

**The Challenges Imposed by the Current Canadian Feed Regulatory System
on the Aquaculture Sector in Canada.**

Prepared for:

The Canadian Aquafeed Working Group (CAWG)

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Background

As part of the National Strategic Action Plan Initiative (NASAPI), a consultation process was undertaken with the stakeholders in the Canadian aquafeed sector. Through this process, the aquaculture feed producers communicated that regulatory issues represent one of the highest priority constraints that need to be addressed in order to set the conditions necessary for the sustainable growth of the Canadian (finfish) aquaculture sector.

The Canadian Aquafeed Working Group (CAWG) has been formed in response to the consultations undertaken as part of the NASAPI. The CAWG is co-chaired by the Aquaculture Management Directorate of Fisheries and Oceans Canada (DFO AMD) and the Canadian Aquaculture Industry Alliance (CAIA) and represented in its membership by aquafeed producers, industry associations, researchers and government. The role of the CAWG is to ensure the effective implementation of the feed related elements of the action plan, to ensure that it remains relevant and to ensure that the initiatives being undertaken related to the plan are effectively implemented and enhance the sustainable development of the sector.

A review of the regulatory process for the animal feed sector in Canada has been ongoing for over 10 years. The negotiations that occur between the Animal Nutrition Association of Canada (ANAC), representing the industry being regulated, and the CFIA, the regulatory agency, have proven very complex. Initially, the focus has been on trying to update the established nutrient ranges in Table 4 of Schedule I of the Canadian Feeds Act. Early in the process, the review of details for finfish was relegated to a 'later round' in the review because the aquafeed sector is servicing the 'minor' group of species in animal production.

Relatively recently, ANAC has taken a new approach related to the regulatory review process which is described as 'Moving Toward a Modernized Regulatory Framework' in their 2008 Annual Report. Further details on this initiative are provided

in the 2009 Annual Report of the association, in the section discussing the association's campaign for modernized feed regulations. A preliminary step in this new approach is to have independent industry experts put forward for consideration by ANAC responsible, scientifically rigorous and commercially practical solutions to the problems evident in the regulations. The staff and Nutrition Committee of ANAC also developed a set of guiding principles for a new regulatory framework which were endorsed by the association's board of directors in early 2009. An unpublished paper titled 'Deficiencies in the Canadian feed regulatory system and the need for performance-based regulation' was prepared in February 2010 by Dr. Steve Leeson under commission from ANAC, as input to the association's regulatory modernization initiative.

The development of this new approach by ANAC provides the aquafeed sector with an opportunity to take the initiative to ensure that its needs are fully addressed in the process – as such, the CAWG have decided to join with ANAC in this initiative. In order to ensure that the needs of the aquaculture sector are fully met through this initiative, an appendix to the ANAC regulatory review paper by Dr. Leeson is necessary to summarize the regulatory issues that are unique to the Canadian aquafeed sector or that require the development of proposed solutions that are unique to the aquafeed sector as compared to the terrestrial animal feed sectors dealt with in the Leeson paper. The goal is also to put forward responsible, scientifically rigorous and commercially practical solutions to the problems evident in the regulations and in their enforcement that are specific to the Canadian aquafeed sector and provide a document to ANAC to support their preparation of a policy position paper to be prepared and submitted to CFIA as part of the regulatory modernization initiative.

The objectives of this appendix are to:

- 1) Provide comments on and supplement the information contained in the Leeson paper in the context of the Canadian aquaculture and aquafeed industry.

- 2) Highlight issues arising as a result of the current regulatory framework vis. the Canadian aquafeed sector.

3) Propose solutions to regulatory issues facing the Canadian aquafeed sector.

1) The Context of the Canadian Aquaculture and AquaFeed Industries

Aquaculture: An Increasingly Meaningful Industry to Canada

Over the past three decades, the Canadian aquaculture industry has become an increasingly important contributor to the Canadian economy. Canadian aquaculture production has grown from about 10,000 tonnes, valued at \$35 million, in 1986 to more than 170,000 tonnes with a value of over \$912 million in 2006 (CAIA, 2010). Aquaculture now accounts for more than 30% of total Canadian fisheries production in value and the sector contributes more than \$2.1-billion annually to the Canadian economy (CAIA, 2010). Aquaculture development has proven to be a revitalizing social and economic force in many coastal communities in Canada (CAIA, 2010). The sector is responsible for over 17,000 jobs and over 90% of these jobs are located in rural, coastal and Aboriginal communities across Canada (CAIA, 2010). Farmed salmon is British Columbia's largest agricultural export product and the largest crop in the New Brunswick agri-food sector. More than 85% of Canadian aquaculture production is exported with the United States being the largest export market. In 2006, the US imported about 79,000 tonnes of Canadian farmed salmon worth more than \$500 million (CAIA, 2010).

Constrained by inappropriate governance and inadequate programming support, the Canadian aquaculture industry has been unable to keep pace with other leading fish-farming nations (CAIA, 2010). Despite possessing great attributes, such as the world's longest coastline and the largest freshwater resources, Canada ranks only 22nd among aquaculture producing nations and accounts for less than 0.3% of the global aquaculture production. Canada accounts for 8% of global farmed salmon production and ranks 4th behind Norway, the UK and Chile as a producer of farmed salmon (FAO, 2009). If a number of constraints were lifted, CAIA estimated that the Canadian aquaculture production could reach 577,000 tonnes valued at \$2.8 billion by 2015 and the sector

could provide sustainable, year-round employment for more than 47,000 people living in coastal, rural and Aboriginal communities (CAIA, 2010).

A number of governmental programs (e.g. Aquaculture Innovation and Market Access Program, AIMAP) are currently aimed at helping the Canadian aquaculture industry enhance its sustainable performance and global competitiveness by encouraging investment in innovation. These programs will have limited effect unless there is a modernization of legislation and regulatory processes to which aquaculture operations are subject. Modernization of the legislation and regulatory processes is essential for attracting investment, enabling the sustainable development of the industry and creating jobs.

A Highly Diverse and Complex Sector

Atlantic salmon is by far the most important finfish species grown by Canadian aquaculture operations. However, numerous other fish species are cultivated by commercial or government fish culture operations for food, recreational fishing, and natural stock rehabilitation purposes. Species cultivated include rainbow trout, chinook salmon, coho salmon, brook trout, Arctic char, lake trout, brown trout, American eel, Atlantic cod, Atlantic halibut, Nile tilapia, spotted wolffish, white sturgeon, sablefish, yellow perch, and walleye. Several other fish and crustacean species could be cultured on a commercial scale using feed-based systems in Canada. There has been significant funding invested by different levels of governments in Canada over the past three decades to support diversification of species for aquaculture.

The life cycle of many of the fish species cultivated by Canadian aquaculture operations is highly complex. In many species, animals transition through different life stages, occasionally including different larval stages. Many fish species are dependent on exogenous feeding from a very early stage of development and at extremely small size (starting at just few mg of weight). These animals need to be reared using sophisticated techniques. Many species require highly specialized diets at different life stages. These diets are generally required in very small amounts for limited periods of time but are

crucial for the survival and normal development of the animals. For many species, there cannot be any viable commercial production without access to highly specialized technologies and feeds.

Issues of Environmental Sustainability

Fish production in Canada is performed in a wide variety of production systems (marine or freshwater net pens, land-based flow-through facilities, recirculation systems, ponds, etc.). Many aquaculture operations release their wastes directly (or indirectly) in the environment with relatively limited capability to recover wastes which is in part due to the high capital and operating cost required to implement waste removal technologies (IPSFAD, 2007). The release of wastes by aquaculture operations may result in nutrient enrichment of the receiving environment which, in turn, may result in environmental changes (Bureau and Hua, 2010). In certain regions of the country, ongoing tensions with some stakeholder groups (environmental non-governmental agencies (NGOs), fishermen, cottage owners, tourism operators, etc.) have led to intense scrutiny and questioning about the potential environmental impacts of aquaculture operations. This issue has hindered the development of the sector for many years. The effective and meaningful management of waste outputs is a complex issue that can, in broad terms, be simplified to the management of the release of solid wastes (mainly organic wastes) and that of “elemental” wastes (e.g. nitrogenous or phosphorus containing compounds) in forms which may stimulate primary productivity (algae and plant) and eutrophication processes in the receiving water body (Reid et al., 2008; Bureau and Hua, 2010). Despite divergences of opinion, there is a general consensus that long-term sustainability of many aquaculture operations in Canada is very much related to how these can minimize or better manage their release of solid and dissolved wastes in the environment (Cho et al., 1994; Cho and Bureau, 1997; Reid et al., 2008; Bureau and Hua, 2010). Since most of the wastes released by aquaculture operations are ultimately from biological and dietary origins, effective management of waste outputs can be achieved through management of the nutrient composition of feeds (Cho et al., 1994; Cho and Bureau, 1997; Bureau and Hua, 2010). Numerous stakeholders in the sector have been proactive in the evaluation

and adoption of nutritional strategies to reduce or manage the waste outputs from commercial aquaculture operations. The invested efforts have resulted in very significant reduction of waste outputs (per unit of fish produced) by fish culture operations in Canada over the past four decades (Bureau and Hua, 2010).

Issues of Food Safety and Consumer Confidence

Despite the many health benefits clearly associated with fish consumption (wild or farmed), farmed fish has been the subject of many negative “headlines” in media over the past few years. Atlantic salmon farming operations have been the target of extremely well-planned and well-funded campaigns by environmentalists and so-called public interest groups funded by “charitable” foundations. Campaigns have been well-orchestrated and have brilliantly used the strong appetite of competing media outlets for controversial stories and the tremendous growth in “health and lifestyle reporting”. The most effective campaigns have focused on persistent organic pollutants (POP) comparison of farmed Atlantic salmon vs. wild Pacific salmon (Easton et al., 2002; Hites et al., 2004). These campaigns have been based on subjective interpretation of legislation in a number of jurisdictions and have, on purpose, left out comparisons of farmed salmon with other wild fish species and overlooked more significant contaminants (e.g. mercury). These campaigns have developed in many consumers the lingering perception of serious food safety issues with farmed food fish. In response, the Canadian aquaculture industry has been proactive in addressing potential criticisms by developing, and transparently documenting and reporting its stringent production and food safety standards (CAIA, 2010). The aquaculture sector is continuously seeking to improve production practices to ensure high consumer confidence in the safety of aquaculture food products. Given that farm-raised fish are fed exclusively commercial feeds, the source of contaminants is mainly the feed, the POPs being largely derived from the fish oil and fish meal used in feeds.

The CFIA regularly monitors livestock feed for environmental contaminants that have the potential to impact food safety and the health of livestock. The CFIA and the Canadian aquafeed producing companies have put in place monitoring protocols for

dioxin, PCB and pesticide levels in feeds and ingredients and to ensure that the ingredients used to produce aquafeeds meet stringent standards (CFIA, 1999; 2009).

Over the last 20 years, feed production and animal and food production have been greatly impacted by the need to accommodate real or perceived, very broad, societal issues. These issues mainly relate to food safety, food composition, animal welfare and various environmental concerns. The Canadian aquaculture industry has undertaken numerous voluntary actions to transparently account for its social, economic and environmental effects. At the national level through CAIA, and regionally through the provincial industry associations, there has been continuous review and adoption of industry best practices, often reflected in species-based or regional Codes of Practice (CAIA, 2009).

Aquaculture producers, more than any other animal producers, require streamlined and stable access to production inputs (feeds) carefully tailored to different animal species, life stages, production systems, environmental and socio-economical conditions, and consumer demands and expectations.

The Canadian Aquafeed industry: Producing Highly Sophisticated Production Inputs

Global aquaculture feed production has grown at a sustained rate of about 10% per year over the past two decades (Tacon, 2004; Tacon and Metian, 2008). In 2006, total aquaculture feed production has been estimated to be more than 25 million tonnes or 4% of total global animal feed production (Tacon and Metian, 2008). The demand for aquaculture feeds will continue to grow due to the expansion and intensification of production by aquaculture operations around the world (Tacon and Metian, 2008; FAO, 2009).

The federal and many provincial governments in Canada have invested very significant resources in aquaculture nutrition research over the past four decades. Canadian researchers and feed manufacturers have been considered pioneers in the field (Cho et al., 1990; Bureau, 2008). The influence of Canadian aquaculture nutrition

community has greatly exceeded that would have been expected/justified by the small size of the Canadian aquaculture feed industry (Cho et al., 1990; Bureau, 2008).

Seven corporations currently produce aquaculture feeds in Canada, namely Skretting North America, EWOS Canada, Martin Mills, Corey Feed Mills, Northeast Nutrition, Taplow Feeds and Viterro Feed Products. These corporations are operating a total of nine (9) aquaculture feed mills in British Columbia, Ontario, New Brunswick, and Nova Scotia. Canadian aquaculture feed manufacturers are producing an estimated 150,000 to 200,000 tonnes of feed annually (Tacon and Metian, 2008). A non-negligible proportion of this production is exported to the United States, Mexico, and different countries in Asia. Several of these markets represent significant growth opportunities for Canadian aquafeed manufacturers. Canadian aquaculture operations also import small amounts of aquaculture feeds from the United States, Europe and Asia. The volume of feeds imported is small but of crucial importance to some aquaculture operations cultivating some difficult to rear species.

Aquaculture feeds are manufactured using sophisticated equipment and techniques. Aquaculture feed mills are often the most technologically advanced and modern of the entire animal feed sector. Production of aquaculture feeds requires considerable investment. Some degree of specialization occurs amongst feed manufacturers, notably for specialized feeds (larval feeds, starter feeds, broodstock feeds, marine fish feeds, etc.) which require highly sophisticated equipment (e.g. micronizer, marumerizer), proprietary know-how and unusual ingredients (e.g. krill, squid liver meal, artemia, copepods, algae, sterols, etc.). These feeds are extremely costly (\$25 - \$200 per kg) but are required in very small amounts (a few kg) for short periods of time (i.e., from a few hours to a few weeks). Nonetheless, these highly specialized production inputs are crucial for successful commercial production of some fish species. Some highly specialized feeds are made by only one or two manufacturers who supply the entire global market. Limited availability (or non-availability) of certain diets (e.g. larval diets) due to import restrictions caused by current feed regulations have already caused a severe setback in production of some fish species (such as walleye and yellow perch) in Canada.

Feeds Formulated to Widely Different Nutritional Specifications

Aquaculture nutrition and feed formulation are fields that have progressed tremendously since the Feed Acts was enacted and nutrient ranges in Table 4 of Appendix I established. It is estimated that more than 300 research teams are carrying out research on fish and shellfish nutrition worldwide. The body of knowledge on nutrition and feeding of aquaculture species is rapidly expanding. Increasingly sophisticated scientific approaches are used to study nutrient utilization and requirements of aquaculture species and establish nutritional specifications for feeds.

Nutritional specifications are increasingly adapted to different requirements of individual species, life stages, rearing environment and conditions, feed ingredient matrix, aquaculture operation needs, fish processor and consumer demands, and market conditions. Consequently, aquaculture feeds are, and need to be, formulated to a very wide range of nutritional specifications. The variations in nutrient and energy contents of aquaculture feeds within species are considerably greater than what is seen in feeds for other monogastric livestock species (e.g. poultry and swine). The levels of essential amino acids (EAAs), essential fatty acids (EFAs), minerals, and vitamins to which feeds are formulated can vary several-fold within species. Differences exist in the nutritional requirement of fish of the same species at different life stages thereby forcing aquafeed manufacturers to formulate feeds to widely different nutritional specifications for feed intended for different life stages. The digestible energy (DE) content of feeds manufactured for salmonid fish species may vary as much as 60% (e.g. 14 MJ DE/kg to 24 MJ DE/kg). Feeds of different DE contents (or different digestible nutrient densities) will result in different feed intakes, very different feed conversion ratios (FCR, feed:gain) and the need to formulate feed with different DE contents to different nutritional specifications. In this context of wide variations in the nutritional specifications and digestible nutrient composition of feeds, the definition of nutritional guidelines and regulations on the basis of the "mass" of the feed (mg per kg feed) is largely irrational (Bureau and Encarnaç o, 2006).

In January 2009, the National Academies' Board on Agriculture and Natural Resources (BANR) and National Research Council (NRC) appointed a 10-member international expert committee "*to conduct a comprehensive review of the scientific literature and relevant sources of data on fish and shrimp nutrient requirements and feeding considerations, with a particular focus on new information acquired during the past decade*". This writer (D.P. Bureau) is a member of the committee. Results of the review and deliberations of the committee are in the final stages of revision and expected to be published in 2011. One of the major conclusions of the committee is that significant gaps remaining in knowledge of fish and shrimp nutrition and that diet composition, species, life stages, growth rate, environmental conditions and production objectives are all factors that can have very significant impacts on the nutrient requirements of aquaculture species. Given these considerations, it became clear to the committee that nutritional specifications/guidelines are moving targets and very difficult to narrowly and meaningfully define.

In Canada, the very small number of approved therapeutants for aquaculture use creates a strong incentive for aquaculture producers to rely more heavily on nutrients and dietary additives as prophylactics. High doses (doses several times above the current Canadian regulatory levels) of vitamin C, vitamin E, copper, zinc, and several other nutrients and dietary compounds have proven effective in improving the disease or stress resistance and normal development of some fish species cultivated in Canada. Research on these issues is in its infancy and significant progress is expected over the next decades.

Aquaculture feeds are formulated with an increasingly wide selection of ingredients. Up until about 10 years ago, fish meal and fish oil represented about 60% of the weight of most commercial salmon and marine fish species feeds sold in Canada. The price of fish meal (Fair average quality (FAQ) basis 65 percent protein, FOB Peru) has surged from about \$500 per tonne to more than \$1,400/MT over the past decade. The price of fish oil is also roughly 4-fold higher than it was 20 years ago (Tacon and Metian, 2008). The reliance of the aquaculture industry on marine-derived resources has also raised concern among environmentalists regarding the impacts of fish meal and oil

demand on reduction fisheries specifically and marine ecosystems in general (Naylor et al. 2009) or about the levels of environmental contaminants in farm-raised fish (Hites et al. 2004). These issues have created a strong incentive to reduce the reliance on marine-derived resources for aquaculture feed manufacturing. Feed manufacturers have had to progressively decrease fish meal and fish oil levels in their feeds, and correspondingly increase their reliance on suitable alternative feedstuffs of plant, terrestrial animal or microbial origins. The volatility of the commodities market, the economic recession, increasing competition, and slim profit margins have added to the complexity of the situation.

Aquaculture feed manufacturers continuously need to optimize the composition of their feed to further reduce cost, improve productivity, ensure good health of the animal, or better fit market and/or environmental requirements and regulations (contaminant levels, final product appearance, waste output restrictions, etc.). The shifts in fish feed formulation and the growing influence of a diversity of factors increase the importance of having a flexible (adaptable) regulatory framework for aquaculture feeds.

2) Insufficiencies of the Current Regulatory Framework Vis. the Canadian Aquafeed Sector

The Feeds Act sets out the legal framework for the control and regulation of the sale of animal feeds. The Canadian Food Inspection Agency (CFIA) is the lead agency responsible for the regulation of the feed industry in Canada. Table 4 of Schedule I of the Feeds Regulations sets out the minimal/maximal dietary levels of nutrients in animal feeds, as well as accepted deviations from these levels.

From the perspective of aquaculture producers, a number of shortcomings in the current regulations are critically important. The current regulatory framework fails to account for the large variety of species cultivated and their complex life stages, the high variability in digestible nutrient density of feeds and the diversity of feed ingredients

used. The current regulatory framework prevents aquaculture producers from having access to feeds and ingredients suited to specific production challenges. The Canadian aquaculture sector is an extremely small market on a global scale and the feed and additives registration process in Canada is too complex, slow, opaque, uncertain, and onerous for international feed manufacturers and feed additive/supplement manufacturers. This ultimately puts the Canadian aquaculture industry at a great disadvantage globally. The Canadian aquaculture industry lags behind and loses competitiveness viz. that of most other countries.

The current regulatory framework doesn't accommodate the wide diversity of the aquaculture species cultivated in Canada.

Table 4 (SOR/90-730) only covers salmonid fish species. This is historically understandable since salmonid fish production represents the bulk of Canadian aquaculture production. However, it is important to note that the family Salmonidae is comprised of three genus (*Oncorhynchus spp.*, *Salmo spp.*, *Salvelinus spp.*) and more than 12 species or sub-species in Canada alone. These animals grow from an initial weight of about 200 mg at first-feeding to more than 5 kg at harvest. They are grown in a wide variety of environments, from indoor tanks to ponds to marine or freshwater cages/net-pens.

There are numerous additional endogenous or introduced non-salmonid fish species that are cultured (or could potentially be cultured) in Canada and the status of these species in regards to Table 4 is not clear.

Anecdotal evidence suggests that some of the CFIA analysts used to consider that Table 4 should be applicable to feed for all fish species cultured in Canada (example discussed below). It is difficult to rationalize that a list of nutrient specifications (e.g. Table 4 minimum and maximum) can be meaningfully applied to such a wide range of species and life stages cultivated under a wide variety of environmental conditions.

The rule currently applied by the CFIA is that all non salmonid feeds and any salmonid feeds which deviate from Table 4 specifications must be registered. The CFIA has the discretionary power to award registration for products. Product registration is generally awarded for specific ingredient formulation rather than specific nutritional and/or chemical specifications. The scientific basis of the decisions made by CFIA analysts is often unclear. CFIA often has extremely rigid expectations in terms of nutritional specifications and requires renewal of registration for nominal changes in nutritional specifications or ingredient compositions. However, the agency does not have the scientific and technical expertise necessary to assess the nutritional adequacy and suitability of different formulations for a wide variety of aquatic species.

The CFIA has informed some feed manufacturers of an unilateral decision that only six (6) non-salmonid fish (species?), namely catfish, cod, haddock, halibut, striped bass and tilapia, can be indicated on product labels due to the lack of information on the nutrient requirements for other species. The CFIA appears to treat many different species as one single species, simply based on colloquial name. The CFIA appear to overlook the fact that the name "catfish" is used for thousands of species from more than 38 families on which with probably more than 50 species cultivated on a commercial basis around the world. The same can be said for "tilapia" which is a name used for nearly a hundred species of cichlid fish from the tilapiine cichlid tribe, on which about eight (8) species (and over one hundred strains) are cultivated commercially around the world. The name "cod" is the generic name part of the full name of three species of the genus *Gadus* (*Gadus spp.*) as well as the name of a number of other species (e.g black cod, *Anoploma fimbria*). Extremely rigid rules are unilaterally made up by the CFIA based on very simplistic assumptions.

The current regulatory framework does not take into account the critical needs for certain production inputs that are produced by a limited number of manufacturers that serve the global market. The successful commercial production of certain species may hinge on the ability of the use of a very small amount (a few kilograms) of certain highly specialized feeds (e.g. larval diets). Canada is an extremely small market and the existing

registration process for feeds, ingredients and feed additives is too complicated, uncertain, and onerous to be a viable option for manufacturers of these crucially important production inputs. A probing example can be found in the mid-1990's when a Japanese company (Kyowa) producing very successful larval feeds interrupted shipping its feeds to Canada because they exceeded Table 4 maximum concentration for vitamin D. Research in Japan had shown that mega doses of vitamin D were beneficial for the development of freshwater and marine fish larvae. Research in Ontario had shown that these feeds were critically essential for successfully weaning walleye fry from live feeds (zooplankton) to dry diets. Only about 500 kg of the Kyowa feed was required for the production of more than 200,000 walleye by the Ontario Ministry of Natural Resources and a limited number of private fish hatcheries. The interruption of feed supply by the manufacturer negatively affected efforts to establish walleye culture in Ontario, notably because this occurred during a period of significant investment by the Ontario provincial government in this activity. This represented a very significant and long-lasting setback for the development of this sector. There are numerous other examples of outdated or flawed regulations affecting the development of different segments of the aquaculture sector in Canada over the past two decades.

The current regulatory framework doesn't accommodate the need to formulate feeds to different nutritional specifications to accommodate various production challenges

Aquaculture producers have to deal with arguably more numerous production challenges than those faced by terrestrial livestock species producers. They also have to accommodate real or perceived societal issues. These issues mainly relate to animal welfare, environmental impacts, food safety and composition.

Table 4 was created in an era prior to major concern about environmental responsibility and issues related to the feed industry's environmental footprint (IPSFAD, 2007; Leeson, 2010). Nutritional management is considered as the key strategy for managing waste outputs and the potential environmental impacts of aquaculture operations in Canada and elsewhere. Canadian aquaculture researchers have been global

leaders in the development of nutritional strategies to minimize waste outputs and potential environmental impacts. The current regulatory framework prevents aquaculture producers from fully adopting these strategies. For example, the current regulatory levels for phosphorus (P) in salmonid feed according to Table 4 range from a minimum of 1.0% to a maximum of 2.5%. Recent work has suggested that salmonid feeds can be formulated to contain much lower total P levels than what is required by the regulations. Given the environmental issues related to excessive effluent P, it would seem appropriate that the regulations related to feed nutrient levels keep pace with current scientific knowledge (IPSFAD, 2010).

As discussed earlier, the very small number of approved therapeutants for aquaculture use in Canada creates a strong incentive for aquaculture producers to rely more heavily on nutrients and dietary additives as prophylactics. Nutrient supplements (vitamin C, vitamin E, copper, zinc, etc.) that are several times above the current maximum levels set out by Table 4 have proven effective in improving the disease or stress resistance and normal development of some fish species cultivated in Canada. There is a great deal of interest globally in the potential of these "natural" approaches to improve the health and final product quality of different fish species. The registration requirements of the Feeds Regulations do not take into account that in a global context,

Canada represents an extremely small market. Therefore, compliance with burdensome rules for the registration of feeds and feed ingredients in this country is a disincentive for many international corporations. The current registration process is also too slow and fraught with too many uncertainties. There are numerous cases where safe and cost-effective nutritional strategies developed through onerous research and development (R&D) efforts by aquafeed manufacturers cannot be adopted in Canada. Too frequently, the cost of surmounting the regulatory hurdles outweighs the potential benefit of participating in the Canadian market. Thus our aquaculture producers are often denied new and innovative feed solutions that are readily available in foreign jurisdictions.

The situation may become even more complicated since there is apparently a movement by the CFIA and Veterinary Drugs Directorate (VDD) of Health Canada to undertake a preliminary screening process to determine whether a product should be classified as a Veterinary Drug or as a Livestock Feed. Unfortunately, some of these ‘nutraceutical’ solutions (even for essential nutrients) describe above may end up being classified as ‘drugs’ further complicating the process for feed manufacturers to obtain approval. Canadian feed producers will likely simply implement such solutions for their clients without making any such claims – thus losing value in the process.

The current regulatory framework does not take into account the wide variability in digestible nutrient composition of fish feeds. Current regulation is simply based on the "mass" of the feed. For some nutrients, notably mineral, vitamins, essential amino acids and essential fatty acids, "optimal" nutritional specifications can vary several folds. The digestible energy (DE) content of feeds manufactured for the same fish species may vary as much as 60% (e.g. 14 MJ DE/kg to 22 MJ DE/kg for salmonid fish feeds). Feeds of different digestible nutrient compositions will result in different feed intakes and very different feed conversion ratios and generally need to be formulated to different nutritional specifications.

The registration of new or existing feed ingredients under current regulatory framework is tedious and fraught with inconsistencies and uncertainties and affects the competitiveness of Canadian aquafeed manufacturers.

The current regulatory framework makes it very difficult to register new feed ingredients and even to maintain the registration status for standard ingredients which have used for years (e.g. fish meals from Peru and Chile). The current process to register new ingredients or to simply renew registration of existing feed ingredients is tedious, long, costly and uncertain. New parameters unilaterally added into requirements by CFIA analysts (e.g. maximum % moisture permitted for fish meal), previously permitted ingredients are removed, rules are inconsistently applied by CFIA personnel and veterinarians. It is difficult to rationalize the basis of some of the unilateral decisions of

the CFIA. This greatly restricts the ability of feed manufacturers to use new ingredients or secure supplies of some key ingredients (e.g. fish meal, squid liver meal). The current regulatory framework puts Canadian aquafeed manufacturers at a great competitive disadvantage vs. aquafeed manufacturers in other countries with more efficient and flexible regulatory frameworks.

The current current regulatory framework does not adequately protect the public against improper use of medications.

The current registration framework also has numerous shortcomings with regard to the manufacturing of medicated feed. It is a stated goal of the CFIA to gain better control of process and protect public from inappropriate use of medication. However, the current regulatory framework and policies in place accomplish the exact opposite. There are medications available where the veterinarian may request an emergency drug release (EDR) but for which the Veterinary Drugs Directorate (VDD) of Health Canada stipulates that it is not required as it falls under the Extra Label Use provision. Current regulatory framework and policies do not allow feed mills to manufacture the feed without an EDR or the drug having a Drug Identification Number (DIN).

However, aquaculture producers are free to obtain any drug and they are free to mix on site. As a consequence medications are being mixed and used on farm instead of by feed mills where these medications can be mixed under controlled conditions with strict inventory, dosage, and mixing guidelines. CFIA analysts and veterinarians should be able to review regulations and advise on their application so treatments are performed based on the spirit rather than the letter of the law.

The consequences

There are numerous examples where Canada's feed regulatory framework has negatively affected the development of different segments of the aquaculture sector in Canada over the past two decades. As the Canadian aquaculture industry attempts to develop and become more globally competitive by focusing on advanced culture techniques, species diversification, production and societal challenges, the outdated

regulatory framework will hinder its development even more. To remain competitive Canadian aquaculture producers require streamlined and stable access to production inputs (feeds) carefully tailored to different animal species, life stages, production systems, environmental and socio-economical conditions, and consumer demands and expectations. It is abundantly clear that the status quo is untenable and that solution must be sought.

Table 4 and the present feed registration process serve no useful purpose and yet they are tying up a large contingent of human resources both on the part of CFIA and feed companies. There is also evidence that CFIA policies and enforcement actions aimed at protecting the public are sometimes accomplishing the exact opposite. These outdated processes must be eliminated and replaced by more efficient and fair regulations and processes that have reasonable flexibility while accomplishing the public safety goals.

3) Proposals to Modernize the Canadian Regulatory System

In the paper prepared for ANAC, Dr. Leeson discusses a number of options for regulatory change from the perspective of the "terrestrial livestock species". From an aquafeed perspective, most of Dr. Leeson's observations represent excellent steps in the right direction. However, there are many more challenges and specificities associated with the production of aquaculture species. The aquafeed industry may require a different set (or at least an additional set) of proposed solutions that adequately address the specificities of aquaculture species.

It has long been clear to Canadian feed industry participants and observers that the status quo is unsustainable for regulation of the industry. Similarly, Canadian aquaculture producers require streamlined and stable access to production inputs (feeds) carefully tailored to different animal species, life stages, production systems,

environmental and socio-economical conditions, and consumer demands and expectations. The current regulatory framework clearly doesn't allow this.

The limitations contained in Table 4 of the current regulations do not simply apply to minimal levels but also to maximum levels. Setting maximum levels are incompatible for the production of certain feeds. Some aquaculture feeds are of very high nutrient densities. These feeds support very high growth rates and very good (low) FCR (feed:gain, e.g. FCR less than 0.8!). These feeds need to be formulated to very high digestible nutrient levels due to the fact that fish only need to consume small amount of these feeds. Establishing upper levels also affect the potential of aquaculture producers of resorting to "nutraceutical" strategies to deal with health issues. As briefly discussed earlier, megadoses of vitamins and minerals during certain life stages of certain species and under certain conditions may be highly beneficial.

The wide variety of species, life stages, production environments and production challenges makes definition of "safe" upper levels of nutrients very difficult for aquaculture species. The field of aquaculture nutrition is evolving rapidly and new discoveries, guidelines and nutritional strategies are developed every year for the great variety of species and life stages cultured. The development of meaningful guidelines on a regular basis is far beyond the capacity of the CFIA and the aquaculture nutrition research community in Canada.

As is the case for the terrestrial animal feed industry, performance-based regulation (incorporating recognized feed safety programs coupled with appropriate federal oversight) is by far the most desirable solution for the aquaculture sector in Canada. Such a system of regulation would place emphasis on commitment and adherence to established standards at the feed mills, fast track new ingredient registration where food and animal safety is an obvious non-issue and provide greater transparency through modern systems (Leeson, 2010).

The Canadian aquaculture and aquafeed sectors have already undertaken numerous voluntary actions to transparently account for their social, economic and environmental effects. At the national level through CAIA and more recently through the Canadian Aquafeed Working Group (CAWG), and regionally through the provincial industry associations, there has been continuous review and adoption of industry best practices, often reflected in species-based or regional Codes of Practice (CAIA, 2009). The last 10 years has seen an increase in the use of independent third party certification programs as a means for aquaculture and aquafeed sectors to objectively demonstrate their commitment and adherence to established standards. Increasingly, many larger retailers and foodservice companies are establishing standards and certification requirements surrounding the sustainability and environmental agenda and this is proving to be a very powerful driving force for stringent self-regulation processes (CAIA, 2009).

As highlighted in Dr. Leeson's paper, the production of “genuine, wholesome and safe” feed is primarily the responsibility of the feed business, with compliance controlled and monitored by the various competent government authorities. This type of approach is gaining wide acceptance globally under the leadership of the European Union (EU). There is strong incentive world-wide for new and more effective forms of regulation based on adherence to recognized food and feed safety systems such as HACCP, coupled with government oversight. There is wide acceptance that the feed industry must now support and be partially responsible for governance and monitoring of feed and food safety. A reduced administrative burden is balanced with greater accountability on the part of manufacturers for the content of feed, so as to make available more informed choices for their customers.

References

Bureau, D.P. 2008. A brief history of fish culture, feed development, and fish nutrition research in Ontario, Canada. Summer Symposium on Nutrition and Feed Technology for Aquaculture, Xiamen (15 June 2008) and Guangzhou (16 June 2008), P.R. China. & National Renderers Association – International Aquaculture Seminars, Jakarta, Indonesia (18 June 2008) and Ho Chi Minh Vietnam (20 June 2008). Available at <http://fishnutrition.uoguelph.ca>

Bureau, D.P. and K. Hua. 2010. Towards effective nutritional management of waste outputs in aquaculture, with particular reference to salmonid aquaculture operations. *Aquaculture Research*, 41: 777-792.

Bureau, D.P. and P. M. Encarnação. 2006. Adequately determining the amino acid requirements of fish: the case example of lysine. In : Cruz-Suarez, L.E., D. Ricque-Marie, M. Tapia-Salazar, M.G. Nieto-Lopez, D.A. Villareal Cavazos, A.C. Puello Cruz, and A. Garcia-Ortega (Eds.) *Avances en Nutricion Acuicola VIII. VIII Simposium Internacional de Nutricion Acuicola*. 15-17 November 2006. Mazatlan, Sinaloa, Mexico. Universidad Autonoma de Nuevo Leon, Monterrey, Nuevo Leon, Mexico. ISBN 970-694-333-5.

Canadian Aquaculture Industry Alliance (CAIA) and Global Trust Certification. 2009. *Global Market Report on Aquaculture Standards and Certification*. November 2009.

Canadian Food Inspection Agency. 1999. *Animal Products Animal Health and Production Summary. Report of Contaminant Results in Fish Feed, Fish Meal and Fish Oil*. <http://www.inspection.gc.ca/english/anima/feebet/dioxe.shtml>.

Canadian Food Inspection Agency. 2009. Chapter 7 - Contaminants in Feed. 7.2 Action Levels for Dioxins, Furans, Dioxin-like PCBs and Total PCBs in Livestock Feed (T-3-109) - Revised: 2009-12-07. RG-1 Regulatory Guidance: Feed Registration Procedures and Labelling Standards.

Available at: <http://www.inspection.gc.ca/english/anima/feebet/regdir/regdire.shtml>

Cho, C. Y., A. J. Castledine, and S. P. Lall. 1990. The status of Canadian aquaculture with emphasis on formulation, quality and production of fish feeds. Pages 67–82 in M. Takeda and T. Watanabe, editors. The current status of fish nutrition in aquaculture. Tokyo University of Fisheries, Tokyo.

Cho, C.Y. and D.P. Bureau. 1997. Reduction of waste output from salmonid aquaculture through feeds and feedings. *The Progressive Fish Culturist* 59:155-160.

Cho, C.Y., J.D. Hynes, K.R. Wood and H.K. Yoshida. 1994. Development of high nutrient-dense, low pollution diets and prediction of aquaculture wastes using biological approaches. *Aquaculture* 124: 293-305.

Easton, M.D.L., Luszniak, D., Von der Geest, E. 2002. Preliminary examination of contaminant loadings in farmed salmon, wild salmon and commercial salmon feed. *Chemosphere* 46:1053-1074.

FAO, 2009. The state of world fisheries and aquaculture 2008. Food and agriculture organization of the United Nations, Rome, 2009. Electronic Publishing Policy and Support Branch. Communication Division. FAO.

Hites R. A., Foran J. A., Carpenter D. O., Hamilton M. C., Knuth B. A., Schwager S. J. 2004. Global assessment of organic contaminants in farmed salmon. *Science* 303 226-226.

Hua, K. and Bureau D.P. 2006. Modelling digestible phosphorus content of salmonid fish feeds. *Aquaculture* 254 455-465.

International Partnership for Sustainable Freshwater Aquaculture Development (IPSFAD). 2007. Towards rational regulations for phosphorus content of Canadian salmonid diets. Final report October 2007.

Leeson, S. 2010. Deficiencies in the Canadian feed regulatory system and the need for performance-based regulation. Unpublished paper, Animal Nutrition Association of Canada, Ottawa, Canada.

Naylor, R.L., Hardy R.W., Bureau D.P., Chiu, A., Elliott M., Farrell A.P. , Forster I, Gatlin D.M., Goldberg R.J., Hua K, Nichols P.D. 2009. Aquaculture in an era of finite resources. Proceedings of the National Academy of Science (PNAS) 106 15103-15110.

National Research Council (NRC), 1993. Nutrient Requirements of Fish, National Academy Press, Washington, DC.

Reid G. K., Liutkus M., Robinson S. M. C., Chopin T. R., Blair T., Lander T., Mullen J., Page F. & Moccia R.D. 2008. A review of the biophysical properties of salmonid faeces: implications for aquaculture waste dispersal models and integrated multi-trophic aquaculture. *Aquaculture Research* 40, 257-273.

Tacon A.G.J. 2004. Estimated major finfish and crustacean aquafeed markets: 2000 to 2003. *International Aquafeed* 7 37-41.

Tacon A.G. and Metian M. 2008. Global overview on the use of fish meal and fish oil in industrially compounded aquafeeds: trends and future prospects. *Aquaculture* 285 146-158