edited

Major Noninfectious Diseases and Their Prevention

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In this day and age of efforts to increase our capabilities to detect bacterial and viral pathogens in populations of hatchery fish, I think we have set aside efforts to understand one or more of the most significant aspects of fish health management. Specifically, I am referring to taking concern, or at least note, of the repeated occurrences of noninfectious diseases in our piscine charges. I am also referring to taking efforts to increase our understanding of the quantitative dynamics of an intensively managed fish culture system, which contain the primary causal factors of noninfectious diseases.

While I was mulling over what I have just said, I pondered about possible reasons for the lack of concern about these nonbacterial and nonviral diseases. The best one I could come up with is that, for the most part, they are not very dramatic in terms of sick and dead fish on the tail screens.

When I presented my thoughts on this topic to the assemblage at the Western Fish Disease Conference, one could have concluded that I was being quite heretical by saying that more than 90% of the infectious disease episodes in hatchery fish have an identifiable noninfectious cause, if we were but to look for it. Further, I stated that the majority of bacterial, viral, and parasitic diseases were really not much more than clinical signs that the fish could no longer cope with the environmental situation.

So, my purpose here is to present information on the causal factors, clinical sign, treatment regimens, and preventive regimens for some of what I consider to be the more important and common of the 36 or so environmental diseases of hatchery fish (Table 1). If I can convince some of you to take heed, I think the pay-off would be a better fish and less production costs.

Causal Factors

In any fish culture system the fish is irrevocably oriented to its environment; i.e., the most quantitative changes in environmental factors cause often measurable changes in the fish. The most frequently involved environmental changes are water-associated, although management-associated changes have been involved (Table 2).

The most frequent effect of the changes in environmental factors is the stress response. In this the fish is responding to the environmental "insult" by attempting to maintain its status quo - which can be a losing battle - as evidenced by the recognized stress-related diseases (Table 3). These are the conditions I will address in this presentation.

Table 1: Major noninfectious diseases of hatchery-raised fish

Disease	Causal Factor(s)
Environmental Gill Disease	Chronic stress response Chemical irritation Physical irritation
Fin-nipping/"Soreback"	Psychological
Strawberry Disease	Infectious factor(s) Allergic response
Sunburn	Photosensitization
Hypoxia	Exceeding oxygen carrying capacity
Brown Blood Disease	Nitrite toxicity
Gas Bubble Disease	Nitrogen saturation
Traumatic Injuries	Birds Netting Pond cleaning

Environmental Gill Disease (EGD) is a rather complex and not too well understood condition. The majority of episodes are diagnosed as Bacterial Gill Disease (BGD) and treated accordingly with one of the water-administered antibacterial medicaments. In many cases, the treatment regimen and the mortality correct the environmental causal factors. Thus, the diagnosis was correct - a logical but often erroneous conclusion.

EGD is considered, first, to be stress-mediated, and, second, environmentally-mediated; e.g., ammonia (HN_3) levels >0.03 mg/l. The most common stressor is a high population density. By itself; i.e, uncomplicated by pathogens, it is more a debilitating than lethal process. This is what makes the condition economically significant.

Table 2:	Direct and indirect causal factors of noninfectious diseases of hatchery fish
	Direct Causal Factors
Water-Associated:	acidity ammonia nitrite dissolved oxygen organic contaminants inorganic contaminants carbon dioxide suspended particulates
Management-Associated:	trauma
	Indirect Causal Factors
Water-Associated:	pH total alkalinity calcium hardness velocity temperature
Management-Associated:	population density physical handling

Table 3:	Stress-related noninfectious diseases
	Environmental Gill Disease
	Frayed fins
	Fin-nipping
	Soreback
	Generalized melanosis

The pathological changes are limited to the gill lamellae. The first change is lamellar hypertrophy; i.e., the lamellar epithelial cells enlarge. This condition is followed by epithelial-capillary separation (ECS) in which the lamellar epithelium (the outside cell layer) separates from the lamellar endothelium (the inside cell layer) and the space fills with fluid from the lamellar vascular space. The final stage is characterized by lamellar hyperplasia; i.e., the lamellar epithelial cells increase in number. This progresses to the point of interlamellar occlusion. This condition is quite recognizable by the incomplete closure of the opercles and the protrusion of gill tissue from the gill cavity.

The primary physiological effect of the foregoing changes has been an increasing difficulty in oxygen uptake and ammonia excretion. In addition, somewhere along the process, one of the saprophytic, aquatic myxobacteria sets up housekeeping on these compromised gill tissues and makes the situation worse. This is the point in time when the fish culturist takes his/her action and "corrects" the situation.

In my opinion, the best treatment regimen is:

1. Stop feeding for at least three days. This reduces the oxygen demand and the generation of solids and ammonia.

2. Administer a 1% salt flush. Even a higher level (2-3%) could be used. For example, just empty the required number of 50 lb bags of salt into the head-end of the pond and do not mix.

3. Reduce the pond population on day-3.

4. Administer another salt flush.

5. Put the fish back on 50-75% feeding level for a few days then go to full feeding.

In my opinion, the most effective approach to preventing EGD is to:

1. Stay on top of the density carrying capacity of the pond by stocking the pond for take-out not by the "Well, it look 'bout right" method.

2. Administer a salt flush on a regular basis - once a week is not excessive.

3. Examine the "poor-doers" on "screen-hangers" for signs of EGD - and other problems, for that matter.

Fin-nipping (aka "fin erosion") is a psychological condition of rainbow and steelhead trout, mainly. It is precipitated by management practices which violate the territorial imperative of the fish; e.g., overcrowding and feeding method. The condition (called the "swimming frankfurter syndrome") is quite common in conservation catchables and smolts. It is used in resource management circles to identify hatchery and wild fish. In my opinion, this does not legitimize the condition.

There is no effective treatment regimen which will reverse the condition. Thus, the best approach is to prevent it from becoming worse or occurring in the first place. As with EGD, population density control is a key factor. Second, feed the fish in such a fashion that they do have to leave their "space" to receive food. This is one of the main drawbacks to using demand feeders in that to receive a meal, a fish must leave its "space" and enter that of another and get nipped in the process. A third control/prevention method is to increase the water velocity to about one body length per second. This gives the fish something else to think about other than biting their transgressors.

Soreback is a sequel to dorsal fin-nipping. In this case the dorsa fin becomes a "target" for reminding a fish that it is in the wrong "space." The situation gets quite worse, often to the point that the vertebral column is visible. Usually this lesion does not become infected with fungus because the continual nipping prevents this.

In summary, most episodes of noninfectious diseases are characterized by:

1. Reduced growth rates
2. Reduced feed efficiency
3. Depression; lack of interest in feed
4. Moderate to high morbidity; i.e., number of affected
5. Low mortality
6. Shallow, rapid respiratory movements

In most cases, prevention of clinical episodes is accomplished by good husbandry. Good husbandry is not expensive, in fact, it usually results in reduced production costs. Finally, good husbandry begins with believing that the job can be done better to get a better fish.