Known Distribution of EMS/AHPNS: Current Status

Eduardo M. Leaño
Coordinator, Aquatic Animal Health Programme
Network of Aquaculture Centres in Asia-Pacific
Bangkok, Thailand

What is EMS/AHPNS?

- Name for unusually heavy shrimp mortality approx. within the first 35 days of culture
- This very imprecise case definition that has led to confusion in diagnosis
- Many possible causes including diseases of well-known pathogens like WSSV & YHV

Source: T Flegel

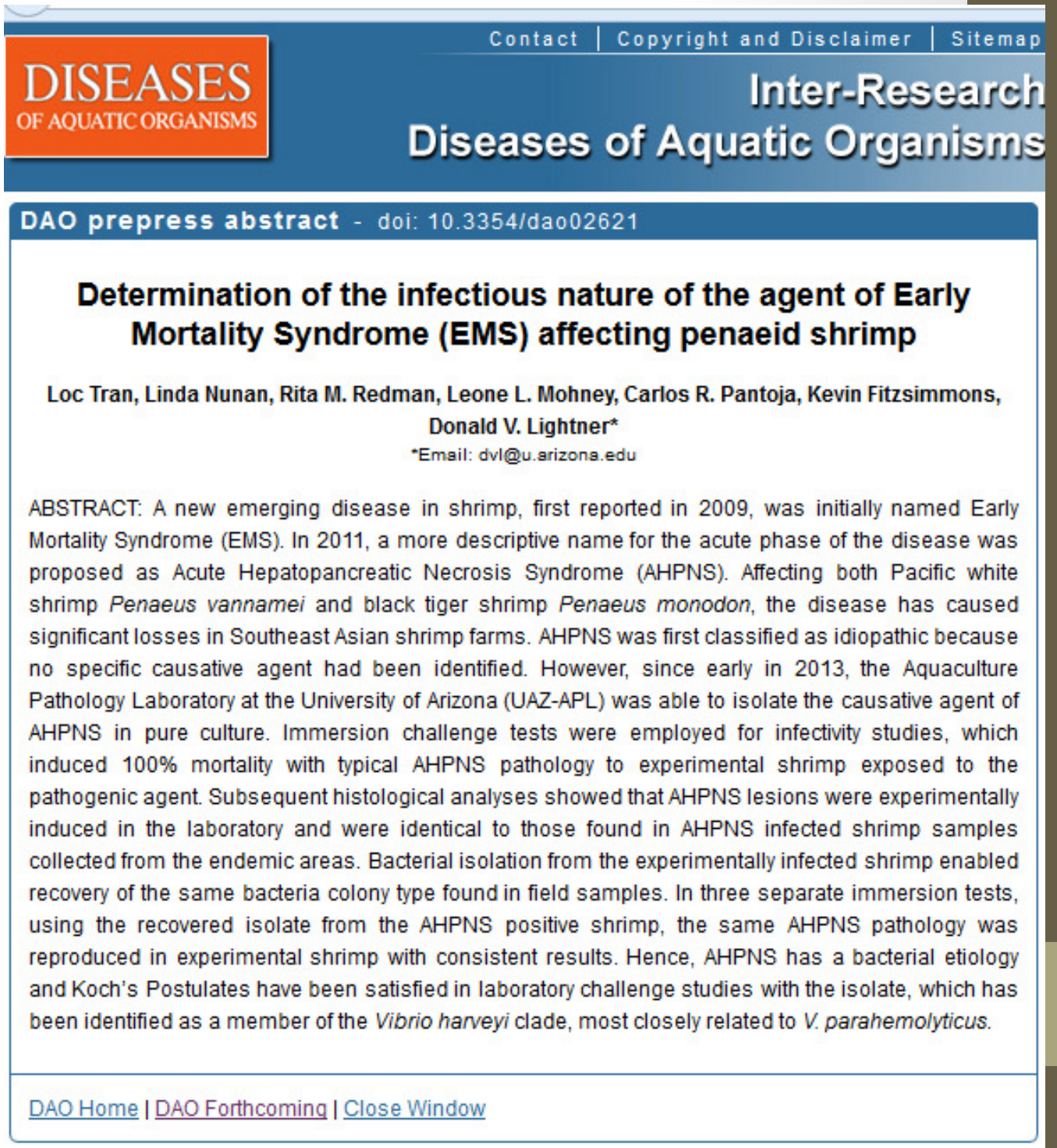
What is EMS/AHPNS?

- Dr. Lightner discovered a new pathology that explain many EMS outbreaks
- He provided a precise case definition which was a major breakthrough for further study

Source: T Flegel

Causative agent:

Vibrio parahaemolyticus



Contact | Copyright and Disclaimer | Sitemap

DISEASES OF AQUATIC ORGANISMS

Inter-Research
Diseases of Aquatic Organisms

DAO prepress abstract - doi: 10.3354/dao02621

Determination of the infectious nature of the agent of Early Mortality Syndrome (EMS) affecting penaeid shrimp

Loc Tran, Linda Nunan, Rita M. Redman, Leone L. Mohney, Carlos R. Pantoja, Kevin Fitzsimmons, Donald V. Lightner*

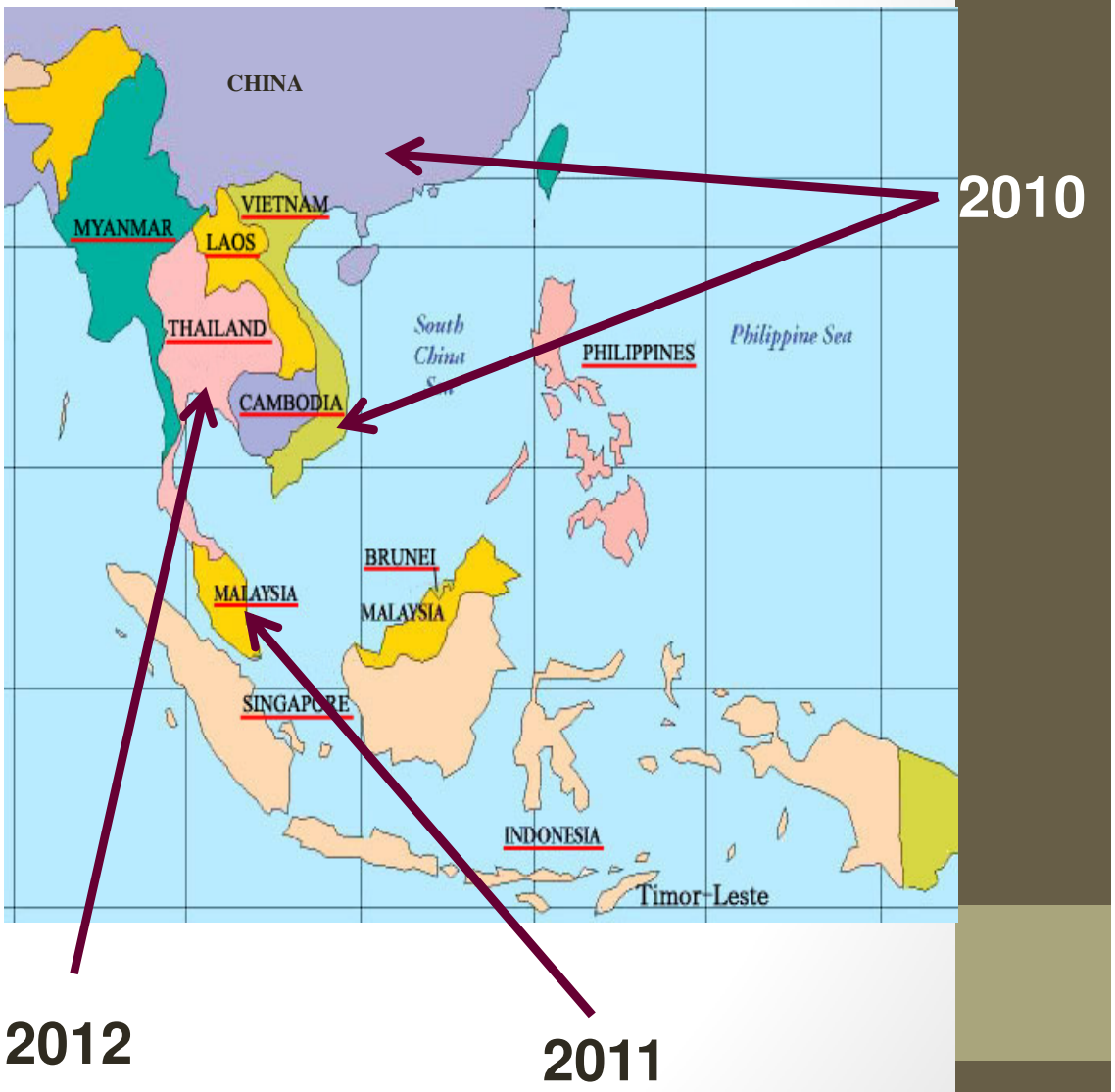
*Email: dvl@u.arizona.edu

ABSTRACT: A new emerging disease in shrimp, first reported in 2009, was initially named Early Mortality Syndrome (EMS). In 2011, a more descriptive name for the acute phase of the disease was proposed as Acute Hepatopancreatic Necrosis Syndrome (AHPNS). Affecting both Pacific white shrimp *Penaeus vannamei* and black tiger shrimp *Penaeus monodon*, the disease has caused significant losses in Southeast Asian shrimp farms. AHPNS was first classified as idiopathic because no specific causative agent had been identified. However, since early in 2013, the Aquaculture Pathology Laboratory at the University of Arizona (UAZ-APL) was able to isolate the causative agent of AHPNS in pure culture. Immersion challenge tests were employed for infectivity studies, which induced 100% mortality with typical AHPNS pathology to experimental shrimp exposed to the pathogenic agent. Subsequent histological analyses showed that AHPNS lesions were experimentally induced in the laboratory and were identical to those found in AHPNS infected shrimp samples collected from the endemic areas. Bacterial isolation from the experimentally infected shrimp enabled recovery of the same bacteria colony type found in field samples. In three separate immersion tests, using the recovered isolate from the AHPNS positive shrimp, the same AHPNS pathology was reproduced in experimental shrimp with consistent results. Hence, AHPNS has a bacterial etiology and Koch's Postulates have been satisfied in laboratory challenge studies with the isolate, which has been identified as a member of the *Vibrio harveyi* clade, most closely related to *V. parahemolyticus*.

DAO Home | DAO Forthcoming | Close Window

History of outbreaks

- First seen in China in latter part of 2009 (officially reported in 2010) and then in Vietnam in 2010
- Next reported from Malaysia in 2011
- Reported from Thailand (eastern Gulf of Thailand) in 2012



History of outbreaks

- May 2013: Mexico

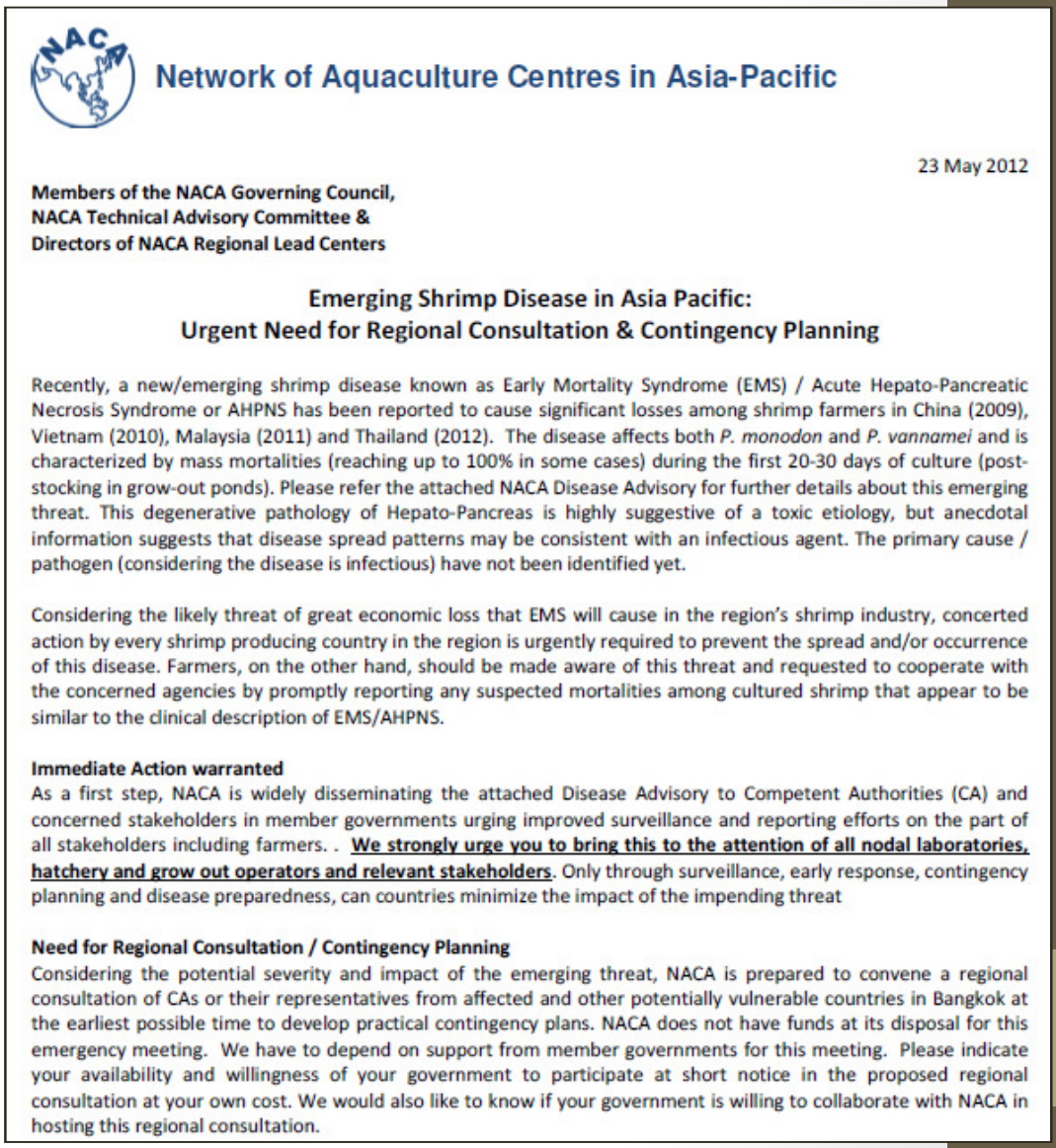
NACA Regional Response to EMS/AHPNS

Recognizing the problem

- Alerting NACA Regional Advisory Group, OIE and FAO to the emerging threat of EMS in Mekong Delta of Vietnam in April 2011
- NACA AG discussed the issue in AGM 10 in Nov 2011

Alerting CA's

- Formal NACA circular to CA's of all member governments in May 2012
- Development and wide dissemination of EMS/AHPNS Disease advisory in May 2012



Network of Aquaculture Centres in Asia-Pacific

23 May 2012

Members of the NACA Governing Council,
NACA Technical Advisory Committee &
Directors of NACA Regional Lead Centers

Emerging Shrimp Disease in Asia Pacific:
Urgent Need for Regional Consultation & Contingency Planning

Recently, a new/emerging shrimp disease known as Early Mortality Syndrome (EMS) / Acute Hepato-Pancreatic Necrosis Syndrome or AHPNS has been reported to cause significant losses among shrimp farmers in China (2009), Vietnam (2010), Malaysia (2011) and Thailand (2012). The disease affects both *P. monodon* and *P. vannamei* and is characterized by mass mortalities (reaching up to 100% in some cases) during the first 20-30 days of culture (post-stocking in grow-out ponds). Please refer the attached NACA Disease Advisory for further details about this emerging threat. This degenerative pathology of Hepato-Pancreas is highly suggestive of a toxic etiology, but anecdotal information suggests that disease spread patterns may be consistent with an infectious agent. The primary cause / pathogen (considering the disease is infectious) have not been identified yet.

Considering the likely threat of great economic loss that EMS will cause in the region's shrimp industry, concerted action by every shrimp producing country in the region is urgently required to prevent the spread and/or occurrence of this disease. Farmers, on the other hand, should be made aware of this threat and requested to cooperate with the concerned agencies by promptly reporting any suspected mortalities among cultured shrimp that appear to be similar to the clinical description of EMS/AHPNS.

Immediate Action warranted
As a first step, NACA is widely disseminating the attached Disease Advisory to Competent Authorities (CA) and concerned stakeholders in member governments urging improved surveillance and reporting efforts on the part of all stakeholders including farmers. . **We strongly urge you to bring this to the attention of all nodal laboratories, hatchery and grow out operators and relevant stakeholders**. Only through surveillance, early response, contingency planning and disease preparedness, can countries minimize the impact of the impending threat

Need for Regional Consultation / Contingency Planning
Considering the potential severity and impact of the emerging threat, NACA is prepared to convene a regional consultation of CAs or their representatives from affected and other potentially vulnerable countries in Bangkok at the earliest possible time to develop practical contingency plans. NACA does not have funds at its disposal for this emergency meeting. We have to depend on support from member governments for this meeting. Please indicate your availability and willingness of your government to participate at short notice in the proposed regional consultation at your own cost. We would also like to know if your government is willing to collaborate with NACA in hosting this regional consultation.

DISEASE ADVISORY

Asia Regional Aquatic Animal Health Programme

Early Mortality Syndrome (EMS)/Acute Hepatopancreatic Necrosis Syndrome (AHPNS): An emerging threat in the Asian shrimp industry

Eduardo M. Leaño and C.V. Mohan
NACA, Bangkok, Thailand

The Asia-Pacific region, being the top producer of aquaculture products in the world, is continuously beset by emerging aquatic animal disease problems causing high mortalities and economic losses among small farmers as well as commercial producers. Over the last couple of decades, several diseases (e.g. luminous vibriosis, white spot syndrome, yellowhead disease, Taura syndrome) have caused significant devastation in the shrimp aquaculture of the region, causing the collapse of some industries (e.g. *Penaeus monodon*). Recently, a new/emerging disease known as early mortality syndrome (EMS) in shrimp (also termed acute hepatopancreatic necrosis syndrome or AHPNS) has been reported to cause significant losses among shrimp farmers in China (2009), Vietnam (2010) and Malaysia (2011). It was also reported to affect shrimp in the eastern Gulf of Thailand (Flegel, 2012).

The disease affects both *P. monodon* and *P. vannamei* and is characterized by mass mortalities (reaching up to 100% in some cases) during the first 20-30 days of culture (post-stocking in grow-out ponds). Clinical signs observed include slow growth, corkscrew swimming, loose shells, as well as pale coloration. Affected shrimp also consistently show an abnormal hepatopancreas (shrunken, small, swollen or discouloured). The primary pathogen (considering the disease is infectious) has not been identified, while the presence of some microbes including *Vibrio*, microsporidians and nematode has been observed in some samples. Lightner et al. (2012) described the pathological and etiological details of this disease. Histological examination showed that the effects of EMS in both *P. monodon* and *P. vannamei* appear to be limited to the hepatopancreas (HP) and show the following pathology:

1) Lack of mitotic activity in generative E cells of the HP;
2) Dysfunction of central hepatopancreatic B, F and R cells;
3) Prominent karyomegaly and massive sloughing of central HP tubule epithelial cells;
4) Terminal stages including massive intertubular hemocytic aggregation followed by secondary bacterial infections.

Similar histopathological results were obtained by Prachumwat et al. (2012) on Thai samples of *P. vannamei* collected from Chantaburi and Rayong provinces in late 2011 and early 2012 (Figure 1). The progressive dysfunction of the HP results from lesions that reflect degeneration and dysfunction of the tubule epithelial cells that progress from proximal to distal ends of HP tubules. This degenerative pathology of HP is highly suggestive of a toxic etiology, but anecdotal information suggests that disease spread patterns may be consistent with an infectious agent.

In China, the occurrence of EMS in 2009 was initially ignored by most farmers. But in 2011, outbreaks became more serious especially in farms with culture history of more than 5 years and those closer to the sea using very saline water of 20 (Panakorn, 2012). Shrimp farming in Hainan, Guangdong, Fujian and Guangxi suffered during the first half of 2011 with almost 80% losses

production

Early Mortality Syndrome Threatens Asia's Shrimp Farms

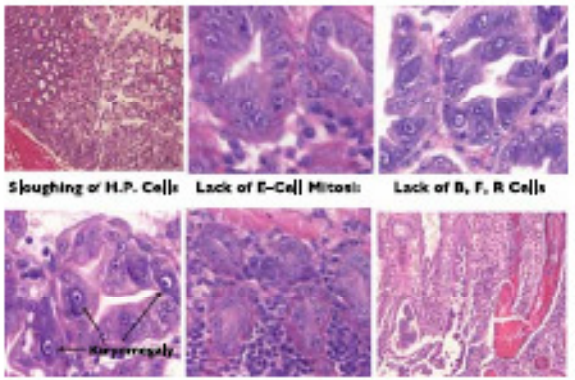


Figure 1. Histopathology of *Litopenaeus vannamei* hepatopancreas from Thailand affected by EMS/AHPNS shows varied abnormalities. Photos courtesy of T. W. Flegel.

Eduardo M. Leaño
Coordinator
Aquatic Animal Health Program
Network of Aquaculture Centres in Asia-Pacific
P. O. Box 1040
Kasetsart Post Office
Bangkok, Thailand
eduardo@enaca.org

C. V. Mohan
Manager
Research and Development
Network of Aquaculture Centres in Asia-Pacific

Summary:
The emerging disease early mortality syndrome has caused large losses among shrimp farmers in China, Vietnam, Malaysia and Thailand. Affecting both *P. monodon* and *L. vannamei*, EMS is characterized by mass mortalities during the first 30 days of culture. Clinical signs include slow growth, corkscrew swimming and pale coloration. Affected shrimp consistently show abnormal hepatopancreata. No causative pathogen has been found for EMS. Its spread points to the need for increased awareness and cooperative reporting.

yellowhead disease and Taura syndrome heavily impacted shrimp aquaculture in the region and caused the collapse of the *Penaeus monodon* industry.

More recently, an emerging disease known as early mortality syndrome (EMS) – also termed acute hepatopancreatic necrosis syndrome or AHPNS – caused significant losses among shrimp farmers in China, Vietnam and Malaysia. It also reportedly affected shrimp in the eastern Gulf of Thailand this year (Flegel, 2012).

EMS affects both *P. monodon* and *Litopenaeus vannamei* and is characterized by mass mortalities during the first 20 to 30 days of culture in growout ponds. Clinical signs of the disease include slow growth, corkscrew swimming, loose shells and pale coloration. Affected shrimp consistently show abnormal shrunken, small,

the effects of EMS appeared to be limited to the hepatopancreas.

The pathology included a lack of mitotic activity in generative E cells, dysfunction of central hepatopancreatic B, F and R cells, and massive sloughing of central tubule epithelial cells. Terminal stages showed massive intertubular hemocytic aggregation followed by secondary bacterial infections.

Similar histopathological results were obtained by Anuparp Prachumwat and co-workers for Thai samples of *P. vannamei* collected from Chantaburi and Rayong provinces in late 2011 and early 2012 (Figure 1). The progressive dysfunction of the hepatopancreas (H.P.) results from lesions that reflect degeneration and dysfunction of the tubule epithelial cells that progress from the proximal to distal ends of H.P. tubules. This degenerative pathology strongly suggests a toxic etiology, but anecdotal information suggests that disease spread patterns may be consistent with an infectious agent.

Serious Losses

In China, the occurrence of EMS in 2009 was initially ignored by most farmers.

Global Aquaculture Advocate; July/August 2012

Convening of Emergency Regional Consultation

Convening of Asia Pacific emergency regional consultation (9-10 August 2012), Bangkok with support from DAFF, Australia

- 17 global shrimp experts
- 40 national delegates representing CA and lead research institutions
- 10 regional/international institutions; national universities
- 8 private sector representatives

Australian Government
Department of Agriculture, Fisheries and Forestry

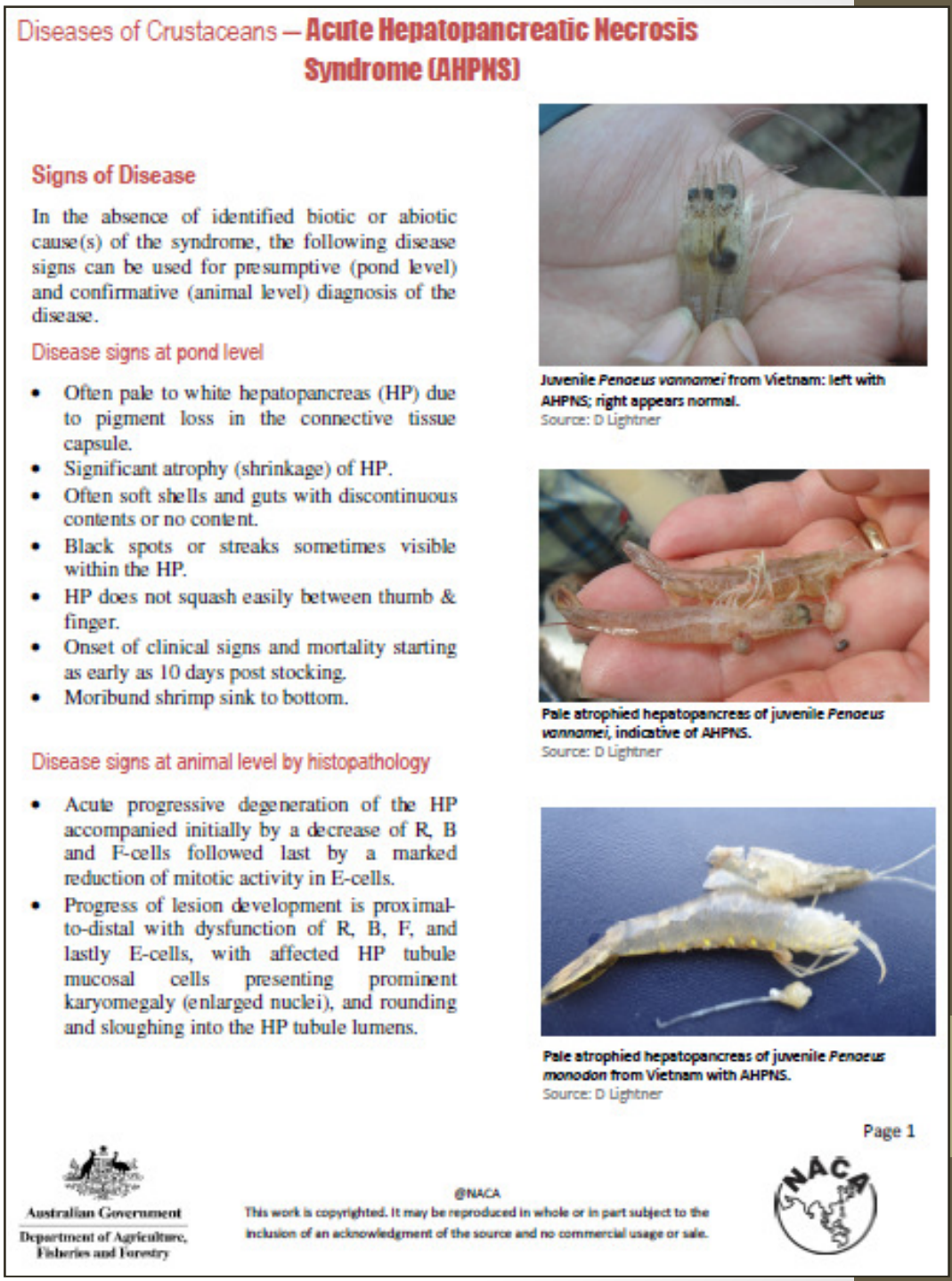
NACA

Technical Report on AHPNS

- Technical report preparation and wider dissemination
  - Latest updates and review of status
  - Case definition at animal and pond level
  - R&D directions
  - Recommendations for national and regional levels

Disease Card

- Development and dissemination of AHPNS Disease Card
  - To harmonize research effort
  - To provide information to support disease surveillance
  - To support outbreak investigations



Diseases of Crustaceans – **Acute Hepatopancreatic Necrosis Syndrome (AHPNS)**

Signs of Disease

In the absence of identified biotic or abiotic cause(s) of the syndrome, the following disease signs can be used for presumptive (pond level) and confirmative (animal level) diagnosis of the disease.

Disease signs at pond level

- Often pale to white hepatopancreas (HP) due to pigment loss in the connective tissue capsule.
- Significant atrophy (shrinkage) of HP.
- Often soft shells and guts with discontinuous contents or no content.
- Black spots or streaks sometimes visible within the HP.
- HP does not squash easily between thumb & finger.
- Onset of clinical signs and mortality starting as early as 10 days post stocking.
- Moribund shrimp sink to bottom.

Disease signs at animal level by histopathology

- Acute progressive degeneration of the HP accompanied initially by a decrease of R, B and F-cells followed last by a marked reduction of mitotic activity in E-cells.
- Progress of lesion development is proximal-to-distal with dysfunction of R, B, F, and lastly E-cells, with affected HP tubule mucosal cells presenting prominent karyomegaly (enlarged nuclei), and rounding and sloughing into the HP tubule lumens.

Listing of AHPNS in QAAD

AGM 11

21-23 Nov 2012

Bangkok

Prior to identification of the causative agent

Listing of AHPNS in QAAD

Based on OIE criteria:

Case: AHPNS

A. Consequences - Summary

1. Significant production losses OR √
2. Morbidity or mortality in wild aquatic animal OR X
3. The agent is of public concern X

- Only one of this criteria has to be met for listing;
- Therefore, AHPNS satisfies the criteria for Consequences

Listing of AHPNS in QAAD

Case: AHPNS

B. Spread – Summary

4. Infectious aetiology is proven OR X
5. An infectious aetiology is strongly associated but not known AND X
6. International spread is likely AND √
7. Several countries may be declared free. √

- Criteria 4 or 5 and 6 and 7 should be met;
- AHPNS only satisfies criteria 6 and 7; thus cannot be considered for listing (in OIE)

- **Due to its importance in the region, however, AHPNS can still be considered for listing in Asia-Pacific QAAD under non-OIE listed diseases.**

Listing of AHPNS in QAAD

Case: AHPNS

C. Diagnosis

7. A repeatable and robust means of detection √

The disease can be properly diagnosed by Level I (field/clinical observation) and Level II (Histopathology) diagnosis;

Since no pathogen/agent has been identified up to this date, there is no further diagnostic method being developed;

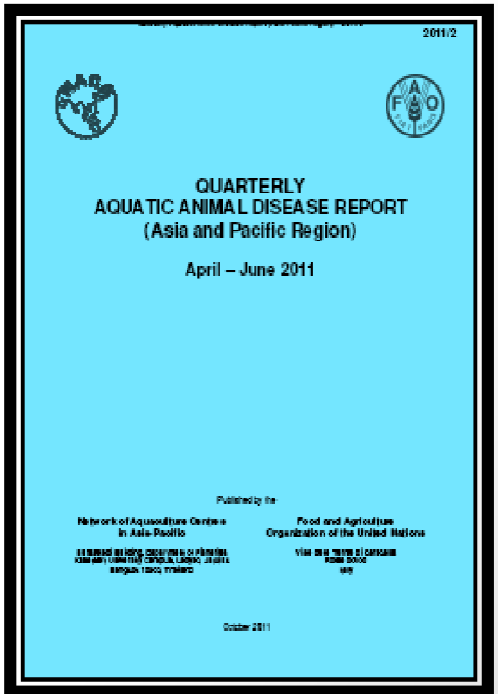
CRITERION MET

AHPNS partially satisfies criteria 7, thus can still be considered for listing in Asia-Pacific QAAD under non-OIE listed diseases.

Listing of AHPNS in QAAD

- Asia Regional Advisory Group on Aquatic Animal Health (AG): decided and agreed to include AHPNS in QAAD Reporting under the non-OIE list of diseases for crustaceans;

- Purpose: gain more information about AHPNS within the region.



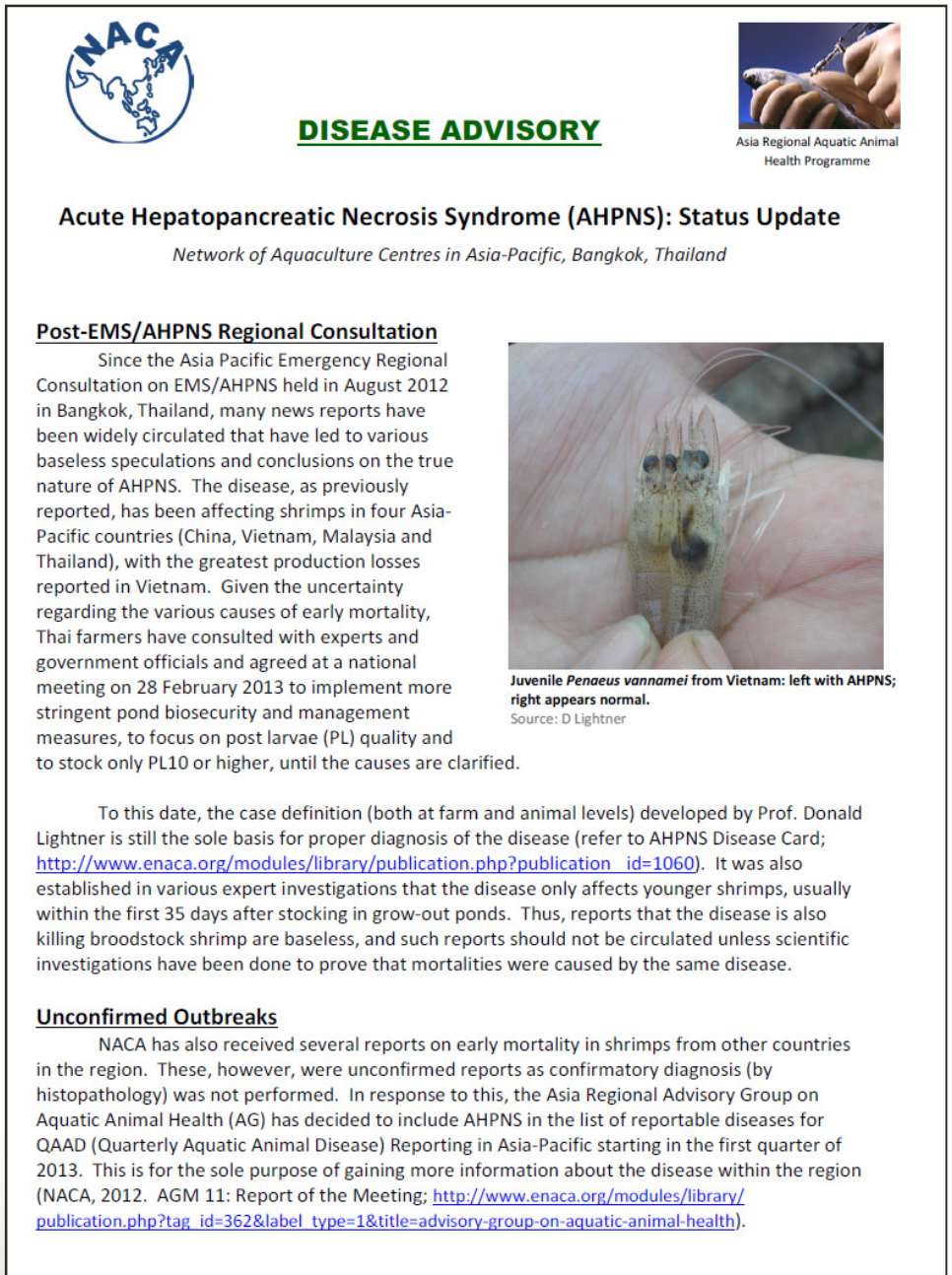
QUARTERLY AQUATIC ANIMAL DISEASE REPORT - 2013

Country: Period:

Item	Disease status [a] Month			Level of diagnosis	Epidemiological comment numbers
DISEASES PREVALENT IN THE REGION					
FINFISH DISEASES					
OIE-listed diseases					
1. Epizootic haematopoietic necrosis					
2. Infectious haematopoietic necrosis					
3. Spring viraemia of carp (SVC)					
4. Viral haemorrhagic septicaemia (VHS)					
5. Epizootic ulcerative syndrome (EUS)					
6. Red seabream iridoviral disease (RSID)					
7. Koi herpesvirus disease (KHV)					
Non OIE-listed diseases					
8. Grouper iridoviral disease					
9. Viral encephalopathy and retinopathy					
10.Enteric septicaemia of catfish					
MOLLUSC DISEASES					
OIE-listed diseases					
1. Infection with *Bonamia exitiosa*					
2. Infection with *Perkinsus olseni*					
3. Infection with abalone herpesvirus					
4. Infection with *Xenohaliotis californiensis*					
Non OIE-listed diseases					
5. Infection with *Marteilioides chungmuensis*					
6. Acute viral necrosis (in scallops)					
7. Akoya oyster disease					
CRUSTACEAN DISEASES					
OIE-listed diseases					
1. Taura syndrome (TS)					
2. White spot disease (WSD)					
3. Yellowhead disease (YHD)					
4. Infectious hypodermal and haematopoietic necrosis (IHHN)					
5. Infectious myonecrosis (IMN)					
6. White tail disease (MrNV)					
7. Necrotising hepatopancreatitis (NHP)					
Non OIE-listed diseases					
8. Milky haemolymph disease of spiny lobster (*Panulirus* spp.)					
9. *Monodon* slow growth syndrome					
10. Acute hepatopancreatic necrosis syndrome (AHPNS)					

Non OIE-listed diseases
8. Milky haemolymph disease of spiny lobster (*Panulirus* spp.)
9. *Monodon* slow growth syndrome
10. Acute hepatopancreatic necrosis syndrome (AHPNS)

Follow-up Disease Advisory



DISEASE ADVISORY

Asia Regional Aquatic Animal Health Programme

Acute Hepatopancreatic Necrosis Syndrome (AHPNS): Status Update

Network of Aquaculture Centres in Asia-Pacific, Bangkok, Thailand

Post-EMS/AHPNS Regional Consultation

Since the Asia Pacific Emergency Regional Consultation on EMS/AHPNS held in August 2012 in Bangkok, Thailand, many news reports have been widely circulated that have led to various baseless speculations and conclusions on the true nature of AHPNS. The disease, as previously reported, has been affecting shrimps in four Asia-Pacific countries (China, Vietnam, Malaysia and Thailand), with the greatest production losses reported in Vietnam. Given the uncertainty regarding the various causes of early mortality, Thai farmers have consulted with experts and government officials and agreed at a national meeting on 28 February 2013 to implement more stringent pond biosecurity and management measures, to focus on post larvae (PL) quality and to stock only PL10 or higher, until the causes are clarified.

Juvenile *Penaeus vannamei* from Vietnam: left with AHPNS; right appears normal.
Source: D Lightner

To this date, the case definition (both at farm and animal levels) developed by Prof. Donald Lightner is still the sole basis for proper diagnosis of the disease (refer to AHPNS Disease Card; http://www.enaca.org/modules/library/publication.php?publication_id=1060). It was also established in various expert investigations that the disease only affects younger shrimps, usually within the first 35 days after stocking in grow-out ponds. Thus, reports that the disease is also killing broodstock shrimp are baseless, and such reports should not be circulated unless scientific investigations have been done to prove that mortalities were caused by the same disease.

Unconfirmed Outbreaks

NACA has also received several reports on early mortality in shrimps from other countries in the region. These, however, were unconfirmed reports as confirmatory diagnosis (by histopathology) was not performed. In response to this, the Asia Regional Advisory Group on Aquatic Animal Health (AG) has decided to include AHPNS in the list of reportable diseases for QAAD (Quarterly Aquatic Animal Disease) Reporting in Asia-Pacific starting in the first quarter of 2013. This is for the sole purpose of gaining more information about the disease within the region (NACA, 2012. AGM 11: Report of the Meeting; http://www.enaca.org/modules/library/publication.php?tag_id=362&label_type=1&title=advisory-group-on-aquatic-animal-health).

- To address the many circulating false and baseless speculations on the effects and spread of AHPNS in the region.

@NACA March 2013

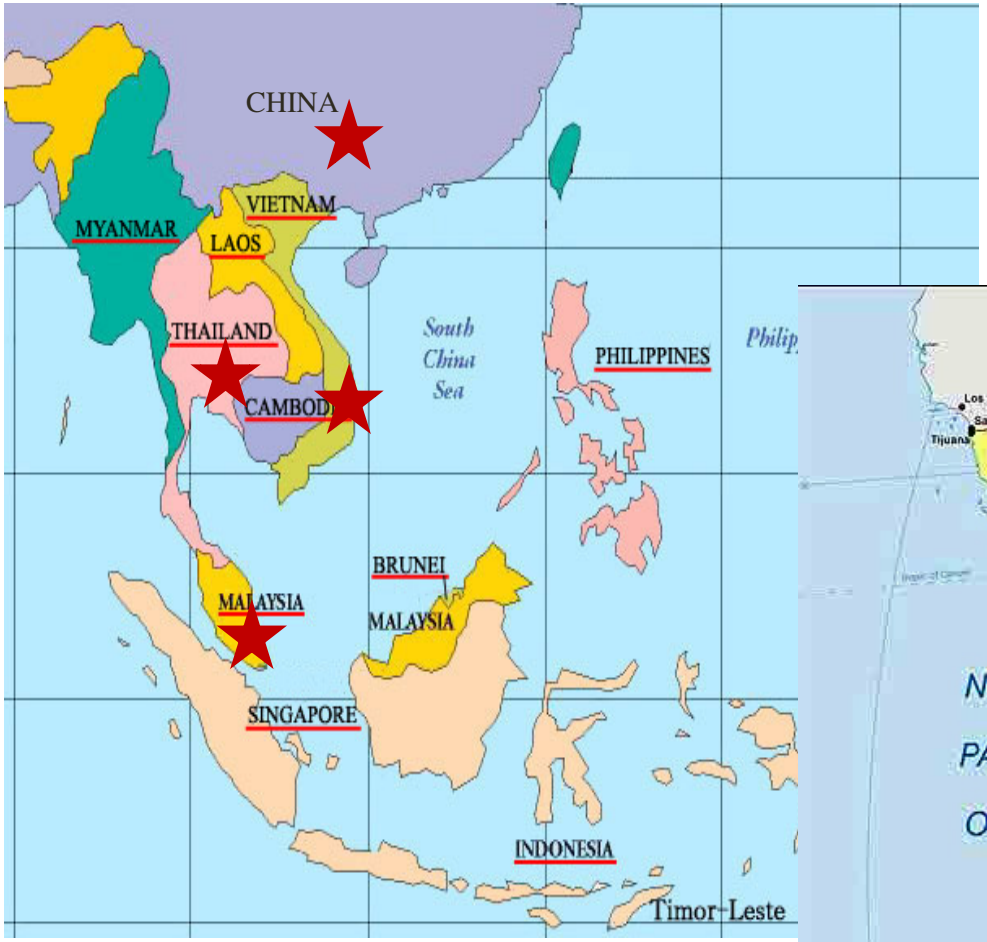
QAAD Report: 1Q 2013

Non OIE-listed diseases (Crustaceans) Acute hepatopnacreatic necrosis syndrome (AHPNS)	Jan	Feb	Mar	Level of diagnosis
Australia	***	***	***	
Hong Kong				
Philippines	***	***	***	
Singapore	0000	0000	0000	
Vietnam	+	+	+	I,II,III

*** No information available

0000 Never reported

AHPNS


CHINA
VIETNAM
MYANMAR
LAOS
THAILAND
CAMBODIA
South China Sea
PHILIPPINES
BRUNEI
MALAYSIA
MALAYSIA
SINGAPORE
INDONESIA
Timor-Leste


UNITED STATES
Washington, D.C.
Los Angeles
Phoenix
San Diego
Tijuana
Houston
New Orleans
Miami
Nassau
THE BAHAMAS
Gulf of Mexico
Havana
CUBA
MEXICO
Mexico
Acapulco
DOMINICAN REPUBLIC
JAMAICA
Kingston
Belmopan
BELIZE
HONDURAS
GUATEMALA
Guatemala
Tegucigalpa
San Salvador
EL SALVADOR
NICARAGUA
Managua
Caribbean Sea
NORTH PACIFIC OCEAN
San José
COSTA RICA
PANAMA
Panama
Barranquilla
Maracaibo
Caracas
VENEZUELA
Medellín
Bogotá
Cali
COLOMBIA
Quito
ECUADOR
Guayaquil
Iquitos
Manaos
Trujillo

Thank you