Thursday September 6th – Archibald / Campbell
Aquatic Animal Health Management 1 & 2
Moderator – Kim Klotins (Canadian Food Inspection Agency)

9:30 AM	**Health Management 1**	Klotins - Compartment Recognition Program and Declaration as a Free Area
9:45 AM		Giffin - Country Freedom for a Foreign Animal Disease in Canada
10:00 AM		Klotins - Transboundary Freedom for Shared Waters
10:15 AM		Gautam - A Tool to Facilitate Risk-Based Surveillance Planning of Marine Aquaculture: An Example Using an ISAV Outbreak in Canada and the USA
10:30 AM		**Refreshments**
10:45 AM	**Health Management 2**	Larson - Response to Canada's First Finding of Whirling Disease in Alberta in 2016
11:00 AM		Jung-Schroers - Recommendations for Stunning and Killing of Common Carp (*Cyprinus carpio*) and Rainbow Trout (*Oncorhynchus mykiss*)
11:15 AM		**Cunha - Tilapia and Other Tropical Fish Aquaculture Policy in Brazil: Diseases and Other Constraints**
11:30 AM		Spark - Improving the Likelihood of a Definitive Diagnoses in Fish Kill Investigations
11:45 AM		Blackwell - Risk Assessment for Imported Finfish

Compartment Recognition Program and Declaration as a Free Area

Kim C. Klotins

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The Canadian Food Inspection Agency (CFIA) is the lead for the government of Canada for the development and implementation of the National Aquatic Animal Health Program (NAAHP), a program designed to prevent the introduction and spread of serious aquatic animal diseases. Fisheries and Oceans Canada (DFO) is our partner, delivering diagnostic services and research for the NAAHP under the National Aquatic Animal Health Laboratory System (NAAHLS). In order to prevent spread of enzootic diseases, the CFIA has zoned Canada for diseases that occur regionally. Permits are required to move declared susceptible species and things, such as used fish graders, from infected areas to free areas. As another option to issuance of a permit, the CFIA offers a compartment recognition program that allows a facility to achieve declaration as a free area. This program requires the development and implementation of a preventive control plan that addresses bioexclusion measures described in the national standards for prevention of introduction of disease. The CFIA inspects the plan against the national standards and its implementation by the facility, and conducts sampling for disease freedom and submits the samples for testing by NAAHLS. If the inspections and testing results are satisfactory, then the recognized compartment can apply for a declaration as a free area. Upon acceptance of the conditions for declaration by the facility, including ongoing inspections by the CFIA of at least annually, then the declaration is published on the CFIA's web site: www.inspection.gc.ca. The compartment recognition program also includes the ability to suspend and revoke the declaration.

Conference Session Designation: (Aquatic Animal Health Management)
Presentation Format: (Oral)

Country freedom for a Foreign Animal Disease in Canada

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Canada is in the process of documenting country level freedom for a foreign animal disease, specifically Salmonid Alpha Virus (SAV) in accordance with the World Organization for Animal Health (OIE) Aquatic Animal Health Code section 10.5.4. Several options for declaration of country freedom are available however the option for declaring freedom when the disease status is unknown prior to targeted surveillance (Article 10.5.4.s3) will be examined in more detail.

Declaration of country freedom requires that basic biosecurity conditions have been met and Article 10.5.4.s3 requires that targeted surveillance has been in place for a minimum time period which is outlined in the Aquatic Animal Health Code. This presentation will review Canada's development of a systematic process for evaluation of basic biosecurity conditions, historical and on-going provincial surveillance in order to determine requirements for development of targeted surveillance programs and declaration of freedom. Evaluation methods have included trade statistics review to determine import risk, internal audit of import controls and disease response policies. Both passive and historical surveillance need to be evaluated to determine the need for future targeted surveillance programs.

Conference Session Designation: (Aquatic Animal Health Programs)
Presentation Format: (Oral)

Transboundary Freedom for Shared Waters

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The World Organisation for Animal Health Collaborating Centre for Epidemiology and Risk Assessment of Aquatic Animal Diseases along with the Canadian Excellence Research Chair in Aquatic Epidemiology at the University of Prince Edward Island, and the Canadian Food Inspection Agency in close collaboration with the Veterinary Services section of the Animal and Plant Health Inspection Service in the US Department of Agriculture jointly convened a workshop in May 2017 in Ottawa on transboundary aquatic animal diseases and evaluation of freedom or managing spread of disease across borders. Potential spread via movements of animals or animal products which are regulated by government authorities were not considered during the workshop. For the purpose of evaluating country freedom or prevention of spread across boundaries, participants identified the following required components: a shared approach to evaluating disease-specific information, a shared approach to evaluation of generated aquatic animal health evidence, evaluation of each country's aquatic animal health system, and maintaining trade while managing risks. A more in-depth discussion of the requirements for each component, identified feasibility challenges and next steps will be presented. It was generally agreed that the magnitude of the impact of water and wild aquatic animal movement on aquatic pathogen transfer across borders and the effectiveness of certain surveillance strategies for early detection of cases and for declaration of disease freedom remain areas that can benefit from more research effort.

Conference Session Designation: (Aquatic Animal Health Management)
Presentation Format: (Oral)

A Tool to Facilitate Risk-Based Surveillance Planning of Marine Aquaculture: An Example Using an ISAV Outbreak in Canada and the USA

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In the event of disease incursion or re-occurrence in a farm, selecting susceptible farms to monitor for disease spread becomes a challenge because the extent of coverage for surveillance and control often has to be balanced against available resources. A tool to assess the risk of disease spread between farms can help make informed decision regarding monitoring and surveillance activities, and support the response strategy, given available resources. We developed three models using seaway distance, hydrodynamic information and the two combined to estimate and compare Infectious Salmon Anaemia virus (ISAv) transmission risks from an infected farm site to all other susceptible farm sites. The models were validated using 2002-2004 ISAv outbreak data for 30 farms (24 in New Brunswick, Canada and 6 in Maine, United States). The outbreak data included monthly infection status of the cages, which was used to determine time sequence of infection spread. An infected farm was considered to remain infected in subsequent time intervals during the outbreak until all fish had been harvested. The first infected farm was considered to be the index site, and was used to assess the risk of ISAv spread to all other active susceptible farms. In the second and subsequent outbreak time intervals infected farms were identified using the farm status in the given time period and all infected farms from the previous time periods to assess the risk of ISAv spread. The three models (hydrodynamic only, seaway-distance, and combined hydrodynamic-seaway-distance based models) were used to assess the risk at each outbreak time interval. At each time interval we ranked the susceptible farms by adding the transmission risks from surrounding infected farms and sorting them from highest to lowest. We converted the rankings to percentiles and assessed the models' predictive performance by comparing the farm sites identified as high risk at each level of the observed ranking with those farms that actually became infected during the next time interval. The overall predictive ability of the models was compared using area under the ROC curve (AUC). Farms becoming infected in the next period always remained within the top 50% of the rank predicted by our models. The overall predictive ability of the model that combined hydrodynamic and seaway-distance information (AUC = 0.833) was similar to the model using seaway distance alone (AUC = 0.827). Our results indicate that such models can aid in the efficient allocation of limited resources by suggesting appropriate levels of surveillance coverage (proportion of farms considered for surveillance) based on the desired level of confidence for correctly including farms that could become infected.

Conference Session Designation: (Aquatic Animal Health Management)
Presentation Format: (Oral)

Response to Canada's First Finding of Whirling Disease in Alberta in 2016

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In August 2016, the first detection of *Myxobolus cerebralis (Mc)*, in Canada, was confirmed from fish sampled at Johnson Lake, Banff National Park (BNP) in Alberta. That first finding triggered a series of events and an emergency response involving numerous government partners (Alberta Environment and Parks (AEP), Parks Canada, Canadian Food Inspection Agency (CFIA), Alberta Agriculture and Forestry, and BC Ministry of Agriculture, Forestry and Fish) to determine and prioritize further fish sampling, tissues to be taken and testing facilities (i.e. where to find fish health laboratory capacity for *M. cerebralis* testing in a country where Mc was considered exotic). The aim was to determine the extent of the parasite range in both wild and cultured fish (and therefore traced stockings). BNP quickly implemented lake closure (Johnson Lake) and containment measures, as several important salmonid populations (including threatened west slope cutthroat trout) exist in the park. Interim biosecurity protocols were also quickly devised through AEP to prevent further potential spread of *M. cerebralis* spore stages through fish sampling operations, and an initial risk assessment of salmonid species susceptibility and Alberta salmonid range, based on temperature and gradient profiles, informed that active surveillance plan. A communication plan was developed to provide key messages to stakeholders, the science community and address media enquiries in a timely manner.

I'd like to provide a high level review of what happened in those frenzied few months of sampling/testing quarantined cultured fish before allowing any fall stocking, and selecting wild fish from key watersheds prior to fall freeze-up, so that samples were at least 'in the freezer' to be processed as we apportioned samples to various testing facilities and geared up labs and personnel under AEP to continue in the longer term surveillance. Since its discovery, whirling disease has become a prominent issue in Alberta, prompting the Canadian Food Inspection Agency to zone the province to prevent the spread of this disease to other parts of Canada, and Alberta Environment and Parks to initiate a Whirling Disease Program dedicated to managing the disease through a three-pillared approach built around delineation, education and mitigation. More detailed specifics of results of *Myxobolus cerebralis* testing will be provided by colleagues in other presentations.

Conference Session Designation: (Aquatic Animal Health Management)
Presentation Format: (Oral)

Recommondations for Stunning and Killing of Common Carp (*Cyprinus carpio*) and Rainbow Trout (*Oncorhynchus mykiss*)

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In Germany stunning of animals in general is regulated in a directive and special requirements for stunning of fish are given. For all fish species these regulations prescribe stunning by percussion or electric current. Only for salmonids, additionally stunning by CO_2 exposure in a water bath is authorised. Precise instructions on how these methods should be used are not available. It is known that stunning of special fish species, like common carp, is difficult by using the authorised methods.

In total 24 fish farms throughout Germany were visited and the whole process of stunning and slaughtering was evaluated. Some of these farms were slaughtering carp and trout; others were slaughtering only one of these species. Therefore the process of stunning and killing was documented 22 times in aquaculture farms for trout and 17 times in farms for carp. If possible catching of fish from the ponds was documented. In all farms, keeping fish in special tanks before slaughter and the transport of fish from these tanks to the stunning site was evaluated. Also in all farms stunning and killing of fish was documented.

An evaluation score with 93 points was established which includes all measured parameters and data about the process. Different evaluation factors were multiplied with scores assessing their importance. By combining the scores from different aspects of the harvesting process, an overall evaluation score was calculated. With the overall evaluation score a gradual classification and an assessment of different techniques and methods for stunning and killing of rainbow trout and carp was possible.

Most of the rainbow trout were stunned by electric current, followed by percussion. In two farms trout were stunned by a combination of both and in one farm CO_2 was used for stunning. In contrast, in most of the documented cases carp were stunned by a combination of electric current and percussion. Stunning by percussion was used in 3 cases and stunning by electric current was uses in four cases. Most of the rainbow trout were successfully stunned by all evaluated methods. Only around 60% of carp were successfully stunned by electric current and around 80% of carp were successfully stunned by percussion. Only a combination of both methods was leading to successfully stunned carp. With the collected data it could be shown, that for stunning by electric current, the conductibility of the water, the stunning time and the size and shape of the stunning tank can have an important influence of the success of stunning. Short stunning times of less than 2 minutes and water conductibility lower than 500µS/cm or higher than 1000µS/cm were leading to problems with stunning of especially carp. In conclusion, a combination of stunning by electric current with adequate conductibility and adequate stunning time and by percussion seems to be the best method for stunning of rainbow trout and carp.

Conference Session Designation: (Aquatic Animal Health Management)
Presentation Format: (Oral)

Tilapia and Other Tropical Fish Aquaculture Policy in Brazil: Diseases and Other Constraints

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Tilapia is the most important species in the Brazilian aquaculture whilst production of other tropical species has increased recently. Brazil was included in the group of the top 4 global tilapia producers and the national fish industry is advancing and maturing as a business with an average of 1.2 billion dollars annual revenues. In addition, native tropical fishes, such as Tambaqui (*Colossoma macropomum*), have emerged as a promise of profit due to their unique taste, vegetarian based diet, commercial appeal as Amazon Bay eco-friendly raised animals and also because these species are not considered commodities. Animal health challenges seem not to compromise the results of tropical fish aquaculture in the country. In fact, the industry has still not passed through any severe sanitary crisis. Currently, endemic bacteriological diseases are considered responsible for major losses in tilapia breeding, and parasitic infections are claimed to be the most important health problem for native Brazilian tropical fish husbandry. Biosecurity measures still need to be implemented in most of farms and inland reservoirs. Aquatic animal health awareness among stakeholders should be reinforced and risk perception remains primarily on parasitic diseases and on exotic diseases such as tilapia lake virus. Main constraints beyond diseases are still to be faced, such as political dispute among parties to rule the regulatory agenda of fisheries and aquaculture in Brazil, environmental issues for licensing in some regions of the country, formal organization of stakeholders, fully comprehension of the role of the private sector and public sector in policy making in aquaculture, technological packages to breed native species with competitive advantages, climate changes (harsh droughts, extended raining seasons) and economical approach to assess the implementation of health tools and sustainable husbandry practices. Despite all these matters, the scenario for aquaculture of tropical fish in Brazil is favorable and attracts robust investments of successful national companies in the terrestrial animal protein field and of international industries with large experience in aquaculture overseas.

Conference Session Designation: (Aquatic Animal Health Management)
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Improving the Likelihood of a Definitive Diagnoses in Fish Kill Investigations

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Despite the relatively high aquatic animal health status, in comparison to other Australian and international seafood sectors, South Australia (SA) remains susceptible to the increasing worldwide threat of both significant known and unknown aquatic animal diseases emerging and spreading. Protecting and maintaining this favorable status to secure production is a core role of PIRSA through investigating fish kill and aquatic mortalities, surveillance for high priority diseases, regulation of veterinary medicine use, regulation of livestock translocations and the development and implementation of emergency response plans.

While disease management is core work for PIRSA's aquatic animal health program and consequently the driver to investigate aquaculture mortalities and wild fish kills, broader government priorities, industry and community expectation requires other causes of fish kills to be determined, including: human health risks, chemical spills (including oil) and other anthropogenic causes that may have compromised the marine environment. For this reason, and in the face of limited resources, fish kill investigations are approached as a whole of government joint effort.

PIRSA investigate approximately 15-20 fish kill reports annually, with the large majority being attributed to environmental and / or anthropogenic causes. In recent years, a number of fish kills caused substantial media and public concern. As a direct result there was a need to develop and implement greater training for regional staff to improve the likelihood of definitive diagnoses. Although failure to reach a definitive diagnosis is not uncommon in fish kill investigations improvements in both site assessment and sample collection and submission were recognized as key focus areas. In South Australia mortality sites may be more than 1200km (or 750 miles) from both the laboratory and key aquatic animal health staff hence reliance on appropriately trained and equipped regional staff is essential.

A collaborative approach to the provision of investigation kits and the development and delivery of fish kill training was implemented between PIRSA Biosecurity SA and PIRSA Fisheries and Aquaculture Divisions. This training has begun and will be completed in 2018 with ongoing annual training proposed. The training involves a significant practical (fish dissection) component in order to preserve appropriate samples to avoid unnecessary delays in fixation to ensure both water and tissue samples are of diagnostic quality. This presentation will include a summary of the state fish kill database and key case studies as examples.

Conference Session Designation: (Aquatic Animal Health Management)
Presentation Format: (Oral)

Risk Assessment for Imported Finfish

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New Zealand is situated at Latitude 40º S and is remote, being over 1500 km from its nearest neighbour Australia and separated by deep ocean (depths greater than 1500 m). Our isolation and active biosecurity measures has meant New Zealand remains free of most OIE listed and other emerging and re-emerging finfish diseases such as Infectious haematopoietic necrosis virus (IHNV) and Infectious salmon anaemia virus (ISAV).

New Zealand's salmonid aquaculture is largely focused on chinook salmon (*Oncorhynchus tshawytscha*) while brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*) support significant recreational trout fisheries with a substantial tourist component. These salmonids derive from broodstock introduced in 1911.

Fish and fish products are highly traded commodities, where 38% of the total global production was traded internationally in 2012. Total production in 2017 represented a 2.3% increase from 2016, when 83.6 million tonnes were produced from aquaculture and 90.4 million tonnes produced from capture fisheries. As captured fish are used for aquaculture feed, aquaculture actually represents 55% of total production for human consumption (FAO 2018).

Global trade can bring with it a significant risk of new disease introduction. To address the challenges around increasing risk of international trade, the Ministry for Primary Industries is currently reviewing the import health standards for all aquatic commodities. Risk assessments have now been completed by for non-viable crustacean imports and for eviscerated or trunked finfish, while a review of mollusc products is planned for 2018.

The 2018 risk assessment for non-viable eviscerated/trunked finfish identified 569 potential hazard organisms. Of these, 40 exotic pathogens were identified as risks (including 19 viruses, 12 bacteria, 4 fungi/microsporidia, and 5 metazoan pathogens) that required mitigation measures.

Simple evisceration was considered sufficient mitigation for most fish diseases prior to 2016, but the OIE has now recognised that additional processing and handling measures including freezing or cooking, may be necessary (Oidtmann *et al.* 2017). Possible risk mitigation options for finfish include further processing, temperature or freezing. As active monitoring is rarely undertaken for non-OIE listed diseases, country freedom was not considered a viable management option for non-OIE listed disease organisms.

The introduction of additional measures based on risk assessments as appropriate will strongly mitigate against the introduction of exotic aquatic diseases into New Zealand.

Conference Session Designation: (Aquatic Epidemiology)
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