- Concerns about the threats posed by the shrimp virus
- The accuracy and completeness of the Shrimp Virus Work Group's report
- Any additional information that could be useful in evaluating the risks posed by shrimp viruses

Then, Dr. Kay Austin of EPA's National Center for Environmental Assessment and a member of the JSA Shrimp Virus Work Group, provided an overview of the Work Group's activities and the report's purpose, history, scope, and findings.

She reviewed JSA's charge to the Work Group:

- To develop a Federal interagency strategy to address the shrimp virus issue
- To identify relevant research on shrimp viruses, their mode of transmission, and their potential for introduction to U.S. shrimp resources
- To contribute to information and education on the shrimp virus issue
- To develop a risk assessment

She explained that, to date, the Work Group has:

- Developed and published the shrimp virus report
- Planned and held stakeholder meetings
- Begun to plan an expert workshop, to be held late in 1997, to formulate the risk assessment

Dr. Austin explained that the report is *not* a risk assessment. It is, however, structured as a problem formulation, which is a scoping activity performed early in the risk assessment process to collect and gather risk-relevant information and define major data gaps, uncertainties, and research needs. The report provides JSA with a basis for discussion and for selecting among options for conducting a risk assessment.

The report focuses on four major virus stressors, chosen because they have a broad distribution and different patterns of virulence: Taura Syndrome Virus (TSV), Infectious Hypodermal and Hematopoietic Necrosis Virus (IHHNV), White Spot Syndrome Virus (WSV), and Yellow Head Virus (YHV).

The report also reviews potential sources for the virus, including shrimp processing and aquaculture, as well as less significant potential sources such as bait shrimp, ballast water, migratory birds, and flooding.

Dr. Austin explained that the report *does not*:

- Perform an actual risk assessment
- Address information available after early 1997
- Discuss risk management options
- Recommend risk mitigation or management actions

She also briefly reviewed highlights of the report:

- New, highly virulent diseases have been documented in foreign shrimp aquaculture.
- Consumer demand for shrimp is growing at a rate of 7 to 9 percent annually. Because the wild shrimp fishery appears to have reached maximum harvest, importation has greatly increased over the last few years to meet this growing demand.
- None of the viruses in question pose a threat to human health.
- Recent events such as catastrophic viral outbreaks in shrimp aquaculture both in the United States and abroad, recent appearances of these organisms in shrimp in commercial retail stocks, and new information on the susceptibility of shrimp and other crustaceans to these organisms have prompted the development of the report.

Dr. Austin also provided data on the economic significance of the problem. The U.S. shrimp industry (harvesting and processing alone) is valued at \$3 billion per year. Imported shrimp account for over 85 percent of the market. In 1995, imports exceeded domestic production by a ratio of four to one, amounting to 720 million pounds. The largest share of these imports come from Latin America and Asia—areas of the world where shrimp viruses are

endemic. Aquaculture operations, in contrast, account for a much smaller portion of the U.S. economic market, ranging from 2 million pounds in 1991 to 4 million pounds in 1994.

Dr. Austin also provided a brief overview of the risk assessment process. She stated that evaluating risk is only part of the environmental decision-making process. To make an effective management decision, economic factors, social impacts, and political factors must also be considered. Uncertainty is always a part of the process of evaluating risk.

She then reviewed significant findings of the report:

- Viral disease has been associated with severe declines in wild shrimp harvests in the Gulf of California. Harvestable populations of the blue shrimp, *Penaeus stylirostris*, as well as a number of less dominant species, plummeted coincident with the observed occurrence of IHNV disease in the Gulf of California. Beginning in 1987, the *P. stylirostris* harvest declined by almost 1,000 tons per year, and it took nearly six years for harvestable populations to recover. The work group found that this was the best piece of epidemiological information suggesting a link between introduced viruses and declines in wild shrimp populations.
- Nonindigenous shrimp viruses have not been documented in U.S. shrimp populations, but detection efforts have been minimal. We have not been sampling them for very long. We may not have been using the right technology or have been looking in the right places.
- Numerous disease outbreaks have occurred in U.S. shrimp aquaculture since 1994. Outbreaks have occurred in Texas, South Carolina, Hawaii, and the National Zoo in Washington, D.C. In January 1997, a White Spot-like virus was detected at the Waddell Research Center in South Carolina.
- Harvesting practices in foreign aquaculture could put U.S. natural resources at risk. The Work Group learned that when an outbreak occurs in a foreign aquaculture setting, often the affected crop is immediately harvested and exported.
- Shrimp may be contaminated from a number of possible sources. Aquaculture and shrimp processing are two potentially important sources that may affect wild shrimp populations. The Work Group also considered a number of other possible sources, such as live and frozen bait shrimp, ballast water, and natural spread via migratory birds, water currents, and flooding.

- In laboratory studies, we have determined that all life stages of shrimp are potentially at risk from the four viruses covered by the report.
- Species other than shrimp may be at risk from these viruses. Viral disease could result in alterations to ecosystem structure, potentially affecting predator-prey relationships, competition, and nutrient cycling. Many other economically and ecologically important organisms that occupy the coastal areas feed on juvenile shrimp, and impacts to these organisms could potentially be serious if the wild shrimp populations on which they feed decline. Other organisms may actually be susceptible to disease themselves or serve as carriers of these viruses.
- Enhanced collaboration among various agencies and stakeholder groups will be essential to control disease outbreaks.

Dr. Austin concluded her presentation by discussing next steps:

- Complete the stakeholder meetings.
- Conduct a planning workshop of experts late in 1997. Workshop participants will consider the shrimp virus report, all comments made at the stakeholder meetings, and comments received in writing.
- Conduct the risk assessment.

Questions About the Shrimp Virus Report Overview

Charleston, South Carolina

July 15, 1997

Q: What is the Shrimp Virus Working Group's time frame?

A: The report is finished, and we are now receiving comments in writing and at these stakeholder meetings. These comments will be considered at the expert workshop to plan the risk assessment, to be held sometime in late 1997. The risk assessment could take anywhere from one to three years to complete.

Q: Why do you keep referring to the shrimp virus situation as a problem, when the purpose of the risk assessment is to determine if there is a problem? To date, we've seen no evidence of the virus in wild shrimp populations.

A: Because so many people are concerned about the situation, JSA considers it to be a problem. No final conclusions or risk management recommendations have yet been made by the Work Group or JSA.

Q: What was the cause of the viral outbreak in the Gulf of California?

A: From what we know, there was a severe viral outbreak in an aquaculture setting, and the ponds were dumped. A Spanish-language document [a thesis prepared by Carlos R. Pantoja Morales while studying the incidence of IHHNV in populations of shrimp off the coast of Sonora, Mexico] contains evidence of a simultaneous occurrence of the disease and severe declines in the dominant population of shrimp in that area.

Q: Did the wild stocks recover?

A: Yes. The declines occurred over a four-year period, and it took about six years for harvestable populations to return.

Q: How can we get copies of this Spanish-language document?

A: By contacting Dr. Tom Siewicki at the Southeast Fisheries Science Center at the NMFS Charleston Laboratory.

Mobile, Alabama

July 21, 1997

Q: You mentioned that the virus has been documented in the wild [in the Gulf of California] in *P. stylirostris* and *P. vannamei*. Have you examined all the other possible explanations for the declines in these populations, such as water temperature, the effects of El Niño, or the effects of predation?

A: [Answered by Tom McIlwain, NMFS] There is still some controversy as to whether the virus was the sole source of these declines, but the best evidence we have to date suggests that the declines were due to a viral problem.

Q: Are you using IHHNV as an example, or are you throwing it in the mix with the rest of the viruses?

A: [Answered by Tom McIlwain] USDA's shrimp farming program has captive brood stocks that are used to produce Specific Pathogen-Free (SPF) shrimp. These stocks are screened for IHHNV, among other viruses.

Q: Can you elaborate on the technical workshop to be held later this year?

A: The Shrimp Virus Work Group is putting together a plan to develop a workshop that we hope will occur in November 1997. We expect to invite 15 to 20 technical experts. They will consider the report itself and public comments that are received in response to the report, both in writing and at these four stakeholder meetings. This group will develop the plan to conduct the risk assessment.

Q: When you do a risk assessment, how will you express the risks to aquaculture? Will it be in generic, qualitative terms, or will you be able to quantify the risk?

A: The JSA would like to see a tiered risk assessment done. The initial risk assessment will be qualitative. This report goes a long way toward this goal, but it has some inadequacies and uncertainties that we hope this process will help to eliminate. An actual quantitative

assessment would still be difficult, although we hope that we will be able to begin work on that. The report lists numerous uncertainties and data gaps, and we will need new research at some point to fill in some of these holes.

Q: How can you do a risk assessment if all these data gaps exist? What will you base the risk on?

A: [Answered by Bill van der Schalie, EPA] Risk assessment is always done in the face of uncertainty. With respect to the shrimp virus problem, the uncertainties are rather large. USDA has used a risk assessment approach, with respect to introduced species, that follows a formalized process that begins with a qualitative assessment based on expert judgment. This process can be useful to help reach conclusions about risk, identify data gaps and major areas of uncertainty, and make intermediate policy decisions about how to deal with problems. As the risk assessment process goes forward, it doesn't preclude taking management actions that may be necessary or doing the important research that is required.

Q: From the processor's standpoint, the worst-case scenario would be stopping imports from certain countries because of virus possibilities or making processors implement expensive procedures. Can we expect that management recommendations will come out of the risk assessment?

A: The risk assessment will evaluate the scientific aspects of the issue. Management issues will be handled separately from the risk assessment process.

Q: I am concerned that the report states that IHHNV is a cause of shrimp declines in the wild catch in the Gulf of California without examining other factors that might have contributed to these declines. The presentation overhead that summarizes the report's findings states, "Viral disease reduced wild shrimp harvests." This statement is misleading.

A: The report does not say that IHHNV was a *cause*. It does say that severe declines in the wild catch were associated with the observed occurrence of IHHNV in wild shrimp populations in the Gulf of California.

Brownsville, Texas

July 23, 1997

Q: [By Tony Reisinger, Texas A&M Advisory Service] Is there direct evidence that IHHNV caused the decline in the population of shrimp in the Gulf of California?

A: The report calls the decline an “association.” Given the information we have, the linkage between the declines and IHHNV is fairly conclusive.

Q: So they actually did find IHHNV in the natural population?

A: That is our understanding.

Q: Are they still detecting IHHNV in the natural population, and has the population rebounded?

A: I do not know if IHHNV is still being detected. It is my understanding that the population has rebounded.

Q: [By Wilma Anderson, Texas Shrimp Association] Has the population of shrimp in the Gulf of California returned to normal?

A: Yes, that is our understanding.

Q: What is the time frame for the risk assessment?

A: We will have a workshop in the fall of 1997 to plan the risk assessment. The JSA Shrimp Virus Work Group advised the JSA that a tiered approach should be taken to developing the risk assessment. The first phase would be a qualitative risk assessment similar to the approach taken by the USDA’s non-indigenous species risk assessment, which uses ranking factors to establish where risks may be. The qualitative risk assessment should provide a useful tool for guiding policies that might be needed to deal with the problem. We don’t have a timetable yet, because we will rely on the experts in the fall to help guide the risk assessment. An extensive quantitative assessment could take one to three years. A qualitative assessment can be conducted in three to six months.

Q: Within a year then, we should have some answers.

A: Yes, I would hope so.

Q: [By Dr. Porfirio Alvarez, Instituto Nacional de la Pesca] Could the decline in the shrimp population in the Gulf of California be the result of natural causes other than the virus?

A: The severe declines were observed coincident with IHHNV infection. We don't have the information to know whether this virus occurs naturally in the Gulf of California.

Thibodaux, Louisiana

July 25, 1997

Q: Have you found anything that would remove the viruses?

A: The report does not go into risk mitigation.

Q: Have techniques been developed to evaluate the contamination of shrimp feed materials—specifically, the parts of shrimp that are used as feed?

A: At the three previous stakeholder meetings, people have spoken to this concern. I have not heard of any recent testing, but there is some old information from the 1960s about testing for bacterial organisms. Testimony at meetings earlier this week and last has indicated that the feed processing temperatures are high enough to destroy viruses, but I have not seen actual data on this.

Q: How long will the risk assessment workshop that is planned for November, 1997 take?

A: It will extend for approximately 2½ days.

An attendee suggested that Congressional staff and the White House Council on Environmental Quality be involved in the November risk assessment workshop.

Review of Shrimp Virus Report Management Goal and Assessment Endpoints

At each meeting, Dr. Charles Menzie reviewed the report's management goal and assessment endpoints and invited meeting attendees to comment on these components of the report.

Management Goal: To prevent the establishment of new disease-causing viruses in wild populations of shrimp in the Gulf of Mexico and southeastern U.S. Atlantic Coastal waters, while minimizing possible impacts on shrimp importation, processing, and aquaculture operations.

Assessment Endpoints:

1. Survival, growth, and reproduction of wild penaeid shrimp populations in the Gulf of Mexico and southeastern U.S. Atlantic coastal waters.
2. Ecological structure and function of coastal and near-shore marine communities as they affect wild shrimp populations.

Charleston, South Carolina

July 15, 1997

Attendees did not comment, but one individual asked for clarification of the meaning of the second assessment endpoint.

Mobile, Alabama

July 21, 1997

There were no comments.

Brownsville, Texas

July 23, 1997

A participant stated that underlying the report is an assumption that there are no existing viruses or diseases in the wild. He stated that this assumption is not valid and that it is necessary

to know what exists before we can know what is new. Another participant noted that there have been scientific publications about diseases in shrimp in the Gulf of Mexico. Yet another participant commented that we need to develop a better sense of what viruses are present in wild populations. He stated that a monitoring program is necessary to establish a baseline.

Thibodaux, Louisiana

July 25, 1997

There were no comments.

4. STAKEHOLDER PRESENTATIONS AND PUBLIC COMMENT
Charleston, South Carolina
July 15, 1997

Stakeholder Presentations

Bill Cox, South Carolina Shrimp Growers Association
Yonges Island, South Carolina
Aquaculture Industry Representative

Mr. Cox made several key points:

- Shrimp aquaculture is helping to meet market demand and is reducing U.S. reliance on imported shrimp.
- The aquaculture industry has worked closely with the South Carolina Department of Natural Resources during 1996 and 1997, and these efforts appear to have produced results. In 1996, several farms were infected with Taura Syndrome Virus (TSV). So far in 1997, the virus has been detected on only one farm in a single containment area.
- Working as a team with South Carolina state government, the aquaculture industry has put management controls in place to minimize the impact of the virus.
- The South Carolina Shrimp Growers Association supports a modified risk assessment focused on discovery of facts about the virus.
- The aquaculture industry has a responsibility to support efforts to keep existing or new viruses from entering the wild or from entering the farm from the wild.
- Shrimp farming is dependent upon a clean environment free from viruses, disease, and pollutants.
- There is no new information in the report; it simply provides a recap of what we already know. JSA needs to expend funds on research and development to combat these viruses, not merely to develop more reports and assessments. The industry needs facts, solutions, and management plans to eliminate these viruses in the United States.
- JSA needs to secure funds for research and development to answer the following questions:
 - Do the viruses really have an effect on wild stock?

- Where do the viruses come from? Have they been here all along?
- What can we do as farmers, processors, and commercial shrimpers to prevent the spread of the virus?

Mr. Cox made the following specific comments on the report:

- The report states that the White Spot Syndrome Virus was diagnosed at the Waddell Mariculture Center in South Carolina. The report should clarify that, to date, the White Spot Syndrome Virus has not been diagnosed on a farm in South Carolina and that the infected shrimp diagnosed at Waddell were in fact taken from the wild.
- The report belittles the importance of aquaculture in the U.S.
- The term “exotic” viruses has negative connotations. Referring to viruses as “exotic” sensationalizes the issue. It can also imply that the use of non-native shrimp species in aquaculture is negative.
- The statement that the U.S. domestic market is dominated by the wild shrimp industry is not true. The market is in fact dominated by imported shrimp.
- The report downplays the significance of the Specific Pathogen-Free (SPF) program. Had South Carolina been more vigilant about preventing non-SPF shrimp from entering the state, TSV may not have occurred in the state.
- It is important to distinguish between “risk” and “real impact.” There is no evidence that aquaculture has affected the wild catch.
- The report identifies aquaculture and processing as the two major vectors for the virus. Recreational fishing and birds should also be added as major vectors.
- The report identifies laws and regulations that can serve as tools for stopping the spread of the viruses. Laws and regulations should not be put in place until the risk assessment is complete and the relevant facts are known.

David Cannon, Edisto Shrimp Company
Edisto Island, South Carolina
Aquaculture Industry Representative

Mr. Cannon made several key points:

- Contrary to what has been published at least twice, manufactured feed cannot be a source of virus.

- Last year, Edisto Shrimp Company experienced a devastating attack of TSV, made worse by having to operate on a very limited water exchange mandated by permit conditions.
- The lack of disease-free or disease-resistant stock has been a major impediment to success. In 1996, Edisto Shrimp Company received SPF shrimp from two hatcheries, both supplying *P. vannamei*. None of this stock had any significant TSV resistance, and both hatcheries were located in areas where TSV was present in 1995. One of the hatcheries became reinfected with TSV, which caused all of Edisto Shrimp Company's ponds to become infected, with a 13 percent survival rate. All this shrimp was supposed to have been inspected under the South Carolina Department of Natural Resources' importation permit program.
- This outbreak, which represents the worst-case scenario, had no measurable effect on wild shrimp populations. Furthermore, TSV has never been detected in South Carolina's wild shrimp populations.
- In 1997, Edisto Shrimp Company decided to stock its ponds with *P. stylirostris*, which has a well-founded reputation for high resistance to TSV.
- Shrimp farmers need stock that is pathogen-free and pathogen-resistant.
- Shrimp farmers are interested in a better understanding of shrimp viruses, and they have incentives that go beyond those of traditional livestock producers:
 - Shrimp farmers are not compensated if they are required to destroy crops because of disease.
 - Because their crop is similar to creatures found in the wild, shrimp farmers are subject to unsubstantiated speculation in the press regarding the effect of pond viruses on wild shrimp populations.
- Shrimp populations in the Gulf of Mexico have not declined after three years of TSV infection in Texas shrimp ponds. The 1996 TSV outbreak does not appear to be having a negative effect on South Carolina's wild shrimp populations. The 1997 shrimp catch in South Carolina is expected to be up from previous years.
- Shrimp have been farmed in South Carolina since 1987. IHHNV has been documented in aquaculture ponds, but to date, no IHHNV has been detected in wild stock.

- The practical effect on wild stock must be the final criterion in any studies that are done. So far, there is no evidence that TSV or other pond-type viruses are present in the Gulf of Mexico, nor has there been a diminished catch in the Gulf.
- Shrimp farmers and the processing industry need to have the threats from shrimp viruses quantified. The following questions must be answered:
 - Can the virus be spread to wild populations by particles of infected shrimp?
 - Can the virus live outside a host and be transmitted to wild shrimp?
 - How does the disease spread in the wild under natural conditions?
 - What concentration of the virus is required to affect wild stock?
- If regulators insist on the use of strictly virus-free shrimp without virus resistance, South Carolina will be left vulnerable to another widespread viral outbreak. This is happening in Texas, which has mandated the use of SPF *P. vannamei*, or native species only, and a TSV outbreak is now underway there.
- Farms are not the only source of viruses. The White Spot Virus found in wild *P. setiferus* could not have come from the farm. In 1996, every shrimp pond in the state was tested for every known virus, and the only virus present in ponds was TSV.

Following Mr. Cannon's comments, Craig Dopson, a commercial fisherman, stated that there are no longer any wild shrimp in the intercoastal waterway near the Edisto River, near where a shrimp aquaculture facility discharges its wastewater.

Steve Kerchner, South Carolina Shrimp Association (Southern)
St. Helena, South Carolina
Wild Fishery Industry Representative

Mr. Kerchner made the following key points:

- In the past, NMFS has been unreceptive to the concerns of fishermen.
- Fishermen are increasingly worried that viruses will infect wild shrimp populations.
- Fishermen were once told that TSV does not affect wild shrimp; however, a study by Dr. Jeff Lotz indicates that TSV has infected native species in a laboratory setting.
- We know that the White Spot Virus, or White Spot-like Viruses, can kill native white shrimp.

- We have not seen hard evidence of a drop in shrimp production from the southern area of the state due to shrimp virus; however, there appears to be a slow, steady decline in production from the two southern sounds. Intense growth and development in these areas may be a factor in these declines. Shrimp is an annual crop, and variations from year to year are normal.
- The utmost caution is warranted, given that the viruses are said to be in our waters, that various aquaculture facilities use these waters, and that viruses flourish in the denser populations found in shrimp ponds.

**Rutledge Leland, Carolina Seafood
McClellanville, South Carolina
*Processing Industry Representative***

Mr. Leland made the following key points:

- In South Carolina, the processing industry is limited in scope. Carolina Seafood is basically an unloading and shipping operation.
- Raising shrimp in a pond is an unnatural process that does not result in the best product, but it is necessary because there are not enough shrimp in the oceans to meet demand.
- The virus could also affect crabs, which is a concern.
- The aquaculture industry needs to institute production controls so that the viruses do not infect wild shrimp.

Attendees asked Mr. Leland the following questions:

Q: Have you seen any decline in shrimp numbers in your area?

A: We don't have any aquaculture within 60 miles of the McClellanville area. Shrimp populations appear to be following the normal ups and downs. I haven't seen any direct effects of viruses in our area.

Q: What are your thoughts about increased regulation of the processing industry? What regulations would be acceptable to processors? For example, how would you feel if shrimp leaving your facility had to be labeled as virus-infected?

A: Labeling shrimp as virus-infected would create serious public perception problems. The public would not purchase shrimp labeled as virus-infected even if the labels provided a clear explanation that the viruses cannot affect human health.

Q: How would the processing industry respond to a regulatory requirement that shrimp heads be buried?

A: Such a requirement would impose added expenses, and the industry would like to avoid this regulation, if possible.

Dr. Paul Sandifer, South Carolina Department of Natural Resources
Charleston, South Carolina
State Regulatory Representative

Dr. Sandifer made the following key points:

- Those who have been dealing with aquaculture policy and research and development issues have for at least five to seven years been raising the questions that the Work Group was only recently charged to address.
- The response of Federal agencies to the issues raised has been “underwhelming.” At the state level, we have been left struggling with far less than perfect science and little to no guidance from Federal partners.
- With the exception of the aquaculture research community, no one has put technical information on the table to help answer questions about how much of a problem these viruses pose beyond the aquaculture ponds themselves.
- The following actions should have been taken by a variety of Federal agencies long before now:
 - Monitoring of wild stocks to determine what viral diseases, either native or introduced, are already present.
 - Monitoring of imported frozen product brought into the U.S. for processing or resale.
 - Refinement and further development of detection and diagnostic methods.

- Development of national certification standards and processes, and designation of an entity to serve as a certifying agent for the disease status of stocks, whether imported or not.
- Development of reasonable approaches to handling virus-affected product in processing plants, whether the product is used for human consumption, bait, or animal feed.
- Provision of realistic guidance to farms and hatcheries on ways to contain and disinfect when a disease outbreak occurs.
- An assessment of the relative risks to wild stocks of the various pathways of the viruses, including natural pathways.
- Development of guidance or national standards related to certification, disease management, and issues of relative risk.

Attendees asked Dr. Sandifer the following questions:

Q: When were wild shrimp first tested for viruses in South Carolina?

A: Tests were first run in March 1997, but some of the samples used in these tests are one or two years old.

Q: For how long have tests been run on farm-raised shrimp?

A: Since the late 1980s.

Q: Hasn't one of the tests used to detect viruses been shown to be ineffective?

A: More than one test has been ineffective. Good diagnostic tests do not exist for all these viruses.

Public Comments

Dr. C. Rolland Laramore
Bonney, Laramore & Hopkins, Inc.
Vero Beach, Florida
Shrimp Pathologist

Dr. Laramore made the following key points:

- The JSA report is a good effort and long overdue.
- JSA must exercise greater care in reporting observations and hypothetical statements as scientific fact.
- The report states that the impact of one virus on a wild shrimp fishery in Mexico has been documented. As “proof,” the report discusses a decline in the harvest of *P. stylirostris* in the Gulf of California, attributed to the IHHN virus. The report does not cite a reference to support this claim. It is doubtful that these claims can withstand scientific scrutiny.
- TSV first appeared in Honduras in 1994, and some predicted that the wild population of *P. vannamei* would be devastated. Instead, a survey of wild postlarvae catch based on the number of animals caught per man-day effort showed significant increases in *P. vannamei* over the next three years.
- It is ludicrous to blame the decrease in the catch in the Gulf of California on IHHNV without sound evidence that an epizootic occurred.

Andrew Duda
A. Duda and Sons, Inc.
Ovedo, Florida
Shrimp Farmer

Mr. Duda made the following key points:

- Additional research is needed to enhance disease resistance in SPF stock.
- Shrimp farmers, as agriculturalists, must take certain risks. Mr. Duda stated that he feels very comfortable taking these risks, given his experience with viral disease in his own facility. He experienced economic losses due to IHHNV in an earlier season, but in 1997, pond production has been excellent and the grow-out this year is on target.
- He cited USDA-APHIS’s successes in controlling disease in non-native species introduced into the U.S. (e.g., horses, cows, and pigs) and urged that these successes be applied to address the shrimp virus problem.

Craig Dopson
Dopson Seafood
Yemassee, South Carolina
Commercial Fisherman

Mr. Dopson made the following key points:

- The commercial shrimp industry has been around for a very long time; fishermen are concerned about the continued well-being of the industry.
- Fishermen don't want to see aquaculture ended, but they don't want it to hurt them either.

Douglas Rader
Environmental Defense Fund (EDF), North Carolina Office
Raleigh, North Carolina

Mr. Rader made the following key points:

- Stakeholders in the process include other groups that do not have a vested financial interest in the shrimp virus issue; hopefully these stakeholders will be invited to make presentations at subsequent meetings.
- EDF endorses the process and the methodology outlined in the report. EDF supports the fullest possible assessment of ecosystem impacts associated with shrimp viruses, analysis of sources, and analysis of transmission pathways.
- Further investigation of the transmission of the virus through human waste pathways might be worthwhile.
- The wording of the primary management goal stated in the report should be reconsidered, because it contains the apparently contradictory terms "prevent" and "minimize."
- No virus is "new."
- The term "ecosystem effects" in the secondary management goal should be clarified to include *non-shrimp-based* ecosystem effects.
- All analysis should be based on strong science that is precautionary in nature. The analysis must recognize potential effects on key species in the ecosystem and interactions among stressors, such as anoxia or hypoxia in estuarine or Gulf contexts.
- A critical component of the analysis is to characterize disease that is present in wild populations or in imported materials.

- Be careful about grandiose conclusions. “No evidence” does not mean “no effect.” The current absence of effects in wild populations is not sufficient evidence from which to draw conclusions.
- Disease resistance is not a goal. It is necessary to look beyond a single-species emphasis.
- The management of nonindigenous species is critically important to the effort’s success.
- The report should use the term “nonindigenous” rather than “exotic.”

Bill McGrath
Fort Pierce, Florida
Retired shrimp farmer

Mr. McGrath discussed initial shrimp farming studies carried out at Crystal River, Florida, in conjunction with the Florida Power Company, and made the following key points:

- An objective of the study was to identify species of shrimp that would demonstrate commercial potential in ponds. Local species were studied first but were found to be inferior in typical commercial pond conditions. In 1973, great success was achieved using *P. vannamei*.
- *P. vannamei* has been used in aquaculture in Florida and South Texas since the early 1970s.
- In a Florida effort underway in conjunction with Harbor Branch Oceanographic Institute, *P. vannamei* is being raised using potable well water that has a particularly high hardness. Shrimp growth and survival have been shown to be comparable to or better than growth and survival in salt water systems. Shrimp farming of *P. vannamei* can now occur inland, away from expensive salt water property.
- By utilizing this approach, yields of farm-raised shrimp in Florida could increase by 15 to 20 million pounds in the next decade.

Eddie Gordon
Owner, South Carolina Crab Co.
McClellanville, South Carolina

Mr. Gordon made the following key points:

- Aquaculturists, commercial shrimpers, and commercial crabbers probably have the same goals, although there may be disagreement about “how to get there” and “how quickly you can get there.”
- The report refers to viruses as “shrimp viruses”; however, these nonindigenous viruses may affect other species, which is a concern.
- The effect of nonindigenous viruses on the ecology of the whole estuary needs to be examined in great detail.
- To avoid bias, a well-rounded group that includes industries other than the aquaculture industry needs to be involved in conducting the risk assessment and ongoing studies.
- Time is of the essence. The priority should be taking action now rather than conducting additional studies. It will be too late if we wait to take action until an effect is observed in the wild.
- The National Academy of Science’s Web site contains a map that identifies known occurrences of TSV in the northern hemisphere. An aquaculture facility is located at or near each of these locations, which strongly suggests that aquaculture is the cause of the outbreaks.

Gerald Hazen
South Carolina Conservation Association
Goose Creek, South Carolina

Mr. Hazen stated that the shrimp virus issue raises the following concerns:

- Cross-over of the virus to other species
- Impacts on crabbers’ and shrimpers’ ways of life
- Controls for effluents discharged from aquaculture facilities and processing plants
- Potential effects of the virus on humans

He also made the following key points:

- More research needs to be done quickly and then applied.
- The word “may” is used too many times in the report—but few things are certain.

Jack Whetstone
Clemson University Extension Service/Sea Grant Program
Georgetown, South Carolina

Mr. Whetstone made the following key points:

- Over 95 percent of species used in agriculture are nonindigenous. Some have been successes, such as soy beans, and others have been failures, such as kudzu.
- State veterinary programs and USDA-APHIS have regulatory programs to deal with introduced agricultural species. These agencies need to be more involved in the regulation of agriculture products.
- Over the last 20 years, four different species of non-native shrimp have been stocked on farms in South Carolina. Thanks to the work of the South Carolina Department of Natural Resources, wild populations have been protected as the industry has developed. However, the fact that no major disease outbreaks have occurred does not mean that there won't be a problem at some time in the future. Continued diligence is important.
- Historically, aquaculture has had problems with disease, and disease is likely to continue as a problem. However, the mode of disease transmission is generally from wild populations to domestic populations (for example, avian influenza and swine brucellosis).
- More applied research is needed.
- Shrimp farmers need practical help from state veterinarians and USDA-APHIS. Like other livestock producers, shrimp farmers need to be indemnified (i.e., receive monetary reparations from the government) if they have to sacrifice their animals.
- More research on the virus is needed with respect to wild shrimp populations and other crustaceans.

Rick Eager
Swimming RockFish and Shrimp Farm
Meggett, South Carolina

Mr. Eager made the following key points:

- Regulations to address the shrimp virus problem will need to be developed carefully on a case-by-case basis. Too often, regulations are written to make enforcement easy or convenient. Regulations concerning shrimp viruses must be written to address what biology requires, not to make it easy or convenient for enforcement.

- A priority area for research is determining the amount of virus that's necessary to cause infection in wild shrimp populations. The assimilative capacity of receiving waters is the key to aquaculture problems.
- The wild harvest has remained flat for years, and it will not increase. Aquaculture is the way that we can produce the food we need to meet demand. "Intensification" is not necessarily a dirty word. Aquaculture can be controlled and managed.

Jesse Chappell
Southland Fisheries Corporation
Hopkins, South Carolina
Finfish Producer

Mr. Chappell made the following key points:

- There is no such thing as a disease-free stock of animals. Viruses, parasites, and bacteria are always present in confinement agriculture.
- It is important to be sure that a disease is caused by a specific organism of concern. There can be look-alikes.
- We need to decide if we want inexpensive sources of food or not. Farming provides a more economical source of food than wild stocks.
- We need to become more proactive in addressing disease concerns, since these organisms are evolving faster than our ability to produce tools for managing them.
- We need to develop effective therapeutants and animals resistant to bacteria and viruses.
- The press needs to present the shrimp virus issue *factually* and avoid the temptation to sensationalize the issue.

Cheryl Shew
Zeigler Brothers, Inc.
Gardener, Pennsylvania
Feed Industry

Ms. Shew read a statement by Dr. Thomas Zeigler, CEO of Zeigler Brothers, Inc. Dr. Zeigler's comments addressed the question "Can viral diseases be transmitted to shrimp through feed?" He made the following key points:

- There are few if any known scientific studies dealing with the transmission of viral diseases by way of feed.

- In the U.S., an estimated 99.9 percent of all prepared shrimp feed is processed into particles or pellets and subjected to temperatures of 170 to 280 degrees Fahrenheit. Most feeds are subjected to temperatures of 190 to 230 degrees Fahrenheit. It is assumed that harmful viruses are rendered inactive by these processing conditions, but documentable evidence could not be located to support this assumption.
- If we are asked to prove that feed is not a vehicle for disease transmission, we are unable to do so, because it is impossible to prove a negative. Therefore, it is perhaps best to list feed among hundreds of other possible transmission agents, including people, vehicles, the wind, and rain.
- We believe that the shrimp virus study should have been done about 15 years ago, before the problem reached these magnitudes. Because these diseases are now endemic worldwide at varied levels of intensity, the best long-term solutions to the problem are mother nature, serious scientific exploration to find solutions, and reasonable regulations.

QUESTIONS

Dr. Charles Menzie asked attendees if they had any final questions for representatives of the JSA Shrimp Virus Work Group.

An attendee asked if a mechanism exists to include biological science in the management actions that may be taken prior to completing the risk assessment. William van der Schalie of EPA's Office of Research and Development, and member of the Shrimp Virus Work Group, responded. He stated that undertaking the risk assessment process does not preclude either doing additional research that we know is needed or taking management actions. He added that research, the risk assessment process, and the management process can occur in parallel. Linda Chavez of NMFS and a member of the JSA stated that the JSA wants to ensure that research efforts are coordinated and that any management or regulatory actions taken are based on the best possible science available. She will report back to the JSA on research needs mentioned by speakers and commentors during the day's meeting.

5. STAKEHOLDER PRESENTATIONS AND PUBLIC COMMENT
Mobile, Alabama
July 21, 1997

Stakeholder Presentations

Richard Gollot
Biloxi, Mississippi
Processing Industry Representative

Mr. Gollot was unable to attend because of problems related to the weather. Tom McIlwain (NMFS) read Mr. Gollot's comments into the record. They contained the following key points:

- Shrimp viruses do threaten the shrimp industry; however, the greatest threat is to those involved in shrimp aquaculture production around the world, not to the processing industry, the U.S. shrimp industry, or even to the wild stocks of shrimp.
- In any newly cultivated crop, the development of disease is not unusual. Therefore, we should not be surprised to find diseases developing as shrimp production increases throughout the world.
- As a shrimp processor, I am concerned about shrimp viruses because they could have a serious impact on the supply of cultured shrimp available to the world. This decline in supply would result in significant price increases and possibly a collapse in the industry itself.
- In Biloxi, imported shrimp have been processed for more than 20 years. If shrimp viruses were to be introduced into the wild population, it would have happened long ago.
- Viruses are probably not affecting shrimp for a number of reasons:
 - Domestic stocks may have some natural immunity to these viruses.
 - The viruses may be concentrated in such low numbers that their spread is unlikely.
 - The infection may already have occurred, but shrimp quickly developed immunity.
- Wastewater discharge permits for shrimp processing plants depend on available water sources (such as rivers) and can vary from location to location and state to state. Before we declare whether or not a wastewater stream can be used for this purpose, we should

determine whether a threat exists, and if so, whether new regulations would make any difference.

- If we can show that these viruses pose a threat to our native stocks, and that disease-carrying organisms have not been introduced so far, or if we can explain why the introduction of these disease-carrying organisms has not had any effect on the shrimp to date but would have an effect in the future, then I would be concerned.
- My primary concern is how these viruses could affect the availability of imported shrimp. Domestic shrimp stocks and domestic shrimp aquaculture are small in number and are unlikely to significantly affect the availability of shrimp for the U.S. or world market.
- I can think of no instance where disease in domesticated stock devastated wild stock.

Becky Gillette
Mississippi Chapter of the Sierra Club
Ocean Springs, Mississippi
Environmental Representative

Ms. Gillette made the following key points:

- The report is comprehensive and contains the kind of scientific information needed to evaluate the sources of potential problems. It provides a good research base from which to make recommendations.
- The report states that foreign shrimp viruses pose no risk to human health. At best, the threat of these viruses to human health is not known. Aquaculture operations are breeding grounds for new and more virulent forms of viruses. To date we know of no shrimp viruses that can affect humans, but this does not mean that a new or mutated virus that could affect humans could not emerge from aquaculture. (A few years ago, *Pfiesteria piscicida*, a toxic algae, was unknown but probably present in the environment in small enough quantities that it caused no damage. After wastewater lagoons containing hog waste broke and discharged into North Carolina streams, *Pfiesteria* caused serious human health problems.)
- In Mississippi, processing of foreign shrimp is a major industry. The wastewater from processing the shrimp is screened to remove solids and then discharged into the Back Bay of Biloxi or other coastal waters. We know that foreign aquaculture operations will harvest a pond when a virus first appears, in order to minimize loss. Therefore, it is likely

that viable shrimp viruses have been discharged into Back Bay. Researchers say that there is no evidence here that native shrimp have contracted foreign disease. This simply means that disease has not been detected, not that it has not occurred.

- One management option would be to prevent the import of foreign shrimp. However, 65 to 75 percent of the shrimp consumed in the U.S. is imported, and thousands of people are employed by the industry.
- Wash water from seafood processing houses should be collected and treated, not only to destroy viruses, but also to improve water quality. The large amount of organics in the wastewater contribute to poor water quality in Back Bay. There is little hope that seafood operations in Mississippi will be required to provide further wastewater treatment. The processors consider this too expensive, and the state is unlikely to require treatment.
- Since it is unlikely that further treatment of wastewater will be required, we must ensure that foreign viruses are not present in imported shrimp.
- Recommended procedures for preventing the spread of foreign shrimp from imported shrimp and from U.S. aquaculture operations include:
 - Periodically test shrimp from all foreign and domestic shrimp farms for viruses. Infected shrimp must be cooked prior to washing so that no viruses escape.
 - Require that shipments of shrimp from each point of origin be kept separate for testing and tracking purposes.
 - Require all shipping bills to indicate farm of origin, packer, and shipper.
 - Place the burden of proof on the country of origin. Their seafood inspectors must certify that shrimp are virus-free. Periodic random testing would be necessary to measure compliance with virus-free shrimp certification programs.
 - Ban the use of imported shrimp as bait.
 - Implement the Lacey Act to address the issue of shrimp viruses.
 - Impose an import duty of one cent (or more) per pound to fund shrimp inspections and research on effective methods for killing viruses in wastewater.
 - Consider whether aquaculture farms are worth the risk in the United States. If new aquaculture facilities are allowed, far stricter controls are needed. Farms should be located inland, far from the coastal environment.

- For existing contaminated domestic ponds, require holding ponds to prevent contaminated runoff from entering the environment. Also, require netting to be placed over ponds to prevent transfer by birds. Require ponds to be fenced to prevent wildlife from transferring viruses from ponds to the environment.
- Require that NPDES permits for aquaculture and processing plants include measures for the control of foreign shrimp viruses.
- Address the issue of ballast water, which is a potential source for introduction of foreign viruses as well as other foreign species.

Ms. Gillette provided attendees with copies of an article from the July/August 1997 issue of *Tide*, the magazine of the Coastal Conservation Association. The article, entitled “Texas Shrimp Farming: Promises, Promises,” questions whether shrimp aquaculture can successfully operate in coastal areas of Texas without posing threats to native shrimp, fish, and wildlife stocks in surrounding bays and estuarine ecosystems.

Ms. Gillette concluded her presentation by stating that we must not wait until our wild fishery industry collapses before taking action.

Stevens Heath
Alabama Department of Conservation and Natural Resources
Gulf Shores, Alabama
State Regulatory Representative

Mr. Heath was unable to attend because of problems related to the weather. Tom McIlwain (NMFS) read Mr. Heath’s comments into the record. Mr. Heath’s comments contained the following key points:

- The JSA should determine the status of the virus in native stocks before taking any major action. There are probably native viruses that we do not know about. Care should be taken not to overreact with respect to aquaculture.
- The risk assessment process should continue, but it is important to err on the side of caution.

Tom Van Devender
Mississippi Department of Marine Resources
Biloxi, Mississippi
State Regulatory Representative

Mr. Van Devender made the following key points:

- The direction that the report takes is good; however, it is important not to get too “carried away.”
- We need to look closely at the possibility of endemic viruses in the Gulf of Mexico.
- The term “exotic virus” used in the report is not entirely appropriate.
- There is some doubt about the use of the legal authorities cited in the report (e.g., the Lacey Act and other statutes) to control shrimp viruses. The Lacey Act would require one of the states whose border is being crossed to have laws specific to viral disease in shrimp, and currently, no state has such a law.
- Mississippi has no shrimp mariculture facilities other than a research facility at the Gulf Coast Research Lab. Water from the lab is treated and then sent to the Ocean Springs Sewage Treatment Facility, so there is no possibility of viruses escaping into the wild from the lab.

Public Comment

Mark Berrigan
Florida Department of Environmental Protection
Tallahassee, Florida

Mr. Berrigan made the following key points:

- Unlike Mississippi and Alabama, Florida has been involved in shrimp aquaculture for a number of years. *P. vannamei* and *P. stylirostris* have been cultured in Florida for approximately 25 years.
- Florida has a functional industry that employs several hundred people.
- Much research on shrimp aquaculture has been performed in Florida at the Crystal River facility. Many of the findings from this research were used to build the aquaculture industry in Latin America.
- An aquaculture facility has been active in the Florida Keys for at least 20 years. No known environmental problems have been associated with this facility.

- Because of the problems associated with shrimp diseases over the last five or six years, Florida has made considerable efforts to tighten protocols and management practices for facilities that hold nonnative shrimp. Current requirements include the following:
 - Shrimp must come from sources or facilities that are approved by the Florida Department of Environmental Protection.
 - Production facilities cannot discharge directly into state waters. Management plans include specifications for confinement, escapement, and crisis situations. Management plans include commitments from growers to eradicate their stocks completely if disease is manifested or if an impending storm will result in escapement.
- Florida has worked with two companies with holdings in Central and South America to design a model for hatchery systems.
- Without further evidence, Florida is reluctant to “throw rocks” at the aquaculture industry. A participant asked Mr. Berrigan if Florida has a state law to prevent the importation of shrimp viruses. Mr. Berrigan said that currently there is no such law in Florida.

**James Heerin
Shrimp Culture, Inc.
Roswell, Georgia**

Mr. Heerin made the following key points:

- Shrimp Culture, Inc., recognizes the importance of research and careful scientific inquiry into the whole range of shrimp health issues, which may inhibit or encourage the development of a healthy and economically viable shrimp farming industry.
- Shrimp Culture, Inc., is concerned that this inquiry and the possible development of guidelines or regulations be based on sound scientific investigation and unbiased analysis, rather than preconceptions or anecdotes—or worst of all—the unsupported claims of advocacy groups.
- Shrimp Culture, Inc., has the following concerns about the report:
 - It mentions catastrophic economic losses to the shrimp aquaculture industry, but makes no mention of economic successes.

- The characterization of the cause of the reduced shrimp catch in the Gulf of California in the early 1990s is questionable.
- The report is only the first step in an important process to assist the development of a healthy shrimp aquaculture industry.
- The stewards of the risk assessment process must adopt a measured, unbiased scientific approach.
- What is needed is a collaborative effort of genuinely concerned stakeholders searching for sound scientific approaches to disease and related health problems in order to foster the development of aquaculture as a means of improving and increasing the supply of wholesome and economical aquatic food products to U.S. and world consumers.
- In the areas of shrimp genetics, breeding, hatcheries, nutrition, and health research, the United States can be a world leader; however, the necessary investment and leadership will dry up if issues such as the potential impacts of shrimp viruses are not addressed in a careful, unbiased, scientific manner, with the same problem-solving attitude that has characterized the regulatory agencies' attitudes to date.

Charles Evans
Delfemar S.A.
Pensacola, Florida

Mr. Evans explained that he is a member of a group that is attempting to raise Australian red claw crayfish in Ecuador.

He made the following key points:

- To raise red claw crayfish, it will be necessary to protect against TSV.
- As we talk about prohibiting imports from foreign countries such as Ecuador, it is important to bear in mind that people from these countries need help and support.
- Originally, shrimp farmers in Ecuador were interested in “production, production, production.” Apparently, the proper precautions were not taken and management practices allowed TSV to spread. Now, what these individuals would most like are education and access to information.
- We should demonstrate the patience to help educate foreign aquaculturists, rather than simply prohibit imports.

R.D. Ellender
University of Southern Mississippi
Hattiesburg, Mississippi

Dr. Ellender made the following key points:

- Industry does not have the tools it needs for shrimp virus diagnosis.
- Some work is being done by the GCRL and by Dr. Don Lightner. Also, good research has been done in Asia. Overall, however, there is a tremendous lack of research on shrimp virology.
- Given current science, it will be difficult to answer questions about carrier status and about viruses in wild shrimp populations.
- Serious research efforts need to be made in the area of shrimp virology and shrimp immunology.

QUESTIONS

Dr. Charles Menzie asked attendees if they had any final questions for representatives of the JSA Shrimp Virus Work Group.

Q: Did the Shrimp Virus Work Group include industry representatives?

A: [Tom McIlwain (NMFS)] It was a multi-Federal agency work group, so industry was not represented. This meeting and the other stakeholder meetings are intended to gather input from other stakeholder groups to help provide a balanced risk assessment.

Q: What is the production of domestic shrimp in Florida?

A: [Tom McIlwain] The primary fishery in Florida is for pink shrimp, which are harvested off the southwest coast of Florida. In 1996, production of pink shrimp was approximately 19.1 million pounds.

6. STAKEHOLDER PRESENTATIONS AND PUBLIC COMMENT
Brownsville, Texas
July 23, 1997

Stakeholder Presentations

Larry McKinney
Texas Parks and Wildlife Department
Austin, Texas
State Regulatory Representative

Dr. McKinney made the following key points:

- The Shrimp Virus Work Group is to be commended for its efforts to address this very serious issue.
- The potential transmission of exotic diseases, specifically shrimp viruses, into native wild stocks is the single most serious issue faced by the Texas Parks and Wildlife Department (TPWD) in its management responsibilities related to shrimp and aquaculture.
- TPWD does not have the resources to assess the degree of risk associated with any of the several transmission pathways described in the report. The fact that acknowledged experts disagree on the potential of such risks compounds the concern. Such conflict makes it difficult for resource management agencies such as TPWD to take appropriate action.
- Each of the four known exotic shrimp diseases has occurred in Texas aquaculture facilities. Despite claims to the contrary and very real efforts by the industry, the industry cannot eliminate the potential for introduction of disease into the surrounding environment.
- Key elements of TPWD's management strategy includes the following:
 - Allowable Exotic Species. Only one exotic shrimp species, *P. vannamei*, is currently permitted for commercial aquaculture in Texas. In the fall, TPWD may consider a petition to allow the use of *P. stylirostris*, a species more resistant to disease, especially TSV. At present, TPWD is considering its use only in closed systems outside the 200-mile coastal exclusion zone.

- Disease Management. The aquaculture industry has worked cooperatively with TPWD to manage TSV, and together they have adopted a response plan that requires reporting of mortalities, disease testing, and non-discharge of affected waters within specified time frames. This fall, TPWD will consider new regulations to enhance its disease management capabilities.
- Native Species. TPWD supports the use of native shrimp in developing aquaculture options that reduce both disease and escapement concerns.
- Coordinated Permitting. The Texas Natural Resource Conservation Commission has adopted rules to address discharge concerns associated with shrimp mariculture facilities. TPWD has a formal role in that process and will consider adoption of complimentary rules this fall.
- The report states that recently discovered Asian viruses appear to be more virulent in domestic shrimp than those thought to be endemic to South and Central America. If this is the case, it reinforces a conservative approach to disease management.
- The report does not adequately describe the significance of the role of states in aquaculture management. The management and permitting approaches of states may vary widely, and these uncoordinated actions may increase disease risk.
- The risk assessment should address two areas that are not addressed in the report:
 - What has been the impact of U.S. assistance to foreign countries to develop aquaculture? If these countries are sending diseased shrimp to U.S. processors, how might the U.S. inadvertently be contributing to the problem?
 - What are Federal agencies doing to address the use of exotic species in Federal waters? If open-water aquaculture develops in the future, who will have permitting authority?
- The two most important research needs are:
 - To assess the presence and distribution of pathogenic viruses in wild stocks.
 - To assess the risks associated with the processing of imported shrimp. (Based on volume, this could be the risk that overwhelms all others.)
- A number of the research needs listed in the report are very broad in nature. These issues need to be addressed, but the research needs that contribute to completing the risk assessment must be the first priority.

- TPWD supports the goal, stated on page 14 of the report. The assessment endpoints also seem appropriate, although the second assessment endpoint (*The ecological structure and function of coastal and near-shore marine communities as they affect wild penaeid shrimp populations*) may be too broad and long-term to be useful in an assessment process that must deliver results in short order.
- It is advisable to adopt a tiered approach to the risk assessment.

Cynthia Sarthou
Gulf Restoration Network
New Orleans, Louisiana
Environmental Representative

Ms. Sarthou made the following key points:

- The Gulf Restoration Network (GRN) believes that the use of non-native shrimp in live mariculture and processing operations poses a threat to the Gulf marine ecosystem. This threat comes in two forms: escapement of foreign shrimp and insufficiently treated effluent.
- The report indicates that the potential for transmission of viruses to native shrimp populations is largely unknown. This is contrary to information published in a June 18, 1997 article in the *Port Lavaca News*, which states that Dr. Addison Lawrence, director of the shrimp mariculture project of the Texas Agriculture experiment station, reported that a white spot-like virus caused a significant die-off of native white shrimp (*P. setiferus*) held at the research lab. Although Dr. Lawrence has no information on the source of the exposure, the article indicates that viruses pose a threat to native shrimp stocks.
- Protection of wild shrimp must take precedence over shrimp aquaculture.
- A risk assessment is needed, but it is a long and involved process. Precautionary measures need to be implemented now.
- The report states that “costs to U.S. processors will increase if new detection, control, and treatment measures are implemented to prevent the environmental release of contaminated wastes.” It is true that these measures may add to the costs incurred by the processing industry; however, it is only equitable that those who benefit from the industry creating the risk bear the burden of the cost of measures needed to prevent environmental contamination associated with their operations.

- Federal agencies must involve a wide variety of interested stakeholders in all phases of the process—from risk assessment to management. The report must include a discussion of the participation by these diverse groups in all phases of the risk assessment and management process.
- The report should mention the responsibilities of the Food and Drug Administration (FDA) and its efforts to date in dealing with the shrimp virus problem. Because FDA is responsible for regulation and inspection of all imported shellfish, it is the front line agency for detecting viral agents in imported shrimp. If FDA is not yet involved, it should be brought into the process.
- A mandatory specific pathogen-free (SPF) brood stock program may be the only effective method of ensuring that aquaculture operations use only pathogen-free stocks. The possibility of a mandatory SPF program should be mentioned in the report.
- The report places too much emphasis on the primary assessment endpoint. Impacts on wild penaeid shrimp cannot and should not be the major focus of the report. Viruses pose a threat to other marine species and to the ecosystem as a whole. Thus, the second endpoint, pertaining to the affects on the ecological structure and function of coastal and near-shore marine communities, is an equally important endpoint.
- Section 7 (Discussion of Action Items) is the weakest section of the report. Although the report recommends a few action steps that might be taken, the impact of these recommended steps will not be seen in the short term. Action is needed now to protect vital marine species and ecosystems.
- Gulf Restoration Network recommends that Federal agencies, including USDA-APHIS and FDA, take the following actions:
 - Require that shrimp from each foreign and domestic shrimp farm be tested for viruses.
 - Require that infected shrimp be cooked prior to sale or processing.
 - Require that shipments of shrimp from each point of origin be kept separate for ease of tracking and testing.
 - Insist that countries of origin bear the burden of having their seafood inspectors certify that shrimp are virus-free.
 - Ban the use of imported shrimp as bait.

- Amend the Lacey Act to include shrimp viruses in order to provide a legal basis to prevent import of contaminated shrimp.
- Require virus-contaminated domestic aquaculture facilities to use holding ponds to stop runoff into the natural environment, net over ponds to prevent transfer by birds, and fence ponds so wildlife cannot transfer viruses from ponds to the environment.
- Require treatment of wastewater from shrimp mariculture facilities and seafood processing plants, as well as treatment and proper disposal of waste products from processing facilities.
- Focus research efforts on developing the most effective and inexpensive methods of treating waste products.
- Impose a duty on imported shrimp to provide a funding source for inspection and research.
- Increase research on potential effects on the coastal community as a whole.
- Federal agencies must focus significant research efforts on methods to contain shrimp viruses. Information is also needed on the potential impact of introducing these viruses into the Gulf ecosystem.
- Research efforts must focus on the greater ecological impact of these viruses, including their effects on ecosystem structure (e.g., species composition) and function (e.g., predator-prey relationships).
- Agencies must determine the full range of risks to the marine environment posed by the processing of contaminated shrimp. They must also determine appropriate treatment processes to eliminate viral agents from wastewater discharges.
- Agencies cannot sit idle while this research is being completed. Action is needed now to prevent the import and possible spread of potentially devastating viruses.

Wilma Anderson
Texas Shrimp Association
Aransas Pass, Texas
Wild Shrimp Fishery Industry

Ms. Anderson made the following key points:

- Exotic shrimp viruses could potentially decimate the wild production of shrimp and threaten the livelihood of shrimpers. Expedient resolution of this problem is necessary.
- In September 1992, the Texas Shrimp Association identified shrimp aquaculture as an activity likely to affect coastal habitat. At this time, no regulations were in place, nor was a state or Federal agency designated to control this new activity.
- In November 1992, the U.S. Army Corps of Engineers held a workshop on shrimp farming on the Texas coast. The Corps had determined that the construction of shrimp farms in dredge disposal areas was a beneficial use of dredged materials. The workshop included sessions on how to access Federal start-up funds for shrimp aquaculture.
- Midway into this meeting, it was announced that exotic shrimp had been accidentally released from a shrimp farm into the Arroyo Colorado during harvest activities. Texas Parks and Wildlife Department took immediate action to control the effects of release into the Arroyo and the Laguna Madre, which included attempts to recover as many exotic escapees as possible. Off-shore vessels caught exotic species at Port Mansfield as late as January 1993. This was the second escapement of exotic shrimp. Another escapement occurred at a Corps of Engineers shrimp farm along the Brownsville Ship Channel.
- In 1994, eels were found infected with nematodes.
- In 1995, TSV was identified on the Texas coast.
- In 1995, shrimp farmers proposed legislation to exempt until 1999 the discharge of spent shrimp-growing waters from permit requirements. The proposed legislation failed.
- In 1995, white shrimp were taken from the Gulf of Mexico and stocked in aquaculture ponds where diseased shrimp had just died. The native white shrimp likewise succumbed to TSV, and those shrimp were placed on the market for consumption. The Texas Shrimp Association protested, but there was no authority to stop this action.
- The Texas Shrimp Association filed suit against EPA, asking that action be taken against the shrimp farms that were operating without wastewater discharge permits.
- In 1997, Texas's lieutenant governor ordered a special subcommittee to develop new legislation addressing aquaculture. However, these new aquaculture bills were killed by the abrupt adjournment of the state legislature.
- Researchers have recently determined that native species are susceptible to a variety of exotic shrimp diseases.

- The Texas Shrimp Association's primary concerns are:
 - The effects on native shrimp of virus and disease from production facilities
 - The dumping of silt and waste into native shrimp nurseries
 - The taking of native shrimp from the wild
 - The credibility of researchers
- The Texas Shrimp Association requests that the Federal government stop investing taxpayers' money in shrimp farming activities and closely monitor overseas participation, both government and private, in shrimp farming.
- Fishermen feel that we must not sacrifice the many for the few. We must therefore conserve and protect our marine and estuarine habitat. Immediate action is necessary to address this serious situation.

Dr. Porfirio Alvarez Torres
Instituto Nacional de la Pesca
Mexico
Mexican Representative

Dr. Alvarez began his presentation by describing the structure of the Instituto Nacional de la Pesca (the National Institute of Fisheries) and its relationship to other Federal Mexican agencies that deal with aquaculture and fisheries. He explained that the agency's current policy is to balance natural resource conservation and economic development. The Institute is in charge of aquaculture research. The main objective of this research is to determine the actual status of disease in both wild and cultured shrimp in order to develop a strategy of control and mitigation.

Dr. Alvarez made the following key points:

- The shrimp industry is economically very important in Mexico, and Mexico is concerned about the potential impacts of disease on the industry.
- Aquaculture in Mexico has been growing steadily since 1987.
- The wild catch has decreased from levels of the 1980s, but volumes have been quite variable.
- In 1995, there were 231 aquaculture farms and 2,235 fishing vessels.
- We need to determine if these viruses have existed in the wild or if they emerged as a product of aquaculture.

- In the Gulf of California, data show a decrease in 1991 in the blue shrimp catch both in the deep sea and in bays and protected waters. We have created a model that simulates the effects of different factors, such as surface water temperature. Over-exploitation by fishermen may be a factor in these declines.
- The recovery of blue shrimp populations in the Gulf may be attributable to adaptation to the virus or to the stabilization of other external factors. Additional rigorous studies are needed.
- A publication by Dr. Lightner contains information on the natural presence of White Spot Syndrome Virus in native U.S. shrimp and crayfish populations. This information should be included in the report of the Shrimp Virus Work Group. It is important that additional research be done on the presence of these viruses in nonshrimp species in the Gulf of Mexico.
- We refer to these viruses as “new,” but we need to determine how long they have been in existence.
- We also refer to these viruses as “exotic.” However, TSV is native to this continent.
- We have data that could help close some of the gaps in the report (e.g., data on genetic variability in natural and cultured shrimp populations in the Gulf of Mexico and the Pacific coast, particularly for white and blue shrimp.)
- Mexico is developing laws and regulations that will establish quarantine and certification procedures. In the United States, laws regarding aquaculture vary widely from state to state; however, in Mexico, quarantine and certification procedures will be consistent among states.
- Mexico is currently developing a very large database on shrimp populations. This database will provide vital baseline information that we can use in resource management decision-making and additional research efforts. The database project will be coordinated among several Mexican agencies.

Attendees asked Dr. Alvarez the following questions:

- Q: [Dr. Paul Frelie, Texas A&M University]. You do not feel that IHHNV was the major cause of the decrease in production of *P. stylirostris* in the Gulf of California. Is that correct?

A: We believe that the decline was due to a combination of different factors, not to one factor, as reflected in the report of the Shrimp Virus Work Group. More analysis is needed of other factors that may have contributed to the decline. The model that we are creating may help answer these questions, but now is not the time to have an in-depth discussion of this model.

Q: [Bill Hoenig, Rich-SeaPak] The report describes a crash in shrimp production in 1984, yet Dr. Alvarez's presentation shows that aquaculture in Mexico did not start until 1987. What then is the relationship between aquaculture, IHHNV, and the decrease in shrimp populations in 1984?

A: This is an important point that needs additional study. Commercial aquaculture did not really begin until 1986. We need to study the factors that contributed to the decline. At the time, discussions of the decline focused on over-exploitation of the shrimp resource, not on viruses.

Fritz Jaenike
Harlingen Shrimp Farms
Los Fresnos, TX
Aquaculture Industry Representative

Mr. Jaenike made the following key points:

- One of the greatest challenges for the shrimp aquaculture industry has been viral disease. Almost rivaling the viral challenges have been pressures that opposing interest groups and the misinformed public have placed on regulators.
- Shrimp viruses have affected the shrimp aquaculture industry for over a decade, and the industry has devoted considerable effort to understanding the viruses.
- One of the most straightforward ways for a shrimp farm to prevent the occurrence of disease is to avoid introducing the virus in the first place. It is ironic that virus introductions have occurred in spite of efforts to remain virus free through the use of SPF starter stocks. The industry has been the victim of incidental virus infections, the sources of which have not been identified. Without an understanding of the sources, it has been difficult to guard against the occurrence of viruses.

- The use of virus-resistant strains and species of shrimp is the safest way to proceed when incidental infections cannot be controlled. The U.S. Marine Shrimp Farming Program has devoted considerable resources to developing SPF strains of *P. vannamei* that are also resistant to TSV. It takes years to accomplish such a goal, and these strains are considered a work in progress. Currently the degree of Taura Syndrome Virus-resistance is not guaranteed, however, these strains remain the only option that Texas shrimp farmers can utilize in 1997.
- Harlingen Shrimp Farms has done considerable work with native *P. setiferus*, and we feel that this species has merit in aquaculture, but it is not a species of choice in all situations. In less intensive situations, *P. setiferus* is an option, but in more intensive operations, more work needs to be done to learn what management techniques are necessary for this species to perform well. *P. setiferus* males can experience reproductive problems when held in captivity.
- The development of SPF populations of *P. setiferus* will be the focus of continued work with this species. Harlingen Shrimp Farms is trying to facilitate this effort by providing starter populations of virus-free *P. setiferus*.
- Much of the Latin American shrimp farming industry has converted to using *P. stylirostris*, which is a species with natural resistance to Taura Syndrome Virus. In previous years, this species was utilized in Texas, but was discontinued due to its susceptibility to IHHNV. SPF stocks of *P. stylirostris* with resistance to IHHN Virus are now available for aquaculture use; however, the Texas Parks and Wildlife Department refuses to allow its importation.
- I have spent two years compiling data that indicates that there is no additional risk to the state of Texas from importing *P. stylirostris*. I believe that use of this species would actually lower the risks from TSV, rather than increase risks to native species.
- This year, all shrimp farms on the upper coastal bend of Texas have experienced significant losses of *P. vannamei* because of TSV. Shrimp farms in the Rio Grande Valley have not been challenged this year with TSV, but the situation remains risky.
- The aquaculture section of the Shrimp Virus Report (3.2.1) states that White Spot Virus and Yellow Head Virus occurred in Texas aquaculture facilities in 1996. This is not the case. During 1996, bioassays and several analyses were conducted on shrimp that were

grown at the facility that had been diagnosed with White Spot Virus in 1995, and no signs of the virus were found in 1996 or have been found this year.

- The same section of the report states that no Federal program currently certifies facilities; however, it is worth noting that the Harlingen Shrimp Farms hatchery conducts routine diagnostic programs that have been reviewed by the world's leading shrimp pathologists.
- The shrimp processing section of the report (3.2.2) refers to the use of contaminated feed. All shrimp farms in the U.S. utilize a manufactured, pelleted shrimp feed. The statement that processed shrimp meal can be a source of virus to the farms is not factual, considering the temperatures involved during feed manufacturing.
- In the viral stressors section of the report (3.3), it is important to distinguish between infectivity by a virus and possibilities for disease caused by a virus. The section of the report that addresses IHHNV states, quoting work by Dr. Lightner, that all three native U.S. shrimp species have been infected experimentally. The report should note that these infections were accomplished either by injection or by offering virus-infected tissues to shrimp as their sole food source. The report should also note that mortalities or disease did not occur in these shrimp despite the viral challenges. In other words, all three native shrimp species are fairly tolerant to IHHNV, and to state that the native shrimp can be infected gives the impression that they are in some danger from IHHNV when they are actually not. The same types of statement—that all three native shrimp species have been experimentally infected with TSV—are made in the TSV section of the report. Here again, the chances for disease are either not existent or highly unlikely. Neither *P. aztecus* nor *P. duorarum* has been shown to exhibit disease symptoms, despite aggressive challenges with TSV. The same section states that, once infected, *P. setiferus* experiences heavy mortality. This is true in a portion of laboratory experiments but has not been shown to occur in the field.
- Harlingen Shrimp Farms has done numerous evaluations of the susceptibility of *P. setiferus* to TSV. The data generated indicate little if any risk to this species from TSV. Data to support this conclusion include:
 - A controlled study done in conjunction with Texas A&M University at Harlingen Shrimp Farms. In this study, all three native shrimp species were fed TSV-infected

tissues. The *P. vannamei* control group remained the only shrimp that exhibited mortality in numerous trials.

- Pond production trials done by Harlingen Shrimp Farms in 1995. In these trials, millions of *P. setiferus* postlarvae were stocked into the same ponds that contained *P. vannamei* survivors of a TSV epidemic. The average survival of the *P. setiferus* to harvested shrimp was 70 percent.
- Several farms in Texas have raised *P. setiferus* in ponds adjacent to ponds stocked with *P. vannamei* that became infected with TSV. I have not yet heard of one instance in which *P. setiferus* have become diseased with TSV in a pond situation.
- The wild shrimp populations section of the report (3.7.1) contains subjective statements that are negative toward aquaculture. The statement that aquaculture is the cause of the spread of viruses is subjective. The assumption that *P. stylirostris* in the Gulf of California suffered mortalities from IHHNV is a correlation but not a conclusion. Several stressors or conditions could have contributed to this decline.
- The report should include retailers among the list of stakeholders. Retailers are not mentioned in discussions of potential pathways of the virus to the United States. The importation and distribution of raw frozen seafood by grocers and restaurants occurs independently of any processors and represents a significant pathway to municipal landfills and waterways.
- The discussion of the management goal states that the focus of the report is on *wild* populations. The report's title references the impact on cultured shrimp. Why is the focus of the management goal removed from the impact of pathogenic viruses on the aquaculture industry? During the discussion of assessment endpoints, all focus is on wild populations, and aquaculture is not even mentioned as a stakeholder at risk.
- The task of completing a risk assessment and setting management goals with such a widely based input system is ungainly at best. Who will determine the most appropriate and practical management goals? Will the risk managers have an in-depth knowledge of the biology of shrimp and shrimp viruses?
- One of the best outcomes of the risk assessment effort would be to organize and generate sound scientific information on viral epidemiology, then use this information as a basis for realistic management recommendations.

- Given the current size of the aquaculture industry, it would be very easy to put tough restrictions on aquaculture and perhaps not on other potential sources. This treatment would be neither fair nor logical.

Attendees had the following questions for Mr. Jaenike:

Q: [Deyaun Boudreaux] I am familiar with one stocking of *P. setiferus* after the die-off of shrimp in May 1995. These *P. setiferus* were supposedly collected from the Gulf of Mexico in May and stocked in June in the ponds where the *P. vannamei* had died. You said earlier that you had stocked *P. setiferus* postlarvae. Are we talking about the same stocking?

A: We are talking about the same stocking. We actually stocked them in July. We harvested them in October and very early November.

Q: And were these shrimp that you got from the Gulf of Mexico the sole source of your shrimp in 1995?

A: Yes.

Q: In 1995, were you able to over-winter any brood stock from the *P. setiferus*?

A: Not at our facility. We dry out everything.

Q: Where did you get your start for the brood stock of *P. setiferus* that you supplied to other farms in 1996?

A: We received those from South Carolina.

Q: Did you at any time ever ship any *P. setiferus* back to South Carolina for stocking?

A: In 1996 yes, but not in 1995.

Julius Collins
President, Gulf Shrimp, Ice and Fuel, Inc.
President, Texas Shrimp Association
Brownsville, Texas
Processing Industry Representative

Mr. Collins made the following key points:

- We are alarmed by evidence that viruses may have been released into the wild population of our valuable native shrimp. More alarming is the disclosure of uncontrolled experiments with our native shrimp, whereby they were captured and stocked in open ponds where cultured species had previously died from non-native viruses. These infected native shrimp were then processed, placed on the market, and sold for human consumption.
- Processors have been suggested as a vector for transmission of shrimp viruses. This has prompted processors to carefully evaluate their procedures for handling domestic and imported shrimp.
- In the Rio Grande Valley along the Gulf of Mexico, we have the world's largest off-shore shrimp fleet. Many processors are located here to process both native wild-caught and imported shrimp. Much imported shrimp comes first to Mexico before its arrival in the U.S. for processing. The largest processors of these shrimp are located in Brownsville. While some imported product is processed in Brownsville, the majority is processed in Matamoros, Mexico, before coming across the border. The wastewater from the Matamoros plant, although untreated, does not flow into the Rio Grande or the Gulf of Mexico but into El Barril de la Laguna Madre, which has no outlet to the Gulf.
- Wastewater from the Brownsville processing plants is treated at the city's wastewater treatment plant before being discharged into the Brownsville Shipping Channel. All shrimp processing facilities in Texas are required to have their wastewater discharged to sewage treatment plants.
- We strongly oppose proposals by the shrimp aquaculture industry to de-list shrimp species whose importation to Texas is currently prohibited
- We also adamantly oppose the taking of wild shrimp for the purposes of aquaculture research.
- Concentrating on vectors such as processors and sea gulls is a smoke screen that does nothing to bring about the basic reforms that must be implemented.
- We recommend that cleanup of all contaminated farms be required and that field research with native and exotic shrimp be ceased.
- The introduction of exotic species by aquaculture should be considered a violation of law under the Non-Indigenous Species Act.

- Domestic shrimp farming represents less than one percent of all U.S. shrimp production. The wild shrimp population is of utmost importance to the fishing and processing sectors.
- Texas processors recommend that processors of imported shrimp in other Gulf Coast states be required to discharge their wastewater to sewage treatment plants and to properly dispose of by-product.
- We must cease the frantic push to build more and more shrimp farms in the United States, until the problems of virus and disease are fully understood.

Attendees had the following questions for Mr. Collins. Deyaun Boudreaux of the Texas Shrimp Association answered on behalf of Mr. Collins:

Q: [Fritz Jaenike] Can you tell me what the basis is for the information you have presented today about the Texas aquaculture industry?

A: This information is contained in *Shrimp Capture and Culture Facilities of the United States*, by E.S. Iversen, D.M. Allen, and J.B. Higman, published in North America by Halstead Press, in 1993.

Q: [Dr. Paul Frelier, Texas A&M University] You made the comment that *P. chinensis* that were imported from China went to Dr. Lawrence's facility? Do you have any proof of that?

A: Several species were involved, but not *P. chinensis*.

Dr. Fernando Jimenez Guzman
Director de Sanidad Acuicola de la Dirección General de Acuicultura
Secretaría de Medio Ambiente Recursos Naturales y Pesca
Mexican Representative

Dr. Jimenez provided information on the shrimp aquaculture industry in Mexico. He explained that shrimp aquaculture in Mexico began in 1977. Currently Mexico has two large zones where shrimp farming is located: 268 farms are located on the Pacific Coast (primarily in the states of Sinaloa, Nayarit, and Sonora), and 11 farms are located on the Gulf of Mexico (primarily in the state of Tamaulipas). Mexico is the second largest producer of cultured shrimp in Latin America.

Dr. Jimenez made the following key points:

- Most postlarvae come from laboratory-reared stock. Wild-captured and imported stock are less significant sources of postlarvae.
- Mexico allows the cultivation of only native Mexican species: blue shrimp, white shrimp, and brown shrimp. The cultivation of exotic shrimp is prohibited.
- There is a feeling that the industry in Mexico is over-regulated, which can discourage investors.
- Mexico has a national initiative in place relating to shrimp aquaculture, extending from 1995 to 2000. The initiative has two subprograms, one dealing with the modernization of the industry and the other with sanitary issues. Several government agencies are involved. Each of these agencies are located under the same secretary.
- The Mexican government has contracted with Mexican universities to conduct research on shrimp viruses and to monitor shrimp disease. Many shrimp farms have been sampled, as well as laboratories producing postlarvae. The government subsidizes diagnostic services to aquaculture facilities.
- Mexico analyzes samples of postlarvae imported from other countries, mainly Nicaragua, Ecuador, Venezuela, Costa Rica, and the United States, to assess hygiene conditions in these countries.
- Mexico has conducted studies of shrimp populations in the Laguna Madre and other locations in the Gulf of Mexico. As of 1996, no viruses have been identified in these wild populations.
- We are conducting laboratory research on viruses such as IHHNV and TSV. Efforts with respect to IHHNV are focused on preventing the virus in blue shrimp populations, because this species is particularly vulnerable to IHHNV. Currently, we do not have problems with IHHNV, but we recognize that problems could possibly develop at any time. We have studied TSV since 1995.
- We have discovered that another pathogen, rickettsia, also poses threats to cultured shrimp. Rickettsial disease can result in losses of up to 80 to 90 percent.
- Mexico is working with the World Bank to develop two laboratories that will support the aquaculture industry.
- Research efforts for 1998 will include additional studies on rickettsial disease and a study of the ecology of *P. aztecus* in the Laguna Madre. We will also work on developing a

vaccine for TSV and on developing GIS/remote-sensing technologies to help prevent diseases in shrimp farms.

Attendees asked Dr. Jimenez the following questions:

Q: Have you looked into potential human health problems related to any of these viruses?

A: All viruses are very specific. They become more specific the longer they are associated with a carrier. We have not detected any viruses that could be transmitted to humans through the consumption of shrimp. Certain viruses can be transmitted to humans through oysters, for example, but again, shrimp viruses are very specific.

Q: [By Heidi Lovett, Texas A&M University] Could you provide more detail on the presence of rickettsial disease?

A: In 1998, we will conduct research on this issue. We identified the presence of rickettsia in studies using electron microscopy. The symptoms of rickettsia infection are very similar to the symptoms of TSV infection. We don't know if the rickettsias in the Gulf of Mexico are the same as those found in the Pacific.

Q: [By Bill Hoenig, Rich-SeaPak] Does Mexico have regulations regarding the treatment and disposal of effluent solids by processing plants?

A: Mexico does not have Federal regulations, but the Federal government has made recommendations to states in the form of an official memo, in order to help prevent an outbreak. The Secretary of Health was also involved in preparing this memo. Measures outlined in the memo include burning processing waste that is not disposed of. Also, we have prohibited the importation of shrimp from Ecuador for aquaculture and have prohibited the movement of shrimp from the Pacific to the Gulf of Mexico and vice-versa. Shrimp vessels from the south of Mexico are prohibited to take their product to the north or anywhere else in Mexico.

Q: [By Dave Buzan, Texas Parks and Wildlife Department] When was the first shrimp farm established in Mexico on the Gulf of Mexico?

A: In 1984.

Q: Is the number of Mexican shrimp farms growing along the Gulf of Mexico?

A: There are currently 10 registered farms.

Q: In what year did you notice the first incidence of TSV?

A: In 1985, in farms. We aren't sure about wild populations.

Q: So you have not confirmed any TSV cases in the Gulf of Mexico?

A: There is a recent report that is not fully confirmed of TSV in white shrimp. We have not seen TSV in blue shrimp in the Gulf. We are testing samples taken last year. We haven't yet confirmed TSV in shrimp in the Gulf of Mexico.

Q: [By Les Hodgson, Marco Sales, Inc.] Do you anticipate that this year's El Niño will have an effect on blue shrimp production, and if so, what effect?

A: Water temperature is one factor that may affect shrimp populations. We are more concerned with the effects of El Niño on sardines and other species than we are about shrimp.

Prior to opening the floor to public comment, Dr. Charles Menzie asked attendees if they had any additional questions to ask presenters. Les Hodgson of Marco Sales, Inc., Brownsville, asked Larry McKinney of Texas Parks and Wildlife Department if his agency knows which viruses, if any, are affecting populations of wild shrimp off the coast of Texas. He also asked what testing of wild shrimp is planned or underway in Texas. Mr. McKinney responded that the status of viruses in native shrimp in Texas is unknown, although a white spot-like virus has been observed in wild shrimp. This lack of knowledge is a concern, but monitoring is very expensive, especially when occurrence rates are low. The state does not have the resources to do monitoring. Dr. Paul Frelier of Texas A&M University stated that the university is starting to test wild shrimp, but the sample is far from statistically valid. The university will also be testing for rickettsia. Dr. Frelier stated that the type of rickettsia that has been detected in shrimp is not a human pathogen.

Public Comment

C. R. Mock
Aquaculture and Environmental Specialist to the Texas Shrimp Association
Galveston, Texas

During his remarks, Mr. Mock offered the following key points:

- The state of Texas should delegate regulatory authority to the proper state agency and pass a law to require that shrimp diseases be reported. Inasmuch as the Texas Department of Parks and Wildlife does not have a fish disease specialist or appropriate facilities, the Texas Department of Health should be assigned this new responsibility.
- There is a concern that shrimp farmers in the United States restock SPF shrimp of high health into diseased ponds, without taking measures to disinfect the ponds prior to restocking. A 1992 USDA-financed document by Dr. Lightner entitled “Shrimp Facility Cleanup and Restocking Procedures” contains important information on cleanup procedures and disease prevention measures. The state of Texas should adopt and implement the procedures set forth in this document.

Robert McFarlane
Consulting Ecologist
McFarlane and Associates
Houston, Texas

Mr. McFarlane spoke on behalf of the Matagorda Bay Foundation and the East Matagorda Bay Foundation. Mr. McFarlane made the following key points:

- The Shrimp Virus Work Group is to be commended for the report; however, it contains several omissions.
- The report does not adequately address the urgency of the issue. While further work is being done on the risk assessment, exotic shrimp will continue to be imported, cultured, and die of their accompanying diseases. Imported shrimp products, some known to be infected, continue to find their way to our waters, threatening our native species and ecosystems. It is ludicrous to allow foreign producers to harvest diseased shrimp and export them to our markets.
- It is urgent that the following emergency procedures be implemented as rapidly as possible, using existing laws and controls:
 - Declare an immediate temporary ban on the importation of exotic shrimp species.

- Declare an immediate temporary ban on the importation of diseased shrimp products.
- The report does not recognize that current U.S. shrimp mariculture policy and practice are fatally flawed. The development of SPF brood stock and high-health rearing facilities are high-technology solutions to low-technology problems. The root cause of disease epidemics is rearing shrimp at high densities. Until methodologies have been developed to economically raise shrimp at lower densities less susceptible to disease epidemics, we will continue to experience disease outbreaks.
- The report does not adequately consider the full ecological consequences of a shrimp virus epidemic on the estuarine and near-shore ecosystems. The report does not consider the role of native penaeid shrimp as “keystone” species. The loss or decline of these shrimp will trigger widespread and essentially unpredictable negative indirect effects in coastal ecosystems. As benthic detritivores and scavengers, shrimp play a vital role in the recycling of nutrients in our estuaries. As prey species for many fishes, invertebrates, and birds, shrimp are a vital link in aquatic food webs.
- We recommend that the tiered approach to risk assessment be utilized.
- Establishment of an exotic virus may be an improbable event. Repeated often enough, it becomes probable and eventually inevitable.

Bill Hoenig
Rich-SeaPak
Brownsville, Texas

Mr. Hoenig explained that Rich-SeaPak is a frozen food processor that processes shrimp, among other foods. Mr. Hoenig made the following key points:

- We are interested in facts. There is much that we do not know. Unknowns include infection vectors, what diseases or viruses already exist in the wild, or where the viruses come from. The course of action should be dictated by the answers to these questions.
- The report leaves out two major stakeholder groups—retailers and the food service industry.
- Rich-SeaPak’s effluents are treated by the city of Brownsville, and solid wastes are disposed of at a rendering plant.

Lin Turner
Coalition for the Protection of Copano Bay
Fulton, TX

Mr. Turner explained that his organization was formed in May 1995 in response to the establishment of a semi-intensive conventional shrimp farm on Port Bay, which intended at that time to discharge into a one-foot deep estuary. Mr. Turner made the following key points:

- Much good bay habitat has disappeared, and we can afford no more habitat losses.
- We want to prevent our bays from being degraded by the discharge of shrimp farm effluent. We want to prevent the transmission of these viruses—Taura, White Spot, and Yellow Head—to our native shrimp and other bay organisms because of the possibly catastrophic consequences.
- The economic benefits of the shrimp aquaculture industry are minimal compared to the economic benefits of the wild-caught shrimp industry, yet the aquaculture industry poses tremendous risks to wild shrimp populations. The risk-benefit ratio is “out of whack” and needs to be addressed.
- If viruses enter wild shrimp populations, the results could be catastrophic.
- We appreciate the Shrimp Virus Work Group’s report, and we support research efforts. However, more is needed from the Federal government, and it is needed now, not three years from now.
- EPA needs to enforce NPDES (the National Pollutant Discharge Elimination System) for shrimp farms as the law requires. EPA has responded that it does not have the money or personnel to do so. EPA needs to examine its priorities, reorder them appropriately, and take action.
- The U.S. Department of Commerce has extended loans to shrimp farmers. Given the precipitous decline in the productivity of these farms in 1995 and 1996, virtually solely due to viruses, it makes no sense to continue to loan money for shrimp farming until the industry can develop methods to contain these viruses.

- There are other ways to grow shrimp. In Rockport, a venture is underway to build a raceway farm for shrimp. No discharge is planned, and the entire operation will be indoors. This type of shrimp farming may solve a lot of our problems.

Pamela Baker
Environmental Defense Fund, Texas Office
Corpus Christi, Texas

Ms. Baker made the following key points:

- The Environmental Defense Fund supports the ecological risk assessment proposed by the JSA.
- The management goal should be broadened to attempt to prevent the establishment of viruses in all marine species, not just shrimp. We already know that viruses can affect other species, such as crabs. The establishment of these viruses could substantially harm fisheries and have severe ecological consequences.
- The management goal must clearly emphasize that the goal is to prevent the establishment of viruses in the Gulf and southeast Atlantic. The management goal currently gives equal status to minimizing potential impacts on shrimp importation, processing, and aquaculture operations. This split emphasis creates a potential conflict that may severely inhibit the assessment process.
- The JSA should consider the indirect ecological effects from the establishment of shrimp viruses.
- The JSA should place greater emphasis on shrimp import and retail industries in order to avoid virus introductions in the first place.
- The JSA should follow a tiered approach for conducting the ecological risk assessment.
- The JSA should also develop a tiered approach to implementing its findings, because of the urgency of the issue and the time it will take to complete the risk assessment and implement the relevant policies.
- Already, there is adequate evidence to take these actions now:
 - Implement Best Management Practices (BMPs) for coastal shrimp farms, including exclusive use of high-health postlarvae from certified facilities, biosecurity

measures to control vehicular and personnel traffic, and regularly scheduled disease monitoring.

- Processing plants should treat their wastewater and dispose of shrimp wastes in a manner that prevents access by animals.
- Disease diagnostic procedures should be improved.

Deyaun Boudreaux
Texas Shrimp Association
Port Isabel, Texas

Ms. Boudreaux made the following key points:

- The report of the Shrimp Virus Work Group contains much valuable information and does a very good job defining authorities over shrimp farming.
- The Federal government has a duty to ensure the well being of the shrimp fishery resource. The Federal government must require states to develop guidelines for the “taking” of shrimp to prevent their exposure to viruses in laboratories, hatcheries, and farms where exotic species have been held for shrimp farming and production.
- Shrimp viruses can mutate and adapt to new hosts and new environments. The medium of water provides many opportunities for exposure to mutated viruses.
- Work should be done by Federal agencies to inventory applicable laws in each state and to develop standards for implementing the Clean Water Act. Site surveys should be required, pursuant to the Clean Water Act.
- We could help shrimp farmers learn to practice water stewardship, which could enhance their chances for healthy, viable shrimp with few losses associated with pollution.

7. STAKEHOLDER PRESENTATIONS AND PUBLIC COMMENT
Thibodaux, Louisiana
July 25, 1997

Stakeholder Presentations

L. Brandt Savoie
Louisiana Department of Wildlife and Fisheries
Baton Rouge, Louisiana
State Regulatory Perspective

Mr. Savoie made the following key points:

- Louisiana has very little experience with this issue, because there are no shrimp aquaculture facilities in the state.
- Shrimp cannot be raised in ponds in the coastal zone of Louisiana without permits from both the Louisiana Department of Wildlife and Fisheries and the Louisiana Department of Natural Resources.
- The total economic impact of commercial marine shrimp and shellfish harvest to the state of Louisiana is estimated to be \$1.9 billion. According to 1996 NMFS data, the commercial dockside harvest of marine shrimp and shellfish in Louisiana is estimated to be \$179.3 million. In 1996, 90.2 million pounds of shrimp were landed. Approximately 22,000 jobs in Louisiana are supported by the domestic commercial marine shrimp and shellfish harvest.
- The following three areas are of concern:
 - Transport of imported shrimp to the United States. No nationwide standard appears to exist. Louisiana currently does not allow live specimens for culture, but does allow imports for processing. There also appears to be no nationwide standard to govern what happens to wastewater during transport.
 - Processing. Currently in Louisiana, processed shrimp parts are screened and landfilled. Wastewater is currently not checked or treated for viruses.

- Pond culture. Currently, there is no pond culture in Louisiana. If allowed, would postlarvae and juveniles be guaranteed disease free, and if so, by whom?

Currently, aquaculture operations are not checked for viruses.

- Shrimp viruses are widespread throughout the world. There is no reason to suspect that viruses would not occur in Louisiana.
- The report suggests that viruses were responsible for reduction in wild stock in the Gulf of California. There is no reason to think this could not happen in the Gulf of Mexico.
- Viruses have not been identified in native U.S. shrimp. There is no documentation, but we have recently been advised that Texas A&M University recently found White Spot Virus in white shrimp brood stock.
- We are concerned that foreign aquaculture operations harvest ponds when diseases are found. Infected shrimp end up in Louisiana processing plants still carrying viable pathogens.
- Species other than shrimp may be at risk. Crabs and crawfish in particular have been found with these viruses. Both are important in Louisiana. We are particularly concerned about risks to crawfish ponds.
- The most important weapon needed to control diseases is knowledge. Without knowledge of the distribution of these viruses, sound decisions about control or containment cannot be made.
- We need to learn if poor production years are linked to viruses that may already be present in wild stocks but have not been observed.

An attendee asked if the White Spot Virus that has turned up in the Gulf of Mexico is the same virus as has been seen in Asia. Mr. Savoie responded that he believes the virus is similar to but not the same as the White Spot Virus in Asia.

William Chauvin
Shrimp World, Inc.
New Orleans, LA
Processing Industry Representative

Mr. Chauvin explained that Shrimp World, Inc., is the management firm for the American Shrimp Processors Association. He made the following key points:

- Members of the American Shrimp Processors Association are very concerned about the issue of shrimp viruses.
- We have experienced wild swings in supply and particularly in shrimp prices throughout the world, nearly all resulting from the successes and failures of aquaculture operations throughout the world.
- Nearly 80 percent of shrimp processed in the United States is imported.
- Many of the operations in the Gulf Coast area continue to be dependent on domestic shrimp production for profitability in their business. In both the Atlantic and the Pacific regions, many processors utilize nearly all imported shrimp.
- The leading shrimp supplying countries, Thailand and Ecuador, supplied 44 percent of last year's shrimp imports. Nearly all these shrimp are cultured.
- Processors depend on both imported shrimp and shrimp from the aquaculture sector for their supplies. We are concerned that overreaction to the shrimp virus issue may endanger a significant portion of our supply. Already, South Carolina has quarantined some shrimp farms and ordered the destruction of shrimp in others. This measure may have been premature or unnecessary.
- The Shrimp Virus Work Group is to be commended for the report; however, additional research and supplementary data are needed.
- Except for the conclusion that indigenous *P. setiferus*, *P. aztecus*, and *P. duorarum* can be infected by viruses under laboratory conditions, there has been no research that concludes that these shrimp can assimilate the virus in the open waters of the Gulf.
- The only instance where wild shrimp were thought to be infected by a virus was in Mexico's Gulf of California, where the species is the same as those utilized in aquaculture operations. The decline in Mexican Pacific shrimp stocks beginning in 1987 may have been due to circumstances other than viruses. An El Niño occurrence possibly could have altered water temperatures and affected predation of shrimp or changed the ecology of the bay and estuary nursery areas. Additionally, along the west coast, there are many "tapos," which are berms that trap the juvenile shrimp and prevent them from emigrating into the open ocean. It is also possible that an abnormal ecological and environmental situation could have reduced the shrimp's immunity to the virus.

- We urge that more research be undertaken to look at the natural stocks in the Gulf and South Atlantic areas to determine if any virus is endemic to these species.
- The report discusses possible introduction of pathogenic viruses from ship ballast water. The species cited are not only different species from those we know may carry a virus, but are also of a different superfamily than the *Penaeoidea*. More research is needed here.
- We are pleased that the Shrimp Virus Work Group recommends that a workshop be convened to further examine this issue and to produce a risk assessment using the information from the stakeholders meetings. We urge that industry representatives participate in this meeting.

Esther Boykin
Earthjustice Legal Defense Fund
New Orleans, Louisiana
Environmental Representative

Ms. Boykin made the following key points:

- The report of the Shrimp Virus Work Group is very readable and contains a useful summary of current information on shrimp viruses and their potential impacts. However, we have serious concerns about aspects of the report.
- The report states that “threats to the sustainability of U.S. marine resources due to exotic shrimp viruses are increasing.” We therefore question the necessity of completing any major analysis document, such as a risk assessment, before taking action to protect indigenous species. Although there are some data gaps and research needs, it is unreasonable and imprudent to require that the science be conclusive before acting. By the time there is absolute proof that our wild shrimp populations are at risk from exotic shrimp viruses, it will be too late. The report does not reflect the urgency for action that this problem demands. We urge the JSA to act swiftly for “real world” protection of these valuable marine resources.
- We urge that the management goal be redrafted to be more protective of wild shrimp populations and aquatic ecosystems and to retain all potential alternatives for such management. Such a goal might read: “Prevent the introduction of disease-causing shrimp into the Gulf of Mexico and southeastern U.S. Atlantic coastal waters.”

- We urge the JSA to consider adopting a precautionary approach rather than an assimilative capacity approach. We do not suggest that a precautionary approach would lead to a “no harm” situation. It should, however, aid in identifying the most feasible precautionary alternatives.
- The JSA should conduct an alternatives assessment rather than a risk assessment. A full range of alternatives for the control of shrimp viruses should be identified. The advantages and disadvantages of each alternative should be reviewed on a number of parameters, including short-term and long-term effects, biological factors, economics, and degree of control.
- One of the most striking deficiencies in the report is the incomplete analysis of the currently available legal mechanisms for addressing the shrimp virus problem. It is helpful that the report outlines the Federal agencies that may have a role in addressing the shrimp virus problems and the potentially relevant legal authorities. Only in reference to the Animal and Plant Health Inspection Service (APHIS), however, does it state that the appropriate legal staff is “currently investigating whether existing statutes and executive orders can be interpreted to provide the authority to regulate the importation and interstate movement of shrimp and shrimp products to prevent and control shrimp viruses.” Such legal research should have been requested from the General Counsel’s office of each potentially relevant department and independent agency long ago. It is likely that legal mechanisms currently exist to address some aspects of the problem immediately.
- We urge the JSA to request assistance immediately from the offices of General Counsel of the following Federal agencies: the Environmental Protection Agency, the Department of the Interior, the Department of Commerce, and the Department of Agriculture.

An attendee asked Ms. Boykin how countries that are affecting our shrimp populations could be made accountable. She responded that she did not have a specific mechanism to outline or suggest. She stated that we currently have mechanisms in place for similar situations, such as Newcastle Disease, which is a viral disease that affects both domestic and wild birds. We do make an attempt to test and quarantine incoming animals that may be carrying this virus in order to protect both domestic and native species.

An attendee, Donald Lirette, stated that a cholera outbreak in shrimp occurred several years ago in Louisiana, coincidentally in the same area where shrimp are processed. He then asked Ms. Boykin if a mechanism exists, perhaps through the Food and Drug Administration, to try to curb the importation of infected shrimp from other countries or states. Ms. Boykin stated that she was not sure, but that this kind of question should be referred to the Shrimp Virus Work Group.

Another attendee asked Ms. Boykin what the liability would be if viruses originating from a shrimp farm were to infect the wild shrimp population and cause direct economic losses to shrimp farmers. She stated that she would assume that there would be some liability, but there would be major problems proving it.

George Barisich
United Commercial Fisherman's Association
Violet, Louisiana
Commercial Fishing Industry Representative

Mr. Barisich made the following key points:

- I hope that this exercise will not be another exercise in futility. The commercial fishing industry has repeatedly supplied dates, opinions, and assistance in matters related to fisheries, only to have most of this information basically ignored. Many in the industry feel that NMFS will do whatever it wants regardless of how unfair or burdensome the actions are to the fishing industry.
- The commercial fishing industry is very concerned about the virus issue.
- Not enough is being done to stop the importation of virus-affected product into the United States. Once a virus is discovered in foreign shrimp farms, the practice is to harvest as soon as possible to cut the losses. This in turn increases the amount of potentially infected product. This issue must be addressed in the risk assessment.
- We must aggressively pursue more ways to test for these viruses and develop ways to prevent their introduction into the wild shrimp harvest areas.
- It is likely that scientists will be asking for more money to study the shrimp virus problem. Some of these funds should be placed in escrow in the event that a shrimp virus decimates the wild shrimp crop. These funds should be used to compensate the fishermen who will be unable to turn a profit through no fault of their own.

- If a large-scale virus epidemic were to significantly reduce our shrimp crop for even one year, the industry would collapse, the economies of the coastal communities would be devastated, and people would lose their vessels and their homes. The bottom line is that the industry must be protected.
- If the virus remains contained in foreign aquaculture facilities and their production capabilities decrease, or they are banned from shipping into the United States, commercial shrimp fishermen will once again get a decent price for their product.
- The Shrimp Virus Work Group report provides a reference point for identifying and starting work on the problem. Positive aspects of the report are that it identifies several possible ways the viruses could be introduced into the wild, recognizes the need for commercial representation, and identifies agencies that should be involved in regulating to prevent the spread of the virus.
- On the other hand, the report is extremely repetitious. The subheadings make statements that do not appear to be substantiated in the report. Also, the fact that NMFS had a great deal to do with the report makes its credibility to the commercial fishing industry slim to none.
- More research needs to be initiated, but NMFS should not necessarily be given control of the research.
- Emphasis should be placed on eliminating the introduction of infected product into the United States, coupled with securing some funding to support the industry if and when the wild crop is affected.

Public Comments

Toby Gascon
Office of U.S. Congressman Billy Tauzin
Gonzales, Louisiana

Mr. Gascon stated that Congressman Tauzin is concerned about the economic and environmental impacts that the virus can pose. He is willing to work with both state and Federal agencies to correct the problem, or potential problem, either through the funding of research or through corrective measures. Gatherings like this stakeholder meeting will help the Congressman

develop an educated opinion about the most feasible action that should be taken to remedy the problem.

Donald Lirette
Terrebonne Fishermens' Organization
Montegut, LA

Mr. Lirette submitted for the record a copy of minutes of a November 1989 meeting of the Citizens Advisory Committee for the Gulf of Mexico Program. He stated that the minutes show the first time the problem was presented publicly to NMFS and EPA.

Mr. Lirette made the following key points:

- Not many shrimpers attended today's stakeholder meeting because they do not trust NMFS, largely because of the way NMFS handled the by-catch issue.
- Statistics in the Shrimp Virus Work Group's report conflict with other data contained in a fish farming magazine. As reported in this magazine, the actual wild shrimp catch throughout the world is far greater than statistics contained in the Shrimp Virus Work Group report.
- Shrimp farms are causing a near collapse of the World Bank.
- There is concern about experimental work with "surrogate" shrimp.
- Shrimp from Texas processed in Louisiana were responsible for a cholera outbreak in the wild Louisiana shrimp population.
- Ship ballast water was responsible for disease in oysters, shrimp, and crabs in Mobile Bay.
- Management actions need to address the processing issue. Importation of diseased shrimp from foreign aquaculture facilities is a concern. There is also a concern that foreign shrimp ponds have sewage effluent running through them.
- I am not opposed to more money for research, as long as the research brings results.

Appendix A
Stakeholder Meeting Agendas

Not available in electronic format.

Appendix B
Stakeholder Meeting Attendees

Not available in electronic format.

Appendix C

Written Comments

The following is a list of people who submitted written comments. The comments themselves are not available in electronic format.

U.S. Congressman Billy Tauzin
Third District, Louisiana

Linda R. Shead
Galveston Bay Foundation

Rebecca Goldberg, Pam Baker, and Douglas Rader
Environmental Defense Fund

Jim Lester
Environmental Institute of Houston

Andrew L. Duda
A. Duda and Sons

Robert W. McFarlane
McFarlane and Associates

James E. Heerin
Shrimp Culture II, Inc.

D.C. Cannon
Edisto Seafarms, Inc.

Fritz Jaenike
Harlingen Shrimp Farms, Ltd.

C.R. "Corny" Mock
Aquaculture and Environmental Specialist to the Texas Shrimp Association

Thomas Zeigler
Zeigler Brothers, Inc.

W. S. McGrath

Steve Kerchner
South Carolina Shrimp Association (Southern)

C. Rolland Laramore

Bonney, Laramore & Hopkins, Inc.

Becky Gillette
Sierra Club, Mississippi Chapter

Deyaun Boudreaux
Texas Shrimp Association

Julius Collins
Texas Shrimp Association

Larry McKinney
Texas Parks and Wildlife Department

Cynthia Sarthou
Gulf Restoration Network

George Barisich
United Commercial Fisherman's Association

William D. Chauvin
Shrimp World, Inc.

Esther Boykin
Earthjustice Legal Defense Fund

Brandt Savoie
Louisiana Department of Wildlife and Fisheries

Appendix D
Report of the JSA Shrimp Virus Work Group

The full report entitled, *An Evaluation of Potential Shrimp Virus Impacts on Cultured Shrimp and Wild Shrimp Populations in the Gulf of Mexico and Southeastern U.S. Atlantic Coastal Waters*, dated June 5, 1997, is available on the Internet at <http://www.epa.gov/ncea/svra.htm>.