

Shrimp Farm Inspection Program Report, 2003-2008

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## Table of Contents

	Page
List of Tables.....	ii
List of Figures .....	iii
List of Appendices.....	iv
Executive Summary.....	v
Introduction.....	1
Materials and Methods.....	1
Results.....	3
Discussion .....	4
Acknowledgements .....	8
Literature Cited.....	9
Tables.....	11
Figures .....	19
Appendices .....	21

**List of Tables**

	Page
Table 1. Shrimp inspection records for 2003, summarized by facility.....	11
Table 2. Shrimp inspection records for 2004, summarized by facility.....	12
Table 3. Shrimp inspection records for 2005, summarized by facility.....	13
Table 4. Shrimp inspection records for 2006, summarized by facility.....	14
Table 5. Shrimp inspection records for 2007, summarized by facility.....	15
Table 6. Shrimp inspection records for 2008, summarized by facility.....	16
Table 7. Shrimp farm production hectares (ha) and yields in Texas from 1999-2008	17
Table 8. Comparison of the shrimp disease inspection results from 1999-2008 .....	18

**List of Figures**

	Page
Figure 1. Boundary line marking the Exotic Species Exclusion Zone to the coast.	19
Figure 2. Location of shrimp farms on the Texas coast from 2003-2008 .....	20

**List of Appendices**

	Page
Appendix A. Exotic Species Culture Facility Inspection Report.....	21
Appendix B. Clinical Analysis Checklist .....	23

## EXECUTIVE SUMMARY

The Texas Parks and Wildlife Department (TPWD) is tasked with conducting shrimp farm inspections to ensure that exotic shrimp and/or pathogens related to aquaculture facilities are not introduced into Texas waters. This report documents results from TPWD shrimp farm inspections conducted during 2003 to 2008. Overall, TPWD conducted 7,363 shrimp farm inspections ranging from a low of 696 inspections in 2008 to a high of 2,053 inspections in 2003. Due to the variable economic trends, the number of shrimp facilities in production and inspected annually ranged from six to thirteen.

In 2003, shrimp farm inspectors conducted 2,053 pond inspections to assess the health of shrimp stocks on two research and 11 commercial facilities. TPWD inspectors requested 18 samples be submitted to Texas Veterinary Medical Diagnostic Laboratory (TVMDL) in College Station, Texas for disease analysis. Shrimp farm operators also voluntarily submitted 114 shrimp samples of questionable health to the TVMDL for disease analysis. No samples submitted to TVMDL in 2003 indicated the presence of viral infections.

In 2004, shrimp farm inspectors conducted 1,553 pond inspections to assess the health of shrimp stocks on one research and 10 commercial facilities. TPWD inspectors requested seven samples be submitted to TVMDL in College Station, Texas for disease analysis. Shrimp farm operators also voluntarily submitted 35 shrimp samples of questionable health to the TVMDL for disease analysis. Due to the presence of Taura Syndrome Virus (TSV), all four Rio Grande Valley shrimp farms were placed under quarantine conditions. TPWD field inspectors and shrimp farmers submitted additional samples to the TVMDL for further examination. Shrimp farms were put under quarantine from May 29<sup>th</sup> till September 1, 2004. No effluent could be discharged before that time due to established guidelines.

In 2005, shrimp farm inspectors conducted 1,335 pond inspections to assess the health of shrimp stocks at one research and 10 commercial facilities. TPWD inspectors requested one sample be submitted to TVMDL for disease analysis. Shrimp farm operators also voluntarily submitted 28 shrimp samples of questionable health to the TVMDL for disease analysis.

In 2006, shrimp farm inspectors conducted 929 pond inspections to assess the health of shrimp stocks at one research facility and nine commercial facilities. TPWD inspectors requested that eight samples be submitted to TVMDL for disease analysis. Shrimp farm operators also voluntarily submitted 32 shrimp samples of questionable health to the TVMDL for disease analysis.

In 2007, shrimp farm inspectors conducted 797 pond inspections to assess the health of shrimp stocks at one research and seven commercial facilities. Shrimp farm operators voluntarily submitted five shrimp samples of questionable health to the TVMDL for disease analysis.

In 2008, shrimp farm inspectors conducted 696 pond inspections to assess the health of shrimp stocks at one research and five commercial facilities. No shrimp samples were submitted to TVMDL for disease analysis.

During 2003-2006, Necrotizing Hepatopancreatitis and Hemocytic Enteritis were the most prevalent diseases detected at the shrimp farms. However in 2004, the lower coast farms were also infected with TSV. During 2007-2008, no diseases were observed at any of the aquaculture facilities even though greater than 1,490 inspections were conducted.



## INTRODUCTION

In Texas, shrimp farm inspections have been conducted by Texas Parks and Wildlife Department (TPWD) staff since 1998. The inspection program was designed to ensure that exotic shrimp and/or pathogenic agents (i.e. viruses) associated with aquaculture were not introduced into Texas waters. Currently, Specific Pathogen Free (SPF) Pacific white shrimp (*Litopenaeus vannamei*) are the only exotic shrimp species that can be cultured within the Texas Exotic Species Exclusion Zone (ESEZ) (Figure 1). Pacific white shrimp are currently on the list of Harmful or Potentially Harmful Exotic Fish, Shellfish, and Aquatic Plants under the Texas Administrative Code, Title 31, Part 2, Chapter 57, Subchapter A. Facility inspections of commercially farmed Pacific white shrimp are conducted to ensure compliance with “department code” which was designed to prevent escapement of cultured exotic shrimp into Texas waters (Juan and Adami, 2003).

SPF Blue shrimp (*L. stylirostris*) can also be cultured on a case by case basis, which would be determined by TPWD when cultured outside the ESEZ. These regulatory measures ensure exotic species do not escape and establish populations that could negatively impact native shrimp species in Texas waters. To prevent harmful disease releases into Texas waters, and possible infection of native crustaceans, farmers must demonstrate “disease-free” status prior to discharging effluents into public waters from shrimp culture ponds (Texas Parks and Wildlife Regulations 2001).

Prior to 1992, farmers were not required to use SPF certified offspring to stock their ponds (State of Texas 1989-1990). SPF brood stocks were developed in the late 1980’s and commercial trials were started in 1990. During that period, Runt Deformity Syndrome caused by Infectious Hypodermal and Hematopoietic Necrosis Virus (IHHNV) (Brock and Main 1994), was present in cultured shrimp. Because quarantines were not yet imposed, virus latent water could be released at that time. Even though confirmed IHHNV infected shrimp were destroyed, not all ponds were examined. In 1995, Taura Syndrome Virus (TSV) caused mass mortalities of Texas farm raised Pacific white shrimp (Brock et al. 1995). The culture water was voluntarily quarantined by shrimp farmers until September 1, as suggested by TPWD Coastal Fisheries management personnel, in order to prevent viral exposure to native juvenile white shrimp (*L. setiferus*). Erickson (1997) determined that while white shrimp were susceptible to TSV, the native brown shrimp (*Farfantepenaeus aztecus*) and native pink shrimp (*F. duorarum*) demonstrated resistance and were not affected.

As part of the TPWD shrimp farm inspection program, inspectors determine the general health of representative shrimp taken from every culture pond prior to discharge and/or harvest. If a shrimp disease manifestation was observed and verified through laboratory examination, the inspectors would quarantine the facility according to the disease identified. The objective of this report is to document shrimp farm inspections conducted during the 2003-2008 production season and report general trends in shrimp health and production efforts.

## MATERIALS AND METHODS

TPWD personnel conducted two types of exotic shrimp inspections: 1) facility inspections and 2) shrimp health examinations. Inspection procedures for facilities and shrimp health examinations are described by Juan and Adami (2003).

Two full-time inspectors conducted the majority of the exotic species facility inspections and shrimp examinations. Additional assistance was provided by Coastal Fisheries Division personnel as needed. The inspection team covered the entire Texas coast during 2003-2008. The west Texas shrimp farms have not been inspected since 2002, due to a possible threat of disease transmission by coastal inspectors. However, inland fisheries personnel can conduct the shrimp farm inspections if needed.

#### *Facility Inspections*

Shrimp facility inspections conducted at both existing and new facilities, ensured that facility improvements or renovations (i.e., farms adding culture ponds or modifying discharge structures, fill and drain canals, wetlands or settling basins) complied with TPWD shrimp farm regulations (Texas Parks and Wildlife Regulations 2001 ). Facility inspection criteria for screening requirements are designed to prevent escape of cultured exotic Pacific white shrimp into Texas waters. Department policy requires an Exotic Species Culture Facility Inspection Report (Appendix A) be completed by an inspector and submitted to the Exotic Species Program Leader for final review. The Exotic Species Program Leader will issue a permit if all departmental criteria have been satisfied. If a criterion was not approved, a second inspection would be conducted at a later date after the completion of specified improvements. A permit must be issued to the applicant before culture operations could proceed.

#### *Shrimp Health Examinations*

Shrimp inspection protocols were developed by TPWD Resource Protection and Coastal Fisheries Division personnel as outlined in the 71<sup>st</sup> Legislature, Texas Senate Bill 1507, Fish Farming Act of 1989, Chapter 637 to protect state waters and marine ecosystems. Shrimp health examinations (e.g. in ponds, tanks and raceways) were conducted by visual examination of shrimp from each culture unit. Relative health of the shrimp was evaluated with the primary objective of preventing disease manifestations from impacting marine ecosystems with effluent discharges. Inspectors recorded shrimp health examination data on the Clinical Analysis Checklist (Appendix B). Shrimp health examinations were conducted when shrimp reached six to eight weeks of age. At this point in their life cycle, shrimp weigh approximately 1.0 g or more and are large enough to exhibit symptoms (as listed on the clinical analysis checklist) of disease manifestation. A minimum of 50 shrimp, randomly sampled, were examined per culture unit during the production season (March-November). The number of specimens (50) was a manageable number by both TPWD and the production facilities. This number would also provide a 5-10 % prevalence of disease infection in a population greater than 100,000 (Lightner, editor 1996). Examinations were conducted prior to the release of effluent water from the facility. Once the shrimp were examined and declared to be disease-free, effluent could be discharged from the facility for a two week period into state waters without additional examinations under the Texas Administration Code, Title 31, Part 2, Chapter 57, Subchapter A, Rule 57.114 (f) (2). However, if disease symptoms were observed during the examination, TPWD inspectors imposed a “mandatory quarantine” status on the facility. The duration of the quarantine period varied depending on the disease identified. If TSV was observed, the quarantine period would extend until September 1<sup>st</sup>. Detection of Yellow Head Virus and/or White Spot Syndrome Virus would require a 90 day post harvest effluent quarantine period.

## RESULTS

### *2003 Facility Inspections*

Inspections were conducted on all shrimp farms in Texas which culture exotic Pacific white shrimp (Figure 2). The TPWD inspection team also inspected two facilities that modified their operations by adding greenhouse nursery raceway systems. No shrimp escapements were reported or observed by farmers or inspectors during 2003.

### *2003 Shrimp Examinations*

Shrimp examinations started April 10<sup>th</sup>, 2003 and included inspections on 2,053 ponds, observing more than 124,000 shrimp. TPWD inspectors requested shrimp farmers to submit 18 samples (2-10 shrimp/sample) to Texas Veterinary Medical Diagnostic Laboratory (TVMDL) for further examination.

Shrimp farmers voluntarily submitted 114 pond samples (2-10 shrimp/sample) to TVMDL for disease examination. With the combined samples (132) requested by TPWD and volunteered by shrimp farmers, 26 were diagnosed with Necrotizing Hepatopancreatitis (NHP) and 22 were diagnosed with Hemocytic Enteritis (HE) and two ponds tested positive for both NHP and HE. NHP has been documented in both aquaculture and wild caught shrimp (Frelier et al. 1992 and Dorf et al. 2005). HE is caused by blue-green algae (Lightner, editor 1996). Neither of these diseases has been documented as threats to wild stocks, therefore no quarantines were imposed on the facilities. Inspection records for each farm are shown on Table 1.

### *2004 Facility Inspections*

The TPWD inspection team inspected two facilities that added ponds to their production system and two facilities leased ponds on an existing shrimp farm. No shrimp escapements were reported or observed by farmers or inspectors during 2004.

### *2004 Shrimp Examinations*

Shrimp examinations started on May 5<sup>th</sup>, 2004 and included inspections on 1,553 ponds, observing more than 90,800 shrimp. TPWD inspectors requested shrimp farmers submit seven samples (2-10 shrimp/sample) to TVMDL for further examination. Shrimp farmers voluntarily submitted 35 samples (2-10 shrimp/sample) to TVMDL for disease examination. With the combined samples (42) from TPWD and shrimp farmers sent to TVMDL, three were diagnosed with NHP, five were diagnosed with HE and 19 tested positive for TSV. Facilities with positive TSV results were quarantined until September 1<sup>st</sup> of the production year. Inspection records for each farm are shown on Table 2.

### *2005 Facility Inspections*

The TPWD inspection team inspected two facilities that added ponds to their production system and one research facility entered the program. No shrimp escapements were reported or observed by farmers or inspectors during 2005.

### *2005 Shrimp Examinations*

Shrimp examinations started on May 11<sup>th</sup>, 2005 and included inspections on 1,335 ponds, observing more than 82,400 shrimp. TPWD inspectors requested a shrimp farmer submit one sample (2-10 shrimp/sample) to TVMDL for further examination. No disease was detected in the sample. Shrimp farmers voluntarily submitted 28 samples (2-10 shrimp/sample) to TVMDL

for disease examination; five were diagnosed with NHP; eight were diagnosed with HE and three were diagnosed with bacterial septicemia. Bacterial septicemia is not caused by exotic pathogens, so no quarantines were imposed. Inspection records for each farm are shown in Table 3.

#### *2006 Facility Inspections*

The TPWD inspection team inspected one facility that added ponds to their production system. No shrimp escapements were reported or observed by farmers or inspectors during 2006.

#### *2006 Shrimp Examinations*

Shrimp examinations started on May 2<sup>nd</sup>, 2006 and included inspections on 929 ponds, observing more than 57,400 shrimp. TPWD inspectors requested shrimp farmers submit eight samples (2-10 shrimp/sample) to TVMDL for further examination. One sample tested positive for both NHP and HE, one sample tested positive for HE only.

Shrimp farmers voluntarily submitted 32 samples (2-10 shrimp/sample) to TVMDL for disease examination; 16 were diagnosed with NHP; 13 were diagnosed with HE and three tested positive for both NHP and HE. Inspection records for each farm are shown in Table 4.

#### *2007 Shrimp Examinations*

Shrimp examinations started on May 24<sup>th</sup>, 2007 and included inspections on 797 ponds, observing more than 49,500 shrimp. TPWD inspectors did not request any samples be examined by TVMDL. Shrimp farmers voluntarily submitted five samples (2-10 shrimp/sample) to TVMDL for disease examination. One sample tested positive for bacterial septicemia. Inspection records for each farm are shown in Table 5.

#### *2008 Facility Inspections*

The TPWD inspection team inspected one facility that added ponds to their production system. No shrimp escapements were reported or observed by farmers or inspectors during 2008.

#### *2008 Shrimp Examinations*

Shrimp examinations started on May 14<sup>th</sup>, 2008 and included inspections on 696 ponds, observing more than 44,200 shrimp. TPWD inspectors did not request any samples be examined by TVMDL. Shrimp farmers did not need to self-submit any samples. Inspection records for each farm are shown in Table 6.

## **DISCUSSION**

### *2003*

Texas shrimp farmers cultivated 1,233 ha and harvested close to 4.1 million kg of shrimp, worth an estimated \$17.9M (Table 7). Unit production averaged 3,309 kg/ha and no shrimp escapements were reported or observed. The number of shrimp diseases reported was also greatly reduced in 2003, compared to 2002 (Juan and Adami, 2004).

More ponds were inspected in 2003 than in 2002 and TPWD inspectors required more sample submissions to TVMDL for disease analysis (Table 8). Conversely, shrimp farmers voluntarily submitted fewer samples than in 2002. In 2002, the fear of NHP caused shrimp farmers to self-submit more samples to TVMDL for disease confirmation. In order to control NHP, this disease needed to be confirmed by TVMDL before the use of feed containing the Investigational New Animal Drug (INAD), Oxy-Tetracycline (OTC) could be used. In 2003, Texas shrimp farmers added more acreage to culture shrimp and the annual production increased to 4.08 million kg. Despite the production increases, the product value dropped slightly (Lam, personal communication 2002). The price of shrimp dropped to its lowest value (approx. \$2.10/lb.) in more than 15 years (Hodgson, personal communication 2002).

#### *2004*

Texas shrimp farmers cultivated 940 ha of ponds, which produced approximately 3.6 million kg of shrimp, worth an estimated \$16.7 million (Table 7). Production averaged 3,840 kg/ha and no shrimp escapements were reported or observed by farmers or inspectors during 2004.

On May 29<sup>th</sup>, 2004, shrimp farmers in the lower Rio Grande Valley area contacted the TPWD inspector about unusual bird activity on the ponds. The shrimp farmers in this area had not started discharging, so they were requested to continue this mode of operation as a precaution. The farmers submitted shrimp samples to TVMDL for analysis with results coming back in early June. TSV was confirmed in all four facilities in the area within a week. Shrimp farmers were contacted to make sure they do not discharge water until September 1, 2004 as per TPWD disease management protocols. This strategy will ensure native white shrimp are large enough and will not be infected with TSV. The strategy seemed to work as a subsequent study did not show TSV in the wild shrimp population (Adami and Juan, 2010). Shrimp farms in the upper coast were also closely monitored after TSV was detected in the lower Rio Grande Valley but no disease was detected during sampling.

Although 1,553 ponds were inspected in 2004, TPWD only required seven pond samples be submitted to TVMDL for disease analysis (Table 8). Once a pond is confirmed with TSV, all ponds on the facility are quarantined; therefore no water can be discharged. Since shrimp farmers can not discharge water before September 1<sup>st</sup>, fewer inspections were required.

#### *2005*

Texas shrimp farmers cultivated 771 ha, which yielded approximately 3.1 million kg of shrimp, worth an estimated \$13.7 million in 2005 (Table 7). This production averaged 4,024 kg/ha in 2005. No shrimp escapements were reported or observed by farmers or inspectors during 2005.

Because of the TSV episode in 2004, fewer ponds were stocked and inspected in 2005. TPWD required fewer pond samples be submitted to TVMDL for disease analysis (Table 8). Conversely, shrimp farmers voluntarily submitted more samples than TPWD requested as an early disease detection management tool. Although, total yield was less than previous year's production, the yield per hectare was greater (Table 7). Despite increases in production per unit, the value per unit went down. This could partly be due to high shrimp imports (USDA, 2007).

The absence of TSV, which previously affected the mid-coast areas (Adami and Juan 2004) and the Rio Grande Valley shrimp farms (Table 8) was a positive observation noted during 2005 inspections.

### *2006*

Texas shrimp farmers cultivated 650 ha of ponds and produced approximately 2.3 million kg of shrimp, worth an estimated \$10 million in 2006 (Table 7). Production averaged 3,500 kg/ha this production year. No shrimp escapements were reported or observed by farmers or inspectors during 2006.

Although fewer numbers of ponds (929) were inspected in 2006, TPWD required more pond samples be submitted to TVMDL for disease analysis (Table 8). Shrimp farmers also voluntarily submitted more samples than TPWD requested as an early disease detection management tool. More ponds were detected to have both NHP and HE. These diseases lowered the unit production compared to 2005.

### *2007*

Texas shrimp farmers cultivated 505 ha of ponds and harvested approximately 1.58 million kg of shrimp, worth an estimated \$6.95 million in 2007 (Table 7). Production averaged 3,129 kg/ha in 2007. No shrimp escapements were reported or observed by farmers or inspectors during 2007. The number of shrimp diseases reported was also greatly reduced in 2007 (Table 8).

Fewer numbers of ponds were inspected in 2007 and TPWD required no pond samples be submitted to TVMDL for disease analysis (Table 8). Shrimp farmers voluntarily submitted five samples to TVMDL as an early disease detection management tool. Only one sample was detected with bacterial septicemia. However, due to unknown reasons, shrimp per unit production was lower than 2006 (Table 7).

### *2008*

Texas shrimp farmers cultivated 394 ha of ponds and harvested approximately 1.69 million kg of shrimp, worth an estimated \$7.45 million in 2008 (Table 7). Production averaged 4,292 kg/ha in 2008. No shrimp escapements were reported or observed by farmers or inspectors during 2008.

Fewer numbers of ponds were inspected in 2008 and TPWD required no pond samples be submitted to TVMDL for disease analysis (Table 8). Shrimp farmers also did not submit samples to TVMDL for disease analysis. No diseases were reported in 2008.

From 2003 to 2008, fewer and fewer ponds were stocked each year and hence fewer ponds were inspected. A possible assumption to the decrease in production is the high volume of imports (National Marine Fisheries Service, 2010). The high volume of imported shrimp has also caused the price to drop and has made the local product harder to sell (Jaenike, personal communication 2005).

The continued use of SPF seedlings, shrimp farmers vigilance, and the TPWD shrimp inspection program have all contributed in controlling TSV infections. NHP and HE are currently the main diseases for the farm raised shrimp. NHP can be controlled by using the INAD-OTC medicated feed. However, farmers still need to be vigilant and submit suspicious samples to a shrimp disease specialist for confirmation before administering the medicated feed.

From 2003-2008, the TPWD shrimp inspection program served both the state and the farmers by detecting diseases and dealing with issues related to shrimp health. Because of the

frequent on site inspections, TPWD ensured that exotic shrimp or harmful pathogens did not escape in the effluent discharge.

Production of SPF disease resistant brood stock by the U.S. Marine Shrimp Farming Consortium and private brood stock producers appears to have curtailed diseases such as TSV, which are a major concern to Texas shrimp farms. Enforcing the use of SPF certified shrimp and continued surveillance of the shrimp farming industry also appears to be an important management tool for reducing the environmental risk of disease transmission to Texas marine ecosystems.

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TABLE 1.--Shrimp inspection records for 2003, summarized by facility.

Facility	Ponds cultured	Inspections By TPWD	Samples submitted by TPWD	Samples submitted by Operator	Samples infected with NHP* (TPWD and Operator)	Samples infected with HE** (TPWD and Operator)	Samples infected with NHP+HE (TPWD and Operator)	Samples not infected (TPWD and Operator)	Samples infected with other disease (TPWD and Operator)
Arroyo Aquaculture	74	230	1	32	13	4	1	15	0
Austwell Aqua Farm	13	37	0	2	0	0	0	2	0
Bowers Shrimp Farm	79	502	4	0	0	0	0	4	0
Bowers Valley Shrimp	67	552	11	47	3	13	1	41	0
Harlingen Shrimp	23	104	0	8	0	2	0	6	0
Loma Alta	25	74	0	14	0	3	0	11	0
Mengers and Son	1	1	0	0	0	0	0	0	0
R&G Shrimp Farm	16	138	1	0	0	0	0	1	0
Southern Star, Inc	109	274	0	11	10	0	0	1	0
St. Martin Seafood	46	93	1	1	0	0	0	1	0
Texas Sea Breeze	14	36	0	2	0	2	0	0	0
TAES-Flour Bluff	8	8	0	0	0	0	0	0	0
TSTC	4	4	0	0	0	0	0	0	0
Total	479	2,053	18	114	26	22	2	82	0

\* NHP = Necrotizing Hepatopancreatitis

\*\* HE = Hemocytic Enteritis

TABLE 2.--Shrimp inspection records for 2004, summarized by facility.

Facility	Ponds cultured	Inspections By TPWD	Samples submitted by TPWD	Samples submitted by Operator	Samples infected with TSV* (TPWD and Operator)	Samples infected with NHP* (TPWD and Operator)	Samples infected with HE** (TPWD and Operator)	Samples not infected (TPWD and Operator)	Samples infected with other disease (TPWD and Operator)
Arroyo Aquaculture	65	194	3	11	7	3	1	2	1
Austwell Aqua Farm	12	25	0	0	0	0	0	0	0
Bowers Shrimp Farm	79	584	1	0	0	0	0	1	0
Bowers Valley Farm	57	304	3	4	5	0	0	1	1
Harlingen Shrimp	23	118	0	3	2	0	1	0	0
Jr's Aquaculture	10	23	0	0	0	0	0	0	0
Loma Alta	23	66	0	9	5	0	0	4	0
Southern Star, Inc	22	88	0	0	0	0	0	0	0
St. Martin Seafood	44	103	0	0	0	0	0	0	0
Texas Sea Breeze	14	43	0	0	0	0	0	0	0
TAES-Flour Bluff	5	5	0	8	0	0	3	4	1
<b>Total</b>	<b>354</b>	<b>1,553</b>	<b>7</b>	<b>35</b>	<b>19</b>	<b>3</b>	<b>5</b>	<b>12</b>	<b>3</b>

\* TSV = Taura Syndrome Virus

\*\* NHP = Necrotizing Hepatopancreatitis

\*\*\* HE = Hemocytic Enteritis

TABLE 3.--Shrimp inspection records for 2005, summarized by facility.

Facility	Ponds cultured	Inspections By TPWD	Samples submitted by TPWD	Samples submitted by Operator	Samples infected with NHP* (TPWD and Operator)	Samples infected with HE** (TPWD and Operator)	Samples infected with NHP+HE (TPWD and Operator)	Samples not infected (TPWD and Operator)	Samples infected with other disease (TPWD and Operator)
Arroyo Aquaculture	69	227	1	22	5	7	0	11	0
Austwell Aqua Farm	12	29	0	0	0	0	0	0	0
Bowers Shrimp Farm	34	205	0	0	0	0	0	0	0
Bowers Valley Farm	46	438	0	0	0	0	0	0	0
Harlingen Shrimp	23	171	0	0	0	0	0	0	0
Jr's Aquaculture	12	24	0	0	0	0	0	0	0
Loma Alta	21	65	0	5	0	1	0	2	2
Southern Star, Inc	11	41	0	0	0	0	0	0	0
St. Martin Seafood	44	116	0	0	0	0	0	0	0
Texas Sea Breeze	7	14	0	0	0	0	0	0	0
TAES-Flour Bluff	4	5	0	1	0	0	0	0	1
Total	283	1,335	1	28	5	8	0	13	3

\* NHP = Necrotizing Hepatopancreatitis

\*\* HE = Hemocytic Enteritis

TABLE 4.--Shrimp inspection records for 2006, summarized by facility.

Facility	Ponds cultured	Inspections By TPWD	Samples submitted by TPWD	Samples submitted by Operator	Samples infected with NHP* (TPWD and Operator)	Samples infected with HE** (TPWD and Operator)	Samples infected with NHP+HE (TPWD and Operator)	Samples not infected (TPWD and Operator)	Samples infected with other disease (TPWD and Operator)
Arroyo Aquaculture	39	100	0	19	15	3	0	1	0
Austwell Aqua Farm	16	51	0	0	0	0	0	0	0
Bowers Shrimp Farm	34	174	0	0	0	0	0	0	0
Bowers Valley Farm	46	340	8	0	0	1	1	6	0
Harlingen Shrimp	14	96	0	13	1	9	2	1	0
Jr's Aquaculture	12	30	0	0	0	0	0	0	0
Southern Star, Inc	10	32	0	0	0	0	0	0	0
St. Martin Seafood	44	88	0	0	0	0	0	0	0
Texas Sea Breeze	6	10	0	0	0	0	0	0	0
TAES-Flour Bluff	4	8	0	0	0	0	0	0	0
<b>Total</b>	<b>225</b>	<b>929</b>	<b>8</b>	<b>32</b>	<b>16</b>	<b>13</b>	<b>3</b>	<b>8</b>	<b>0</b>

\* NHP = Necrotizing Hepatopancreatitis

\*\* HE = Hemocytic Enteritis

TABLE 5.--Shrimp inspection records for 2007, summarized by facility.

Facility	Ponds cultured	Inspections By TPWD	Samples submitted by TPWD	Samples submitted by Operator	Samples infected with NHP* (TPWD and Operator)	Samples infected with HE** (TPWD and Operator)	Samples infected with NHP+HE (TPWD and Operator)	Samples not infected (TPWD and Operator)	Samples infected with other disease (TPWD and Operator)
Austwell Aqua Farm	10	31	0	0	0	0	0	0	0
Bowers Shrimp Farm	34	216	0	0	0	0	0	0	0
Bowers Valley Farm	45	333	0	3	0	0	0	3	0
Harlingen Shrimp	13	90	0	2	0	0	0	1	1
Southern Star, Inc	9	26	0	0	0	0	0	0	0
St. Martin Seafood	40	91	0	0	0	0	0	0	0
Texas Sea Breeze	4	8	0	0	0	0	0	0	0
TAES-Flour Bluff	2	2	0	0	0	0	0	0	0
Total	157	797	0	5	0	0	0	4	1

\* NHP = Necrotizing Hepatopancreatitis

\*\* HE = Hemocytic Enteritis

TABLE 6.--Shrimp inspection records for 2008, summarized by facility.

Facility	Ponds cultured	Inspections By TPWD	Samples submitted by TPWD	Samples submitted by Operator	Samples infected with NHP* (TPWD and Operator)	Samples infected with HE** (TPWD and Operator)	Samples infected with NHP+HE (TPWD and Operator)	Samples not infected (TPWD and Operator)	Samples infected with other disease (TPWD and Operator)
Arroyo Aquaculture	2	14	0	0	0	0	0	0	0
Bowers Shrimp Farm	74	432	0	0	0	0	0	0	0
Harlingen Shrimp	12	93	0	0	0	0	0	0	0
Southern Star, Inc	11	61	0	0	0	0	0	0	0
St. Martin Seafood	44	94	0	0	0	0	0	0	0
TAES-Flour Bluff	2	2	0	0	0	0	0	0	0
Total	145	696	0	0	0	0	0	0	0

\* NHP = Necrotizing Hepatopancreatitis

\*\* HE = Hemocytic Enteritis

TABLE 7.--Shrimp farm production hectares (ha) and yields in Texas from 1999-2008

Year	Pond area (ha.)*	Yield (million kg**)	Yield/ha	Value (million dollars)	Dollars/ha
1999	689	2.40	3,495	16.40	23,803
2000	879	2.56	2,916	18.60	21,160
2001	1,165	3.53	3,032	19.80	16,996
2002	1,225	3.76	3,067	17.37	14,171
2003	1,233	4.08	3,309	17.96	14,562
2004	940	3.61	3,840	16.67	17,743
2005	771	3.10	4,024	13.66	17,705
2006	650	2.27	3,500	10.00	15,400
2007	505	1.58	3,129	6.95	13,769
2008	394	1.69	4,292	7.45	18,885

Note: \* 1 ha = 2.47 acres

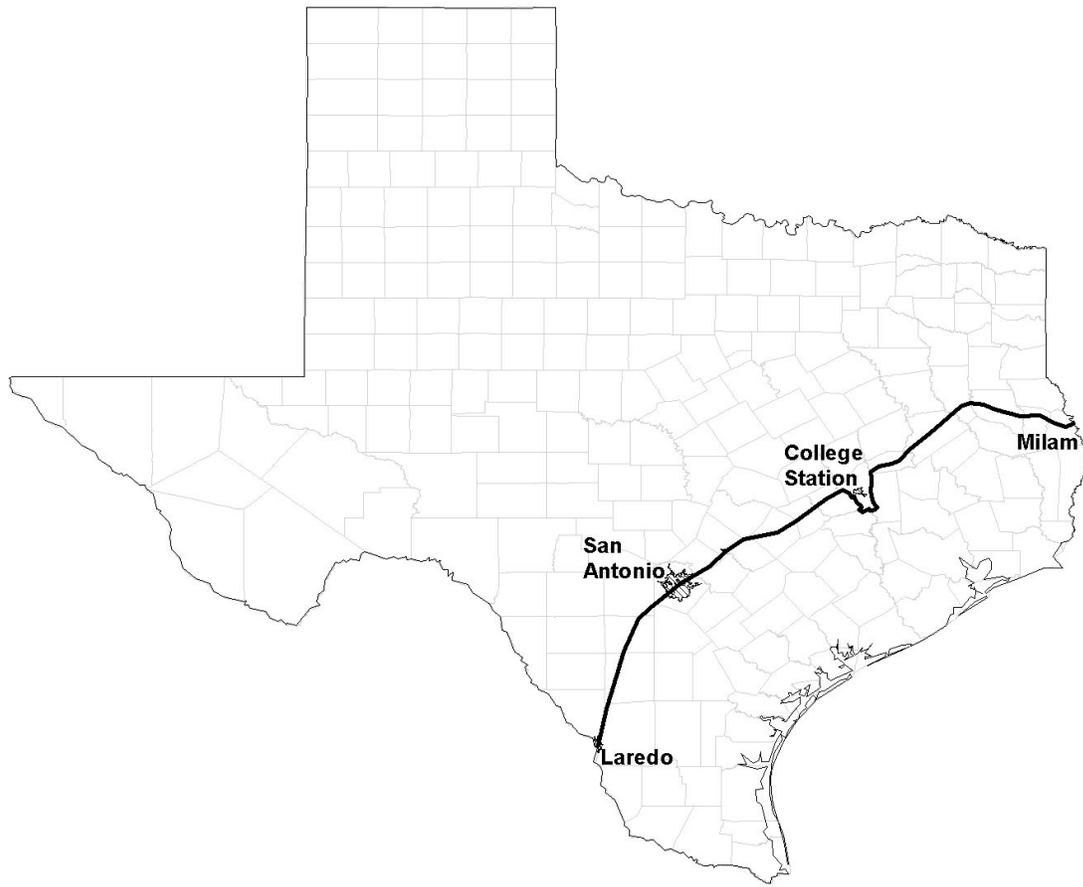
Note: \*\* 1 kg = 2.2 pounds

TABLE 8.--Comparison of the shrimp disease inspection results from 1999-2008.

Year	TPWD Inspections	Samples Submitted by TPWD	Samples Submitted by Operator	Samples infected with TSV	Samples infected with NHP	Samples infected with HE	Samples infected with NHP+HE	Samples infected with other diseases *	Samples submitted, not infected
1999	747	50	112	25	76	5	0	0	56
2000	1,113	33	152	0	87	17	8	7	66
2001	1,406	23**	158	0	74	32	27	4	43
2002	1,781	11	134	0	84	8	0	0	53
2003	2,053	18	114	0	26	22	2	0	82
2004	1,553	7	35	19	3	5	0	3	12
2005	1,335	1	28	0	5	8	0	3	13
2006	929	8	32	0	16	13	3	0	8
2007	797	0	5	0	0	0	0	1	4
2008	696	0	0	0	0	0	0	0	0
<b>Total</b>	12,410	151	770	44	371	110	40	18	337

\* Vibriosis and/or bacterial septicemia and/or extra cellular bacteria

\*\* One sample was lost



*FIGURE 1.*—Boundary line marking the Exotic Species Exclusion Zone to the coast.

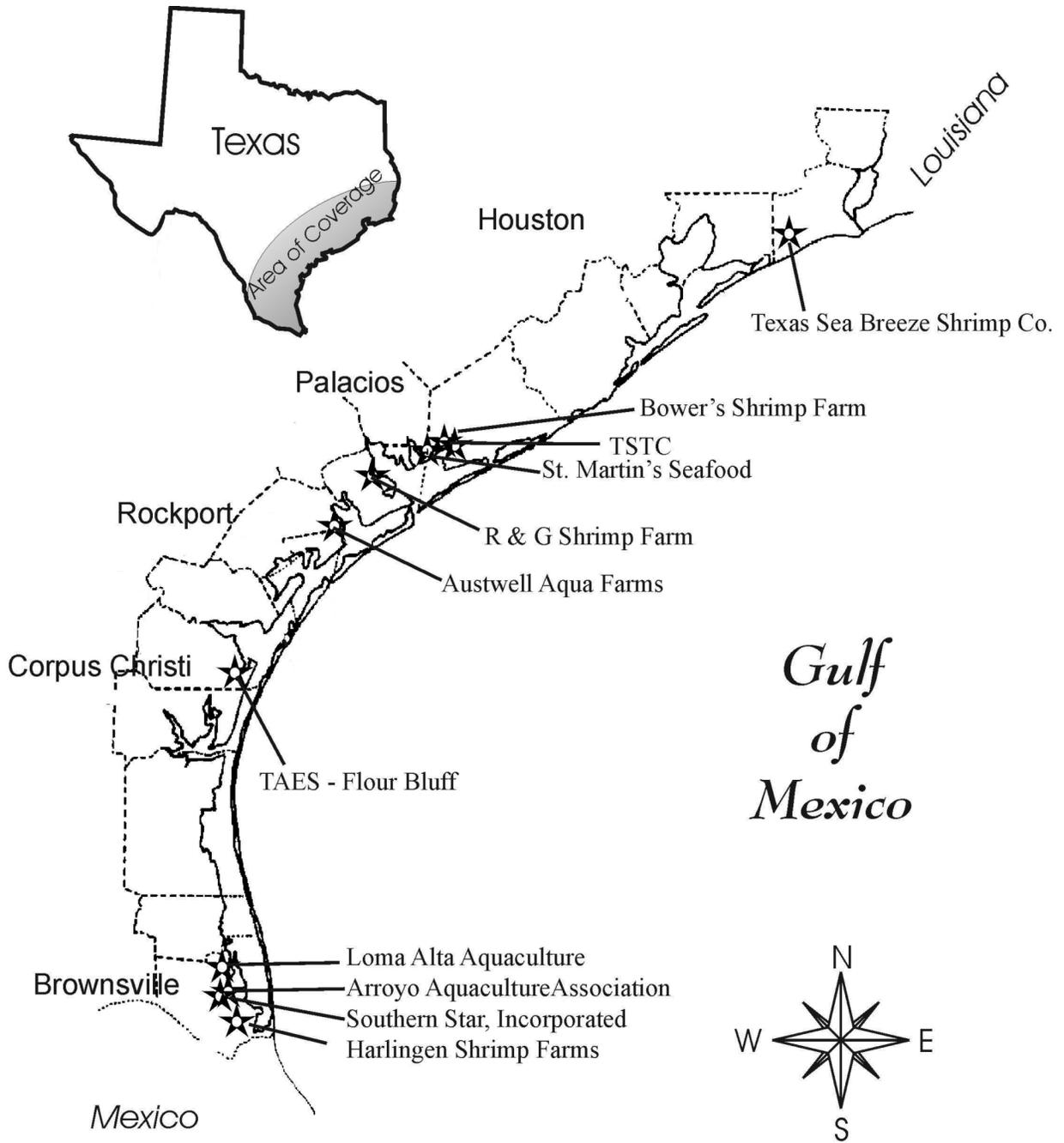


FIGURE 2.—Location of shrimp farms on the Texas coast from 2003-2008.

Appendix A. Exotic Species Culture Facility Inspection Report

TEXAS PARKS AND WILDLIFE DEPARTMENT  
EXOTIC SPECIES CULTURE FACILITY INSPECTION REPORT

Culturist's Name: \_\_\_\_\_ Date: \_\_\_\_\_  
 Company: \_\_\_\_\_ Time: \_\_\_\_\_  
 Address: \_\_\_\_\_ Phone (work): \_\_\_\_\_  
 \_\_\_\_\_ Phone (home): \_\_\_\_\_  
 Facility Location: \_\_\_\_\_

Fish Farmer License Number: \_\_\_\_\_ TPWD Exotic Species Permit Number: \_\_\_\_\_

		YES	NO
1.	Does the culturist possess a current Exotic Species Permit?	_____	_____
2.	Are transport vehicles, trailers, or semi-trailers properly marked (Fish, Tilapia, etc.) or are removable signs available?	_____	_____
3.	Are holding and culture containers escape proof?	_____	_____
4.	Are at least 3 screens capable of capturing the smallest specimen of each permitted exotic species in place between the rearing facility and any public waters?	_____	_____
5.	If facility is located within the <b>Exotic Species Exclusion Zone</b> , has the applicant submitted an <b>EMERGENCY PLAN</b> to the Department?	_____	_____
6.	Are facilities above the 100 year flood plain?	_____	_____
7.	If within the 100 year flood plain, has an acceptable flood protective dike been constructed to at least a height of one foot above the 100 year flood elevation? (Culturist must provide copies of HUD flood plain maps or elevations determined by a certified engineer).	_____	_____
8.	Does the facility have reasonable security measures to prevent theft or accidental release of Exotic Species?	_____	_____
9.	If Tilapia are held at this facility, have they been certified as Blue Tilapia, Nile Tilapia, Mozambique Tilapia or hybrids between these species?	_____	_____
10.	If exotic shellfish are held at this facility, have they been certified as being disease free from an approved disease specialist?	_____	_____
11.	Is facility designed such that a discharge of waste into or adjacent to state waters will, or is likely to occur? (If yes, applicant must obtain the appropriate wastewater discharge authorization or exemption from the Texas Natural Resources Conservation Commission).	_____	_____

\*\*\*\*\*

CERTIFICATION COMMENTS

( ) Approval Recommended

( ) Approval Not Recommended

Explain deficiencies, if any: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Other Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Second Inspection Required: Y ( ) N ( )

\_\_\_\_\_  
Certifying TPWD Staff

\_\_\_\_\_  
TCEQ Representative

\_\_\_\_\_  
Title

\_\_\_\_\_  
Title

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Signature

CULTURIST (Permit Holder)

I agree to correct the deficiencies noted above (if any) within \_\_\_\_\_ days and maintain the facilities at or above Department standards.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

## Appendix B. Clinical Analysis Checklist

TEXAS PARKS AND WILDLIFE DEPARTMENT  
4200 SMITH SCHOOL ROAD. AUSTIN, TEXAS 78744  
512-389-4800

## CLINICAL ANALYSIS CHECKLIST

Facility location: \_\_\_\_\_  
Water body/system type: \_\_\_ pond \_\_\_ indoor outdoor tanks \_\_\_ re-circulating \_\_\_ other  
Culture unit description (number, letter, etc.) \_\_\_\_\_  
Stage and date of stocking: PL \_\_\_\_\_ (day) and \_\_\_\_\_ (date)  
Date of disease manifestation: \_\_\_\_\_  
Duration of effect (days, hours since beginning): \_\_\_\_\_  
Severity of problem: \_\_\_ total \_\_\_ heavy \_\_\_ moderate \_\_\_ light \_\_\_ not determined  
Extent of problem: \_\_\_ One water system \_\_\_ Multiple systems, explain: \_\_\_\_\_  
\_\_\_\_\_

Type/size of animal affected:  
*Litopenaeus vannamei* (age post-stock, weight, length or etc.) \_\_\_\_\_  
Other animals affected, explain: \_\_\_\_\_  
\_\_\_\_\_

Abnormalities or manifestations observed in a random sample consisting of a minimum of 50 animals. Sample size \_\_\_\_\_ (Report number of occurrences for first 7 characteristics.)

## Characteristics:

- |   |  |
|---|--|
| 1. Gut empty _____                        | 6. Gill discoloration _____  |
| 2. Emaciation _____                       | 7. Shell or underlying skin with gross<br>pathology typical of virus infection _____ |
| 3. Rostral deformity _____                | 8. Heavy or unusual predator activity _____  |
| 4. Digestive gland atrophy/necrosis _____ | 9. Erratic swimming observed _____   |
| 5. Shell fragile or atypically soft _____ |  |

Remarks (include event history, observations of water quality, if manifestation of disease is present or not present and time since last feeding):

Necessity of Laboratory examination: \_\_\_ Submit for lab test \_\_\_ Submission Unnecessary  
Reporting examiner (print): \_\_\_\_\_  
Agency mailing address: \_\_\_\_\_

\_\_\_\_\_  
Date of report

\_\_\_\_\_  
Signature of reporting examine





