

**Blue Ocean Institute**  
**Farmed Fish**  
**Core Points and Points of Adjustment**  
October 2008

**Inherent Operational Risks**

***Core Points***

General System Design: An aquaculture system's design is a good overall proxy measure for the likely effect of the operation on the environment. For example, open systems (e.g., net pens and net cages) are more likely to have pollution, disease, and escape issues than closed systems (e.g., recirculating tanks). With shellfish, which don't require supplemental food input, the more important question is whether they are harvested on or off of the bottom.

- 1.00 This species is raised in a high risk system (e.g., net pens; net cages).
- 2.00 This species is raised in a moderate risk system (e.g., most ponds; raceways; bottom culture of mollusks).
- 3.00 This species is raised in a low risk system (e.g., re-circulating closed system; suspended culture of mollusks; zero-discharge ponds).

***Points of Adjustment***

- 0.25 Species is raised at a high stocking density; OR there is a high density of sites in the geographic region, with evidence of environmental impact.
- 0.25 Operations do not incorporate best-available, cost-effective technology to reduce environmental impact.
- 0.25 There are no effective zoning or permitting practices for siting of facilities.
- 0.25 Government programs encourage expansion of high-impact systems.
- +0.25 Species is raised at a low stocking density OR there is a low density of sites in the geographic region, which results in minimal impact to the natural ecosystem.
- +0.25 Operations incorporate innovative culture methods that limit environmental impacts (e.g., polyculture).
- +0.25 There are effective zoning or permitting practices for siting and operation of facilities (e.g., mandatory consideration of hydrographic characteristics; requirements for site rotation).
- +0.25 Government programs preferentially encourage the expansion of low-impact systems over high impact systems.

## Feed

### **Core Points**

Ecological Footprint of Feed: "Trash" fish, frequently used in developing countries, is an industry term used to refer to whole fish or fish parts fed to farmed fish without being processed into fish meal and fish oil. Twenty percent was selected as a cut-off because carnivorous species (e.g., salmon; eel; tuna; cobia; etc.) generally consume greater than twenty percent fish products (fishmeal, fish oil, or trash fish), while omnivorous or herbivorous species (e.g., catfish; tilapia; carps; etc.) consume less than twenty percent fish products.

- 1.00 Typical aquaculture feed includes high levels of fishmeal, fish oil, or "trash" fish (i.e., >20% of the feed; e.g., salmonid feeds).
- 2.00 Typical aquaculture feed includes moderate levels of fishmeal, fish oil, or "trash" fish (i.e., <20% of the feed; e.g., tilapia and catfish feeds).
- 3.00 No feed is used (e.g., mollusks and seaweeds) or typical aquaculture feed includes no fishmeal, fish oil, or "trash" fish (e.g., paddlefish; filter-feeding carps).

### **Points of Adjustment**

- 0.25 When fish products are used, the major sources score low on the Wild-Caught Fisheries Ranking System.
- 0.25 Feed contains greater than 10% of fish products and public or private sectors are not working to reduce fish content in feed.
- 0.25 Feed conversion ratio (FCR) is high (i.e., >2.0; e.g., eel).
- 0.25 Government policy promotes research, development and commercialization of carnivorous or other highly fishmeal-dependent species.
- +0.25 When fish products are used, the major sources score high on the Wild-Caught Fisheries Ranking System; OR the source is innovative and ecologically sound (e.g., fisheries byproducts); OR no feed is used.
- +0.25 Feed contains less than 10% of fish products OR public and private sectors are working to reduce the fish content in feed; OR no feed is used.
- +0.25 Feed conversion ratio (FCR) is low (i.e., <1.3; e.g., salmon); OR no feed is used.
- +0.25 Government policy promotes research, development and commercialization of herbivorous species or other species not highly dependent on fishmeal.

## **Pollution**

### ***Core Points***

Typical effluent treatment procedures:

- 1.00 Effluent is not treated before discharge (e.g., salmon net pens).
- 2.00 Effluent is partially treated before discharge (e.g., infrequently discharged effluent from catfish ponds).
- 3.00 Effluent is substantially treated before discharge (e.g., recirculating shrimp systems; settling ponds; reconstructed wetlands); OR treatment is not necessary because supplemental feed is not used (e.g., molluscs or seaweeds).

### ***Points of Adjustment***

- 0.25 Operations have demonstrated negative impacts on water quality or sediment/benthic characteristics (e.g., elevated nutrient levels; algal blooms; altered benthic communities).
- 0.25 Pollutants (e.g., pesticides; parasiticides; antibiotics; plastic; nets; dead fish) are frequently discharged into the environment or otherwise not appropriately discarded.
- 0.25 Effluent regulations do not exist, are lax, or are poorly enforced, which allows for degradation of the aquatic environment.
- 0.25 Available technologies and practices to reduce or recycle waste (e.g., feed sensors; low-pollution feeds) are not used.
- +0.25 Operations generally improve water quality or sediment/benthic characteristics (e.g., oyster farms).
- +0.25 Chemicals (e.g., pesticides; parasiticides; antibiotics) are rarely or never used.
- +0.25 Robust water quality regulations exist (e.g., permits required; discharge caps; strong enforcement), and regular monitoring occurs.
- +0.25 Innovative methods and practices to reduce or recycle wastes are used (e.g., integrated systems; effluent and solid wastes used as terrestrial fertilizer); OR innovative methods and practices are not needed because raising this species does not create waste.

## **Risk to Other Species**

### ***Core Points***

Frequency and Impact of Escapes:

- 1.00 Farmed species regularly or intermittently escape into the wild AND escapes are non-native to the area or otherwise pose a risk to native populations or ecosystems (e.g., most non-native fish raised in outdoor facilities).
- 2.00 Escape frequency is not known OR farmed species is native to the area where it is raised and poses minimal risk to native populations or ecosystems (e.g., channel catfish in the US; most native mollusks).
- 3.00 Farmed species never (or virtually never) escape to the wild (e.g., species is raised in bio-secure facilities).

### ***Points of Adjustment***

- 0.25 This farmed species has been known to survive in the surrounding ecosystem if it escapes; OR would likely survive given its physiological requirements.
- 0.25 This farmed species is known or is likely to compete with wild species for food or habitat if it escapes; OR this species is known or is likely to compromise the genetic integrity of the wild species (e.g., through spawning disruption, genetic introgression or establishment of feral stocks) if it escapes.
- 0.25 This farmed species is known or is likely to amplify and transmit disease or parasites to wild populations (e.g., infectious salmon anemia or sea lice infestations) if it escapes.
- 0.25 Regulatory authorities are not adequately addressing the risks of escape or spread of disease associated with farming this species.
- +0.25 This farmed species has not been known to survive in the surrounding ecosystem if it escapes; OR would not likely survive given its physiological requirements; OR farmed species is a native mollusc.
- +0.25 Operations employ management protocols and techniques to limit the ecological impacts of escaped farmed fish (e.g., triploidy; sterilization); OR it's unlikely that escaped individuals will either compete with wild species for resources, or compromise the genetic integrity of wild species.
- +0.25 Operations employ effective disease and parasite management protocols (e.g., fallowing of pens; retaining water when disease outbreak occurs); OR incidence of disease or risk of retransmitting disease is low.
- +0.25 Regulatory authorities are addressing the risks of escape and spread of disease associated with farming this species.

## **Ecological Effects**

### ***Core Points***

Ecological sensitivity of site used for operations:

- 1.00 Operations are generally located in areas of high ecological sensitivity (e.g., coastal wetlands; mangroves).
- 2.00 Operations are generally located in areas of moderate ecological sensitivity (e.g., coastal and nearshore waters; rocky intertidal or subtidal zones; river or stream shorelines).
- 3.00 Operations are generally located in areas of low ecological sensitivity (e.g., land that is less susceptible to degradation such as land formerly used for agriculture or land previously developed).

### ***Points of Adjustment***

- 0.25 Farming this species causes substantial damage to surrounding habitat, ecosystem or other resources (e.g., groundwater depletion; stream diversion; saltwater intrusion; soil salinization; loss of habitat for juvenile fish; loss of flood control; dredging hard bottoms; etc.).
- 0.25 Harmful or lethal predator deterrents are used (e.g., bird/seal shootings; acoustic deterrent devices); OR operation otherwise harms wildlife (e.g., dolphin/seal entanglement; disrupting migration routes; bird/animal shooting).
- 0.25 If seed is collected from wild sources, the intensity of collection is high enough to result in depletion of brood stock, wild juveniles, or associated non-target organisms (e.g., collection of postlarvae shrimp).
- 0.25 Government policy encourages aquaculture operations to locate or expand in areas of high ecological sensitivity.
- +0.25 Operations enhance habitat structure or function (e.g., constructed wetlands).
- +0.25 Predator deterrents are not used OR predator deterrents are used but are not harmful or lethal (e.g., predator exclusion nets), AND operation does not otherwise harm wildlife.
- +0.25 Seed comes predominantly from hatcheries or on-farm sites (e.g., seed for trout); OR if seed is collected from the wild, it does not deplete brood stock, wild juveniles, or associated non-target organisms (e.g., collection of oyster or mussel spat).
- +0.25 Government policy encourages the growth of aquaculture operations in areas of low ecological sensitivity; OR protects sensitive habitats from aquaculture operations (e.g., prohibitions on cutting mangroves).