COMMENTS AND RECOMMENDATIONS ON NATIONAL ORGANIC STANDARDS BOARD, ORGANIC AQUACULTURE STANDARDS SECOND DRAFT (OCT. 20, 1998) & THIRD DRAFT (MAY 18, 1999): AUTHORIZED METHODS AND MATERIALS FOR THE PRODUCTION OF ORGANIC FINFISH AND SHELLFISH

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Thank you for the opportunity to contribute to the development of organic aquaculture standards. The nation-wide establishment of organically certified aquaculture operations is a feasible and exciting goal. Since confined aquaculture of many species began less than 40 years ago, the state-of-the art, particularly for organic approaches, is in its infancy compared to terrestrial farming. National standards could provide an important incentive for some aquaculture producers to modify their operations towards organic practices.

Initially, a relatively small number of aquaculture businesses will pursue national organic certification. This first wave of applicants is likely to include a number of small producers, some of whom are on the cutting edge of using recirculating aquaculture and integrated aquaculture-agriculture systems that are more environmentally sound and potentially more compatible with organic principles than mainstream production systems. Organic aquaculture standards, therefore, should be adaptive by stimulating and accommodating future innovations that clearly fit organic farming principles.

Our comments assume that standards consist of concise statements of objective and desired end-points. After promulgation of rules under adopted standards, we understand that the U.S. Department of Agriculture will develop more detailed management practices to guide the certification process. These management practices should provide detailed guidance on how to meet the standards across the widely different types of aquaculture systems involving different species. The total list of aquaculture species raised in the United States represents a much greater range of biological traits than is found in the smaller number of terrestrial livestock species.

We recommend three guiding principles for the ongoing revision of these draft standards. First, the aquaculture standards should be consistent with the *goals and objectives* of organic agriculture standards so that aquatic producers have the same types of obligations as terrestrial farmers. Second, to assure practicability, the standards must accommodate the biology and ecology of farmed aquatic organisms, which differ greatly from that of terrestrial livestock and plants. Third, we urge the Board to actively seek comments from a broad array of aquaculture producers and analysts and buyers of aquaculture products. Special efforts should be made to contact small aquaculture producers who often get left out of national forums but may harbor the most serious, present-day interest in organic aquaculture. We would be glad to identify some initial contacts.

For each standard, please find below our major recommendations (bold-face type) and explanations. Comments apply to the second draft submitted by Fred Kirschenmann (Draft-2) unless we specifically refer to the third draft submitted by Kathleen Merrigan on May 18, 1999 (Draft-3).

A. GENERAL REQUIREMENTS

1. Add "shellfish" after "Fish" to clarify that this applies to both groups of animals.

2. We prefer Draft-3 and recommend revisions in four places.

1st revision. **Add "and shellfish" after "Finfish" in the first sentence.** If a producer introduces an exotic species or non-resident, genetically different population of shellfish, the potential for ecological havoc resulting from escapes is as great, perhaps greater, than for escapes of non-native finfish. See also the 3rd revision.

2nd revision. **To clarify the intent of the text "prevents the escape of...nutrients, and wastes to the environment.", add the sentence: "Land-based systems must properly treat any effluents released to natural waters to prevent point source pollution problems."** Netpens are not the only aquaculture systems faced with the challenges of nutrient and waste management. Poorly managed on-land systems also can pollute natural waters, particularly constant flow-through systems or periodically drained static ponds. The EPA is beginning a review of the Clean Water Act regulations that apply to aquaculture effluents. The Board should stay abreast of this EPA review as some findings and regulatory changes may inform future revisions of organic aquaculture standards.

3rd revision. **Replace "Filter feeding shellfish including oysters, mussels, and clams" with "Filter feeding and grazing species of shellfish already found in local waters and not considered to be aquatic nuisance species".** The listing of oysters, mussels, and clams is an incomplete set of appropriate species and is not needed to meet this standard's objectives. A relevant example of grazing shellfish is the farming of abalone (a mollusc) in barrels and cages suspended below a long dock in Monterey Bay, California and fed hand-harvested wild kelp. Such operations might be good candidates for organic aquaculture certification because they utilize native species that are well contained in rearing units and add little nutrients to the water column. Our proposed revision aims to permit open-water farming of filter feeding molluscs when they are native species or a previously introduced species that is already widespread and not considered to be an ecological threat in the environment. For instance, a farmed oyster species, *Crassostrea gigas*, was introduced from Asia approximately 100 years ago and is now widespread on the U.S. West coast. Some oyster farms may be good candidates for organic certification. We are aware of at least one oyster operation that was pursuing organic certification a few years ago in order to differentiate its product from that of other oyster farms that applied herbicides and pesticides for controlling invasive organisms in their oyster beds.

We recommend further analysis to determine if this standard should allow open-water farming of crustaceans that feed on naturally occurring foods (e.g., low-input, extensive aquaculture of crayfish in rotation with rice farming).

4th revision. After the sentence "Netcages and netpens which allow unrestricted flow....", add new text as follows:

> **Production is permissible in impermeable suspended bags and other units floating in natural waters that meet criteria i-v. Production of in permeable floating units (e.g., cages, netpens) shall be permitted only if the production system is located in such a way that there is sufficient water exchange to keep confined animals healthy and prevent water quality changes, unnatural build-up of sediments, and other ecological changes to the surrounding environment. Specifically:**
>
> **i. Feeding techniques shall optimize feed utilization and feed waste and feces shall be limited in order to avoid influencing the surrounding environment.**
>
> **ii. The oxygen levels in the entire water column and bottom sediments shall not diverge considerably from the natural levels in the area.**
>
> **iii. Algae populations in the water column may not diverge considerably from the normal state in the area.**
>
> **iv. Microbial communities in the bottom sediments shall not diverge considerably from the normal state in the area.**
>
> **v. New introductions of species and locally occurring, aquatic nuisance species are prohibited from aquaculture systems located within natural waters.**

Although present-day uses of floating cages and netpens for raising finfish have caused water quality problems, organic finfish culture could be feasible in such permeable floating units if producers opt to keep fish stocking and feeding at sufficiently low levels to avoid waste accumulation. The KRAV standards for organic aquaculture are IFOAM accredited and allow production in permeable floating units under significant restrictions (KRAV 1999, see section 7.3). Our suggested language draws in part from the KRAV standards.

The present state of netpen and netcage technology is largely inadequate to prevent escapes of cultivated animals but this may change. There is active research and development on impermeable and enclosed floating bag culture systems. New technologies may turn out to be as secure as enclosed, on-land ponds. Note that aquaculture organisms, including ecologically undesirable exotic species, have escaped from on-land facilities, particularly from outdoor ponds which are vulnerable to flooding, breaching of pond dikes by small mammals, removal of live fish by wading birds etc. Organisms can escape through the effluents of indoor, flow-through aquaculture operations if appropriate barriers are missing; embryos, larvae, fry, and other small life stages are the hardest to confine.

B. FEED

1. No comment
2. No comment

3. We prefer Draft-3, B.2 but recommend two modifications. First, change "wild resources" to "sustainably harvested wild sources". Second, prohibit the use of fish meal in diets of animals that are not naturally piscivorous. Given that a prime objective of organic culture is to closely simulate the natural life cycle of the organism, organic certification should allow farming of naturally piscivorous fish that are fed fishmeal or live fish harvested *sustainably* from wild sources or derived from organic fish farms. For example, an aquaculturist producing a piscivorous fish species fed with cultured baitfish is more closely following natural feeding processes than if the fish were fed formulated feed containing proteins mostly from soy beans or other terrestrial sources. Also, if a farmer managed to rear a much sought after piscivorous fish species in a secured facility that was environmentally sustainable, using pure breeding stock and humane methods of farming and killing, such an operation should be eligible to apply for organic certification. That said, using fish meal in diets of aquacultural organisms that are not naturally piscivorous, (e.g., marine shrimp) seems much less compatible with organic farming principles.

Because the prevalent use of fishmeals in aquaculture does raise some legitimate concerns about environmental *un*sustainability, we would like to share some additional thoughts on this issue. **To encourage environmentally sustainable aquaculture on a *global* scale, we recognize the value of encouraging a shift towards more farming of plant-eating fish (herbivores). But this poses a conundrum for aquaculture in most of North America. The United States has relatively few native species of herbivorous fish and, to date, none have emerged as good aquaculture candidates. Shifting to aquaculture of herbivorous fish in the United States would require increased production of exotic species.** The most likely candidate species of herbivores—tilapia, and certain Chinese carps—raise a host of ecological problems once individuals escape into the wild (as has already happened in some cases). Many fisheries and aquatic ecologists have cautioned against the spread of these exotic species; and some states ban or severely restrict their use.

Two ways around this conundrum are (a) to raise exotic, herbivorous species in intensive, indoor recirculating aquaculture systems, typically the most contained rearing systems, or (b) to raise only permanently sterile individuals in less secure systems. Recirculating aquaculture systems involve high capitalization and energy costs and much technological interventions. These are significant barriers to involvement of small-scale, producers in organic aquaculture using recirculating systems. We suspect that the Board does not wish to inadvertently discourage small-scale organic fish farming. This is part of our rationale for allowing fish ingredients from sustainably fished wild sources in diets of piscivorous farmed fish. For a limited number of aquaculture species, methods have been worked out to produce permanently sterile individuals by inducing triploidy and then screening each individual to confirm successful sterilization. Note that this strategy conflicts with standard D.1 in Draft-2 and Draft-3. Please see our suggestions under D.1 below for how to reconcile this conflict.

A shift towards aquaculture of fish species that are not exclusive herbivores but naturally feed much lower on the food chain would also reduce reliance on the farming of piscivorous fish. Some aquacultural fish species are omnivores that eat very little fish protein. For instance, tilapia as a group (several species are farmed) are naturally omnivorous. They may feed on benthic algae, phytoplankton (algae species suspended in the water column), macrophytes (rooted aquatic plants), zooplankton (microscopic invertebrates and larval fish suspended in the water column), fish eggs, fish larvae, and detritus (partially decomposed organic matter). Other aquaculture species are naturally benthic feeders, eating a variety of plant and animal matter they encounter on the bottom of waterbodies. Benthic feeding species currently farmed in the United States include native species of sturgeon and paddlefish, although current practices rely on feeds containing fishmeal. The adoption of organic standards could stimulate some producers of these species to develop more natural diets. Common carp are also omnivores, easy to farm, and in growing demand, especially in some minority communities. Unfortunately, they are an introduced species whose spread to many North American waters has caused ecological havoc. Therefore, organic standards should discourage escapes of common carp into waters where they do not yet exist (see discussion of aquatic nuisance species under A.2).

4. We strongly prefer Draft-3, B.2 with the modifications suggested above (under B.3). In addition, we suggest adding a sentence that calls for preventing the transmission of xenobiotic contaminants and pathogens from processing by-products and waste-products used as feed inputs. Limiting the source of fishmeal and fish oil only to waste products raises two problems. The fish waste products may contain contaminants, particularly since contaminants often build up in fatty tissue. Can fish wastes be handled in a manner that prevents contamination by pathogens that may be passed along to cultured organisms eating the waste-derived feeds?

5. To encourage consistency with certification of terrestrial organic farming, we prefer the wording provided in Draft-3, B.4. Also, does Draft-2, B.5 prohibit all binders are or just artificial binders? Binders are an important component of pelleted fish food. Fish will not readily consume food pieces that are too small. Pelleted food that breaks apart too easily generates excessive waste, resulting in worse water quality in rearing units and effluents, higher feed costs for the aquaculturist and a lower food conversion ratio for the fish.

6. We recommend modification of this standard to permit limited and carefully monitored use of antibiotics when a rare health crisis occurs until organic aquaculturists have developed alternatives to such use of antibiotics. This is in keeping with the "phase-out" approach that the Board previously took regarding antibiotic use in terrestrial "production stock" animals. The FDA-approved use of antibiotics in aquaculture is *only* for a health crisis situation (FDA-approved new animal drugs) and *not* for preventative, prophylactic use, improved growth rates or enhancement of reproduction or fertility (expressly forbidden under extra-label use of an approved new animal drug). If desired, various caveats could be added to discourage any potential abuse of this allowance, such as requiring the producer to keep a log of antibiotic use and alert the organic certifier at the start and end of the treatment. Presently, the FDA lists only 3 antibiotics as approved drugs for a very limited list of aquaculture species and with specified withdrawal times (see Table 1 in Federal Joint Subcommittee on Aquaculture 1994). Of the 3 approved antibiotics , only 2 are available in the United States, and of those 2, only 1, Terramycin (an oxytetracycline), is approved for use with feed (Federal Joint Subcommittee on Aquaculture 1994). Medicated feed is critically important because, unlike terrestrial organisms, other processes for treating ill fish require handling and movement of varying degrees that will stress further stress them, thus potentially enhancing the disease problem. Antibiotic-supplemented-feed is the only way of administering antibiotics without some kind of handling or transfer of farmed aquaculture organisms.

Most aquaculture producers prefer to avoid antibiotics and turn to them only in crisis situations. Farmers have to specially order bags of medicated feeds and these are more expensive than normal feeds, increasing what is already the highest operating cost of many aquaculture businesses. Because antibiotics are much less palatable to most fish, they tend to eat less of the medicated feeds. This reduces the efficacy of the treatment while worsening food conversions, depressing fish growth, and further stressing the fish.

Although most commercial aquaculturists might not use the language of "holistic health management", many of them try to follow a basic principle of aquatic animal health management that is clearly compatible with holistic approaches. This principle has two key elements: (1) disease occurs only when the host is both environmentally stressed and exposed to the pathogen; and (2) the most effective and cheapest way to avoid disease problems is to maintain optimal environmental rearing conditions in order to minimize stress on the host.

Depending on the type of aquaculture systems used, it is either impossible or very expensive to fully remove potential pathogens from inflow rearing water. If a disease outbreak occurs, there may not be any approved medications for treating the disease. If there is an approved medication, it is expensive to apply, of limited efficacy, and tends to further stress the animals.

Sometimes, even approved medications are incompatible with the rearing operation. An interesting example is recirculating aquaculture systems: producers cannot use any antibiotics in these systems because the antibiotics would also kill the nitrifying bacteria in the biological filter; these beneficial bacteria break down fish ammonia waste before the water is returned to the fish rearing units.

Many aquaculturists are relying on hard-earned practical experience to apply this health management principle of reducing environmental stress. Compared to the world of terrestrial livestock, they have access to much less information from university and on-farm research about the health needs of the great variety of farmed aquatic animals. The adoption of organic aquaculture standards could stimulate more research and development of holistic health management. Therefore, we think it is important that the first set of standards accommodate present-day limits to disease treatment while maintaining the integrity of organic farming principles and providing a strong incentive for innovation on holistic methods.

The United States has some outstanding fish pathologists and aquatic microbial ecologists who could provide valuable input to the Board on this issue. For instance, they could comment on whether or not organic aquaculture standards need to extend the antibiotic withdrawal times presently required by the FDA. Hopefully, the innovative efforts of organic aquaculture producers will make it feasible to remove this allowance in 5-10 years.

7. We prefer the wording provided in Draft-3, standards B.3 and B.4.

C. ENVIRONMENT

1. We support encouragement of polyculture of diverse aquatic animal species but caution against *requiring* polyculture for organic certification. Exciting research and development in polyculture—and a small number of apparently viable businesses—are underway in the United States. Some of the more promising systems combine fish culture with hydroponic production of vegetables. But successful management of a polyculture system may place an insurmountable burden on farmers who are struggling to overcome the unknowns and problems of raising only one species. With the addition of each species to system, the complexity and possible sources of devastating errors increase. This is particularly true for indoor recirculating systems that can suddenly crash in response to fairly minor errors in aquaculture practice. There are relatively few known combinations of species that have life cycles amenable to polyculture and that can be raised profitably.

After the statement, "and recycling freshwater aquaculture effluents into cropping systems", please add "or within recirculating aquaculture systems." Recirculating aquaculture systems typically recondition and reuse 90% or more of the rearing water and are the subject of increasing research, development, and new businesses. The application of freshwater aquaculture effluents to cropping systems is desirable as long as it is not a requirement. Diversion of aquaculture effluents to cropping systems may not be feasible in many situations due to constraints of the aquaculture site or the local climate.

We also recommend adopting the sentence in Draft-3, C.2 about "enclosed pond systems" but modifying this term to read "on-land production systems, such as enclosed ponds and other static-water systems, flow-through raceways, and recirculating water systems". Organic aquaculturists using the full range of on-land systems should be required to document their management of nutrients and wastes in a livestock plan.

2. Consider deleting the statement "must be monitored daily for ideal environment (e.g., ammonia, nitrate, & oxygen levels, salinity, pH, etc.)" and shifting such details to the handbook of management practices. Depending on the species cultivated, the scale of the operation and the densities of organisms raised, daily monitoring of all relevant water quality parameters may be overkill and place an excessive financial burden on small producers. Monitoring requirements should be tailored to the needs of different species and water quality issues posed by different types of aquaculture systems. This is best handled in a written guide of management practices.

We also recommend adding the following text: "Water inside the rearing unit should meet optimum water quality conditions for the species cultured and, if these levels cannot be met naturally, then supplemental measures should be used." The need for supplemental measures will depend on the intensity of production. For example, ponds lightly stocked with culture organisms may only need periodic supplementation of oxygen to maintain optimum water quality. On the other hand, more heavily stocked systems will require more frequent or constant supplemental oxygen, mechanisms to remove settleable and suspended solids (from feces and uneaten food) and may involve biological filters to treat ammonia waste that is excreted through animal gills. Back-up systems (e.g. backup generators, pumps etc) should be included in the management plan to deal with emergency situations such as a loss of power or rapid drop in dissolved oxygen and be appropriate for the expected level of production. Water chemistry limits have been determined for many cultured organisms. Wedemeyer (1996) provides a good discussion of general recommendations for cold and warm-water fish. Although it is impossible to completely avoid possible toxicants, especially in outdoor rearing units that may be sinks for airborne contaminants, or from naturally occurring trace metals, organic producers should strive to ensure that the rearing unit water is as free as possible from toxicants. Our impression is that the recently initiated EPA review of standards for aquaculture effluent will not address water quality within the rearing unit, but we suggest checking with the EPA about this.

3. We suggest revising this standard to say: "Biomass/water flow and biomass/water volume ratios must be sufficiently low to maintain optimum water quality conditions for the farmed organisms, taking into account changing requirements at different life stages. This is generally the most effective way to assure humane and environmentally optimal rearing conditions. Producers using oxygen injection must maintain humane biomass/volume ratios in rearing units to allow natural mobility behaviors of organisms." More detailed directions tailored to the needs of different species could appear in the written guide of management practices.

It is imperative to prevent overcrowding of animals and assure that they experience optimal environmental conditions but this cannot be achieved by requiring one upper limit of biomass per unit rearing volume. Different aquacultural animals have widely different behavioral needs for movement volume. Some fish naturally school together at certain life stages, other fish depend more on two-dimensional areas of tank or pond bottoms than on stocking density for their well being, and molluscs naturally vary from dense clumps of mussels and oysters to individual, freely moving grazing abalone.

In most aquaculture systems, the ability to maintain optimum ranges of dissolved oxygen concentrations and stay below stressful ammonia waste concentrations becomes limiting long before animals might experience stress due to physical crowding. Thus, a producer who meets these water quality needs will avoid overcrowding. There is one exception to this rule of thumb that water quality needs becoming limiting before needs for humane rearing volumes. The recent advent of oxygen injection into the rearing water of recirculating water on-land systems could lead to situations where water quality is kept optimal but naturally mobile animals are overcrowded. Because this technology has high capital and operating costs, its present-day use is rare but this might change as the mainstream, on-land aquaculture industry look for ways to reduce its water demands.

4. We recommend adding the following sentence: "Harassment techniques for deterrence of predators are prohibited and producers should instead use structural exclusion and barrier techniques." We support the use of non-lethal predator control measures if and when fish-eating birds and mammals prey excessively on cultured organisms. Non-lethal measures, however, can be disturbing to non-target species and nearby human residents while remaining relatively ineffective on predator species. Routine methods of discouraging predators include the use of Auditory Deterrent Devices (ADDs) such as pyrotechnics or fireworks, live ammunition, noise cannons and exploders (Littauer et al. 1997). These methods are considered harassment techniques and are often ineffective against predators (Draulans 1987). We recognize the expense of such barriers for organic aquaculturists but feel that these techniques are superior to ADDs because they are more effective in the long-term and more benign to neighboring wildlife.

5. **This standard may not be necessary because common aquaculture practice is to avoid lead and other metals that are lethal to finfish and shellfish at very low dissolved concentrations (see Lawson 1995: Table 2.1; and Wedemeyer 1996: Table 3.1).** The overwhelming majority of aquaculture operations use PVC pipe in their plumbing systems, and even then, producers flush new pipes for two or more days to get rid of residual volatile compounds that can kill their animals. Some well-financed aquaculture operations use stainless steel pipe in portions of the plumbing system.

D. ORIGIN, BREEDING OF STOCK

1. We propose three modifications to this standard. First, to assure consistency with standards for terrestrial livestock and crops, add "genetically engineered organisms", as defined by the Board to the examples of prohibited organisms.

Second, we suggest requiring secure containment for farming of *fertile inter-specific* hybrids in cases where escaped individuals have access to suitable ecosystems harboring

one or both parental species. Fertile inter-specific hybrids are produced by crossing two taxonomically distinct species. An ecosystem is "suitable" if the interspecific hybrid can survive and reproduce in it (ABRAC 1995). This recommendation does not apply to cases where suitable ecosystems lack either of the parental species.

Two scientific, peer-reviewed reports pointed out the threats to aquatic biodiversity posed by escapes of fertile, interspecific hybrids and recommended secure containment of these organisms in cases where escapes could interbreed with a parental species in the wild (ABRAC 1995, Scientists' Working Group on Biosafety 1998). The ABRAC report, which only addressed small-scale uses in research and development, was officially adopted by the Secretary of Agriculture as voluntary guidelines. Building on the ABRAC report, the Scientists' Working Group on Biosafety report addressed all scales of commercial use. Many interspecific hybrids of aquatic animals are fertile and are capable of backcrossing with either or both parental species, generating viable introgressed offspring. If such backcrossing occurs on a large-enough scale, it results in introgressed populations and permanent loss of wild populations of the pure species.

Introgressive hybridization into wild populations homogenizes distinct species and is a concern due the widespread decline of aquatic biodiversity in the United States (Williams et al. 1989, Norse 1994). For instance organic aquaculturists in the North Central region might become interested in farming "hybrid walleye", an inter-specific and fertile hybrid produced by crossing walleye and sauger. Wild populations of walleye are socio-economically and culturally important to recreational fishermen and Native American communities and play an important ecological role in rivers and lakes of the North Central region. Certain wild populations of walleye have declined in their native range and would be particularly vulnerable to the genetic risk of introgression by escapes of farmed hybrid walleye. Likewise, aquaculture of hybrid striped bass (white bass x striped bass), another fertile hybrid is on the rise. This hybrid is the implicated cause of introgression documented in a lake population of white bass (Forshage et al. 1988) and in the declining, commercially important stock of Chesapeake Bay striped bass (Harrell et al. 1993).

Third, we propose revising the total prohibition of triploid organisms to allow its use for the cultivation of introduced(exotic) species, provided that the triploid organisms are permanently sterile. This reduces ecological risks posed by farming exotic herbivorous fish species in the United States (see discussion above of B.3) in a way that should maintain the integrity of organic principles. Triploid finfish and shellfish are typically produced by applying a brief temperature or pressure shock shortly after fertilization so that the egg retains intact an extra set of chromosomes that would normally be degraded. Triploidy renders adults of certain species functionally sterile, providing a form of biological containment for the risks posed by escapes of introduced species. Documentation of permanent sterility is needed to avoid known problems with triploid induction in certain species. See ABRAC (1995) for a discussion of these problems and of methods for documenting permanent sterility. This recommendation reconciles the tension between objectives of standards B.3 and D.1

Whatever the Board decides about this issue, the wording "triploiding" is incorrect and should be replaced by "induction of triploidy". The word "induction" refers to human intervention to produces the triploid condition and fits better with the fact that some aquatic animal species are naturally triploid. Organic aquaculturists should be able to produce naturally triploid animals.

2. To be more consistent with conventional aquaculture terminology and to prevent spread of disease from organisms brought into an organic aquaculture facility, we suggest revising the Draft-3 version as follows:

> **Broodstocks, seed (gametes, fertilized eggs, fry, smolts and other juvenile life stages) and grow-out stock shall be obtained from certified organic operations. If organic broodstock, seed, or grow-out stock are not available, organisms may be procured that have been organically managed from the first day after their birth. All organisms brought into the operation should be disease-free for certifiable diseases.**

Many states require screening of aquacultural organisms for certifiable diseases, involving testing for pathogens that are detectable by reliable diagnostic methods. Regional programs also exist to coordinate disease prevention across government jurisdictions, for instance the Great Lakes Fish Disease Control Policy and Model Program (Hnath 1993). Lists of certifiable diseases are regularly revised in light of new developments.

How will this standard be applied to seed obtained from wild broodstock? The aquaculture of some species still relies on collection of gametes from wild adults or of juvenile life-stages from the wild. As the Board assesses the pending proposal to certify wild caught salmon from Alaska, we encourage applying consistent logic to the sourcing of wild seed.

3. The word "eyestock" should be spelled "eyestalk". Also, consider adding a statement such as: "In species where humane collection of viable gametes from live animals of one or both sexes is impossible, gametes may be obtained from humanely killed adults." We agree with the intent to prevent inhumane treatment of animals. In most fish species, eggs and sperm can be humanely obtained by gently squeezing the lower belly and vent area of the animal. In many aquacultural species of shellfish, there are humane non-invasive ways to get adults to release their gametes. For example, once oyster adults have developed mature gametes, producers get them to naturally release their gametes in a static tank of water, sometimes simulating natural triggers for gamete release by quickly changing the water temperature.

Humane collection of viable gametes from live animals of one or both sexes is impossible in certain species. For instance, Pacific salmon naturally die after depositing their eggs and sperm. Although it is possible humanely squeeze viable sperm from the vent of live Pacific salmon males, it is difficult to obtain good quality eggs from live females. Therefore, the typical procedure is to kill a female, cleanly open the body cavity, and have the fully developed eggs simply drop down into a clean bucket. In some catfish species, the only way to obtain viable sperm is to sacrifice the male and dissect out ripe sperm from the gonads.

E. HEALTH

1. **We prefer the wording in Draft-3.**

2. **Please note our recommendation regarding use of antibiotics in the discussion of standard B.6. The Board should also consider allowing naturally produced vaccines (e.g., bacterins) that are USDA-licensed.** All currently allowed USDA licensed vaccines for aquaculture are bacterins made from heat-killed cells of the pathogen (Federal Joint Subcommittee on Aquaculture 1994). We recommend consultation with some fish health specialists to determine the complete makeup of these bacterin vaccines. Note that the IFOAM accredited KRAV standards allow vaccination (see standard 7.6.4), restricting it to only young life stages. This restriction may be unnecessary because vaccination may not work on older animals. The rationale for this KRAV restriction is unclear to us.

3. **We suggest replacing the existing language with the following: "Those treatments listed under Unapproved New Animal Drugs of Low Regulatory Priority in the Guide to Drug, Vaccine and Pesticide Use in Aquaculture (Federal Joint Subcommittee on Aquaculture 1994) are permitted provided that organic aquaculturists follow prescribed dosages and in are accordance with good management practices."** The approved treatments involve specifically limited uses of each substance. The materials include: acetic acid, calcium chloride, calcium oxide, carbon dioxide gas, Fuller's earth, garlic, hydrogen peroxide, magnesium sulfate (Epsom salts), onion, papain, potassium chloride, povidone iodine compounds, sodium bicarbonate (baking soda), sodium chloride, sodium sulfate, and urea and tannic acid. These are considered non-synthetic and are consistent with the National Organic Program's National List.

F. HARVESTING

1. **In order to adhere to the advice given by euthanasia experts such as the American Veterinary Medical Association and the Universities Federation for Animal Welfare (Anonymous 1988, 1993)., we recommend replacing the second sentence (Methods such as concussion...) with: "Humane methods of killing fish including anesthetic overdose, decapitation or pithing may be used as appropriate to the species."** This list is quite limiting and we would like to explore additional humane methods of slaughter. These organizations do not approve concussion as a humane form of euthanasia. Cooling to 4°C, which does facilitate handling, slows metabolism but does not necessarily raise the pain threshold. Finally, although carbon dioxide is acceptable for non-aquatic animals, it is less desirable than other methods for aquatic animals (Noga 1996).

Will this standard allow the harvest and marketing of live animals? Retail marketing of live aquacultural animals occurs both at fish farm sites and in aquaria/holding tanks in grocery stores and restaurants. Some examples include oysters and other molluscs sold in the shell, fish sold pond-side at some small catfish and trout farms, and carp and tilapia sold from live tanks at grocery stores specializing in Asian foods.

2. To be up-to-date with relevant regulations, consider adding the sentence, "Processors must develop a Hazard Analysis Critical Control Point (HACCP) plan as is required by the FDA (FDA 1998)."

H. OTHER COMMENTS

1. Algae, aquatic plants, and amphibians and water-dwelling reptiles. Two areas of aquaculture that are not covered by existing drafts of the organic aquaculture standards. The first area is the growing production of marine and freshwater algae (both microscopic and large species) and aquatic macrophytes. We encourage the Board to eventually expand the organic aquaculture standards to cover marine and freshwater algae and macrophytes. These forms of aquaculture could provide some important opportunities for organic certification. They also pose some difficulties that may differ from those involving organic certification of terrestrial crops. The second area involves farming of amphibians and water-inhabiting reptiles (e.g., frogs, alligators) that are sometimes included in the purview of aquaculture. We encourage the Board to consider whether such production should be covered under the organic aquaculture standards.

2. Siting on Private and Public Lands. Draft-2 indicates plans to develop standards for the siting of organic aquaculture operations. A complex suite of federal and state regulations govern the siting of aquaculture operations. Certain operations, both on private and public lands, have triggered a variety of environmental and socioeconomic problems. Any organic standards developed to address this issue should follow the basic principle of preventing environmental degradation due to adverse impacts on habitats, water quantity or quality, and biological diversity.

Organic standards should also consider adverse effects on capture fisheries (both commercial and recreational). It is equally important to keep in mind parallels between aquaculture and terrestrial farming on public lands. For instance, if the Board decides to prescribe organic standards for cattle ranching on the open range, then it would be consistent to prescribe organic standards for farming of molluscs (oysters, clams, mussels, abalone, etc.) in public waters or on public submerged lands. We would be glad to contribute to the development of standards for the siting of aquaculture operations.

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