

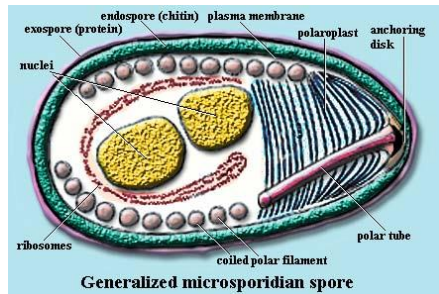


Biosecurity theory and practice on shrimp farms/hatcheries

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Presentation

- Biosecurity defined
- Why?
- Where?
- How?
- Expected result



Vietnam No understanding of biosecurity. This hatchery has had serious problems in terms of production and performance. This will continue.

Biosecurity **Defined**

- An evolving term that has a specific definition for aquaculture:
- Common usage refers to
“All of the proactive strategies that are used to lessen the potential impact of pathogenic organisms on your crop.”

This involves every aspect of the culture process from site selection to harvest protocols.
- Adaptive When one is aware of the nature of the risk, strategies may have to be adapted to compensate for different pathogens, etc.

Why is biosecurity important?

- Prevention of disease is the best approach to management
- Failure can be and often is disastrous
- Ignoring biosecurity is foolish and a poor use of resources
 - EMS/AHPNS is one example
 - WSSV another example
- There will be others----be prepared.

Movement of animals carrying the pathogens into environments that are consistent with the spread of the pathogens must be prevented.

Biosecurity failures

- All too common for people to dismiss the need to be proactive
- Disease is not going away
- In my opinion it is foolish to abandon the common sense measures that all farms and hatcheries should be using Surface disinfection and copious washing.
- The reality is that biosecurity protocols should be a standard operating procedure
- Proactive strategies cost \$\$

Biosecurity How

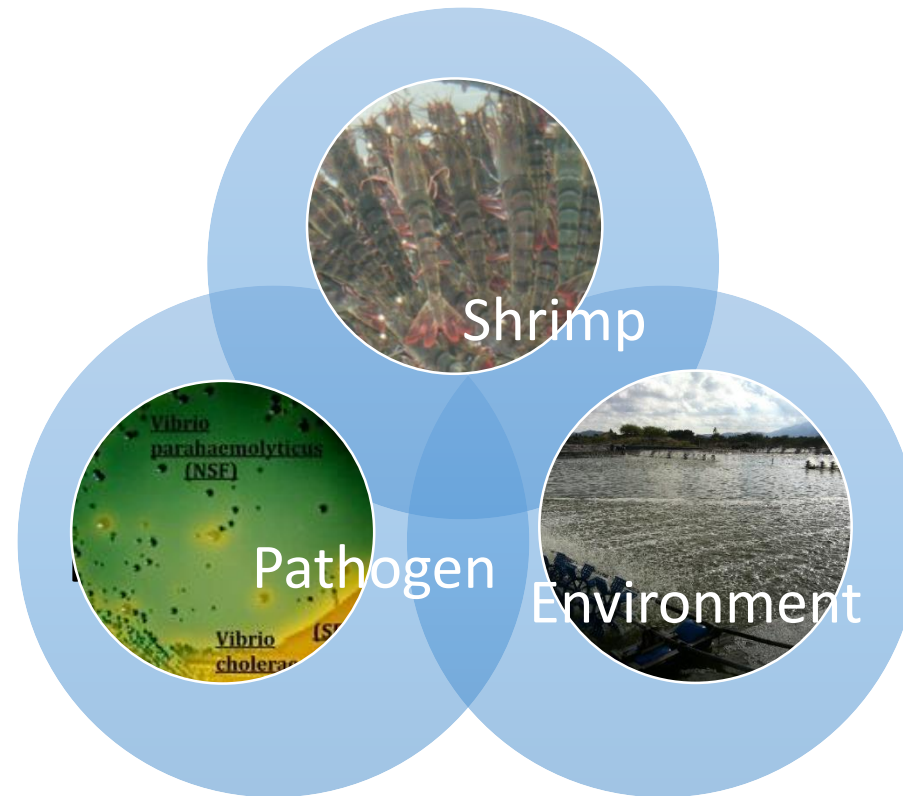
Subject of most of the rest of the presentation

1. Goal should be exclusion (limitation) of pathogen where practical.
2. Limiting the ability of a pathogen to spread and to cause disease.
3. Prevention of disease via stress reduction and improved animal health.
4. Important to keep in mind that exclusion may not always be possible (not economically viable) and that controlling potential pathogen loads and animal stress levels are more practical long term solution.
5. Production processes are connected-failure at one step can result in failure on the farm.

Disease is a complex phenomenon

Disease is the outcome of the relationship between the host, the pathogen and the environment.

Using appropriate biosecurity strategies will result in a shift in this dynamic in favor of the shrimp.



What are the tools?

- Exclusion
- Stress reduction
- Management of pathogen loads (population health sampling)
- Ultimately anything that can tip the balance in favor of the host
- Development of Best Practices at all levels of the process

Best practices

- Not necessarily the same as BAP's which are NGO standards that do not equate with sustainable practices or offer protection
 - Proof is with AHPNS and other diseases that occur on certified farms
- Certification does not equate with sustainability
 - Certification is about making money for NGO's
- Biosecurity is an essential component of sustainable production
- Disease is natural; the absence of disease is not natural
- Important to find the balance
- Minimizing pathogen loads and maximizing animals ability to tolerate exposure

Biosecurity operates at different levels

- Local
 - What you do on your farm. How do you control potential problems?
 - Example don't buy PLs from hatcheries that do not screen them and that ignore biosecurity protocols in maturation and early stage hatchery
- Regional
 - How are potential sources of pathogens moved between areas?
 - Limiting movement of post larval shrimp and broodstock
- Country wide
 - Restricting use of non secure broodstock (SPF is not enough-history is critical)
 - Banning use of potential carriers (such as Chinese polychaetes and warm water squid)

Where to start?

- Water source
- Pond preparation
- Animals being stocked
- Culture practices
- Design and layout of the ponds
- Vigilance
- Responsible environmental stewardship

Water source



Clean water from sources free of pollution and contamination.

Water from oceanic sources is typically very clean with low pathogen loads and low nutrient loads.

However water can easily be contaminated by the influence of estuaries and rivers as well as poorly run shrimp farms.

High water exchange rates of clean water has fixed many a problem (Strep in Guatemala, AHPNS in some farms in SE Asia, etc.)

Water from estuaries generally has higher nutrient loads, high bacterial loads and higher vector loads. Typically a source of vibrios and other potential problems.

One must consider what pathogens one may be dealing with. This should shape the protocols that become SOPs.

Biosecurity protocols must be adaptive and flexible.



Filtration of incoming water



Filtering the water where-ever it can is a best practice.

Into reservoirs



Directly into ponds

The finer the filter the better. Better to fill ponds slowly than fill them full of vectors.

A best practice



This is a sign that filtration is failing

Filtration continued



Even sand filters can lower risks

Drum filters are costly and can slow the rate of filtration but they also can work to very low levels (50 microns or less)



Pond preparation

- Unlined ponds proper use of lime and fertilizers
 - Chlorination has become routine; should only be done when it is absolutely needed and not as an SOP.
ADAPTIVE BIOSECURITY
 - Killing everything off is a bad idea. An SOP for WSSV (although it does not work well if at all)
- Proper maturation of pond ecology before stocking
 - Trickier-no set protocol to follow
 - Important to understand what is happening
 - Monitoring

High blue green algae levels are a sign of improper pond preparation and maintenance and nutrient imbalances.



Proper treatment of discharge water is essential A best practice

- Minimize the passage of pathogens through the farm into the surrounding water environment
- More of a problem when farms are on top of each other
- Although can be a problem whenever cross contamination of influent and effluent occur





Dumping untreated effluent is a bad idea



Dumping raw untreated effluent from shrimp farms onto beaches is a bad idea



Even in farms where the water is being reused, some treatment is essential. Should be tailored to the farms needs and problems

Impoundment of discharge

A best practice

- Use of settling ponds with slow turnovers to allow organic matter to settle out and microbial ecology to mature
- Mini wet lands with proper planning will clean water up naturally
- Avoid mixing influent with effluent at all costs
- Water reuse where possible can work

Breaking the cycle when animals are being stocked

- Maturation
 - Screening of adults individually if they come from non-biosecure areas (almost all pond reared animals)
 - Use enrichment when looking for etiologic agent of AHPNS
 - Break the cycle here through the elimination of carriers, antibiotics, heavy water exchange and quarantine. Test to verify.
- Nauplii
 - Most pathogens that move from maturation to grow-out are not inside of the nauplii
 - Same precautions apply regarding AHPNS
 - Break the cycle by copious washing and surface disinfection to dislodge attached bacteria and viruses. Test to verify.

PLs as a source of potential pathogens

Post larval shrimp sources

SPF Specific pathogen free animals

Poorly understood and overused term

simply means that when the shrimp are screened as a population, one cannot detect pathogens one tested for

must be based on history as well as statistical sampling of populations
a weak link in the process

Proper biosecurity starts with maturation facility

Only screened for known pathogens. This is a potential problem.

Animals being stocked

- Post larval shrimp
 - If the previous biosecurity measures have not been taken then there is little that can be done at the time of stocking
 - Stress testing animals and holding them in acclimation systems for 24-48 hours under stress to force problems to appear
 - Copious washing and surface disinfection and prophylactic use of antibiotics in case of AHPNS of adults in maturation.

Why do I advocate use of antibiotics?

- Nothing wrong with responsible use as a component of biosecurity when there is a need
- NGO bandwagon is irrational and based on fear mongering about residues
- Use in broodstock and/or PLs will not result in measurable residue levels in the final for sale meat

Stocking of animals

- PLs that are carriers can lead to problems
 - Well documented
 - Sequential wash with 200 ppm of formalin followed by 50-100 ppm of iodophor and lots of clean water will dislodge many surface borne pathogens
 - Acclimation protocols that do not stress animals more than necessary
 - Use of ascorbic acid during transport
 - Exogenous supply of nucleotides
 - Other things?

Culture practices

- Stress reduction
- Optimum feeding practices
- Vigilance and surveillance



Excluding pathogens is impossible when shrimp farms are built on top of each other influent and effluents are mixed

Pathogen exclusion

Best Practice

- Pathogen entry
 - Environment water, soil, vectors, air, personnel, feed ADAPTIVE
 - Animals Post larval shrimp carriers, fish, contaminating organisms



Ponds that contain fish, crabs, species of shrimp other than those stocked are wide open to all kinds of problems.

This is an example of very poor biosecurity

Pond biosecurity is multilayered. Should include provisions for keeping birds, crabs, disease vectors out.



Failure to implement proper protocols at any step in the process is problematic

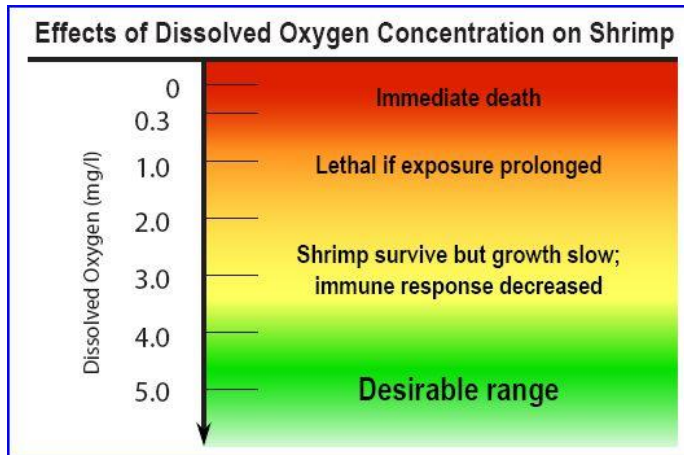


Best Practice

Stress reduction

Why is this an element of biosecurity?

Stress weakens animals increasing susceptibility to disease. Since absolute pathogen exclusion is challenging at best maintaining a healthy production environment allows one to lessen the risks of outbreaks and amplification of pathogen loads.



Low dissolved oxygen levels are the number one stressor of farmed shrimp



Water quality monitoring

Best practice

- Essential to characterize the production environment.
- Minimize stress
- Creates better farming conditions
 - pH, CO₂, O₂, NH₃, NO₂, NO₃, H₂S, etc.
 - Monitor heavy metals in soils at least one time a year. They accumulate from feeds and bio-accumulation. Can be a source of stress.
 - Algal composition and bacterial loads
 - Important to get a picture of what is occurring in the ponds
 - Blue green algae produce hundreds of toxins many very toxic and many not as of yet characterized. They do not belong in fish or shrimp ponds at high levels.

Vector control



Bird netting to keep birds out of ponds

Vultures feeding on dead shrimp are not good.



Best practice

Egrets at exit gate are a sign of trouble



Animal health monitoring

Best Practice

- This is not widely practiced. Animals need to be sampled as a population **regularly**.
- Animals also need to be looked at daily for overt signs of problems
 - Feeders, water quality testing personnel
 - Look at outlet areas when water is exchanged
 - Behavior is an important gauge of health that is often ignored until it is too late
 - Presence of birds (AHPNS yes, WSSV no)

Feeders should be trained as to what to look for.

Boats should be used on single ponds and not moved between ponds.



Sampling of animals

- American Society of Fisheries Blue Book
 - Statistical sampling of random samples from population
 - High levels of confidence when samples are truly random and the tests employed are accurate and sensitive
 - Large margins of error is the reality
 - PCR great technique but flawed
 - Presence of low levels of PCR reactive material does not mean that there will be a problem
 - Probes must be specific
 - Problems with timing of testing
 - WSSV temperature issue
 - AHPNS Load can be very low enrichment essential

Farm design

Many problems are a result of poor pond design and poor site location. When building a farm these should be taken into account.



Ponds built on top of each other, influent and effluent mixed, birds move between ponds.

Note crab fences to keep crabs out of ponds and from moving in between ponds.



Guatemala -effluent becomes influent

Best biosecurity to date

- Indoor closed systems
- Super high density production systems offer the greatest control although a failure at any one point in the system can have great costs



Conclusions

- Goal should be to stack the odds in favor of the shrimp
- Systematically addressing all of those factors that contribute to animal health problems
- Begins in maturation and ends at harvest
- Must be used consistently in the absence of perceived issues
- Worst enemy of the farmer is complacency and trusting that suppliers have their best interests in mind **BE PROACTIVE**
- Ignorance is not bliss

Take home message:

- Biosecurity is adaptive
- The nature of the pathogen is critical to the types of biosecurity. Viral exclusion versus bacterial exclusion?
- **KNOW THY ENEMY**
- Complacency has cost many a farm their economic viability

It's what we don't know and don't see that we have to protect ourselves against

