



OCT 12 2012

The Honorable John D. Rockefeller, IV
Chairman, Committee on Commerce, Science,
and Transportation
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

We are pleased to transmit a report from the National Aquatic Animal Health Task Force (Task Force) on infectious salmon anemia virus (ISAV), as requested by Congress in the conference report accompanying the Consolidated and Further Continuing Appropriations Act of 2012.

In accordance with the request, this report examines the risk ISAV poses to wild Pacific salmon and the coastal economies that rely on these fish. It also establishes research objectives for further study, which were created in partnership with the Government of Canada and our Federal, state, local, and tribal partners.

The Task Force that developed this report is comprised of subject matter experts and senior leaders from the three Federal agencies that share responsibility to protect the health of U.S. aquatic animals: the Department of Agriculture, Animal and Plant Health Inspection Service (APHIS); the Department of Commerce, National Oceanic and Atmospheric Administration; and the Department of the Interior, U.S. Fish and Wildlife Service.

Should you or your staff have any questions about this report, you may contact Mr. Brian Baenig, Assistant Secretary for Congressional Relations, Department of Agriculture, at (202) 720-7095.

Similar letters and a copy of the report are being sent to Senators Cochran, Hutchison, and Inouye, and Representatives Hastings, Markey, Rogers, and Dicks.

Sincerely,

Ken Salazar
Secretary
Department of the Interior

Thomas J. Vilsack
Secretary
Department of Agriculture

Rebecca M. Blank
Acting Secretary
Department of Commerce

Enclosure



OCT 12 2012

The Honorable Kay Bailey Hutchison
Ranking Member, Committee on Commerce, Science,
and Transportation
United States Senate
Washington, D.C. 20510

Dear Senator Hutchison:

We are pleased to transmit a report from the National Aquatic Animal Health Task Force (Task Force) on infectious salmon anemia virus (ISAV), as requested by Congress in the conference report accompanying the Consolidated and Further Continuing Appropriations Act of 2012.

In accordance with the request, this report examines the risk ISAV poses to wild Pacific salmon and the coastal economies that rely on these fish. It also establishes research objectives for further study, which were created in partnership with the Government of Canada and our Federal, state, local, and tribal partners.

The Task Force that developed this report is comprised of subject matter experts and senior leaders from the three Federal agencies that share responsibility to protect the health of U.S. aquatic animals: the Department of Agriculture, Animal and Plant Health Inspection Service (APHIS); the Department of Commerce, National Oceanic and Atmospheric Administration; and the Department of the Interior, U.S. Fish and Wildlife Service.

Should you or your staff have any questions about this report, you may contact Mr. Brian Baenig, Assistant Secretary for Congressional Relations, Department of Agriculture, at (202) 720-7095.

Similar letters and a copy of the report are being sent to Senators Rockefeller, Cochran, and Inouye, and Representatives Hastings, Markey, Rogers, and Dicks.

Sincerely,

Ken Salazar
Secretary
Department of the Interior

Thomas J. Vilsack
Secretary
Department of Agriculture

Rebecca M. Blank
Acting Secretary
Department of Commerce

Enclosure



OCT 12 2012

The Honorable Daniel K. Inouye
Chairman, Committee on Appropriations
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

We are pleased to transmit a report from the National Aquatic Animal Health Task Force (Task Force) on infectious salmon anemia virus (ISAV), as requested by Congress in the conference report accompanying the Consolidated and Further Continuing Appropriations Act of 2012.

In accordance with the request, this report examines the risk ISAV poses to wild Pacific salmon and the coastal economies that rely on these fish. It also establishes research objectives for further study, which were created in partnership with the Government of Canada and our Federal, state, local, and tribal partners.

The Task Force that developed this report is comprised of subject matter experts and senior leaders from the three Federal agencies that share responsibility to protect the health of U.S. aquatic animals: the Department of Agriculture, Animal and Plant Health Inspection Service (APHIS); the Department of Commerce, National Oceanic and Atmospheric Administration; and the Department of the Interior, U.S. Fish and Wildlife Service.

Should you or your staff have any questions about this report, you may contact Mr. Brian Baenig, Assistant Secretary for Congressional Relations, Department of Agriculture, at (202) 720-7095.

Similar letters and a copy of the report are being sent to Senators Rockefeller, Hutchison, and Cochran, and Representatives Hastings, Markey, Rogers, and Dicks.

Sincerely,

Ken Salazar
Secretary
Department of the Interior

Thomas J. Vilsack
Secretary
Department of Agriculture

Rebecca M. Blank
Acting Secretary
Department of Commerce

Enclosure



OCT 12 2012

The Honorable Thad Cochran
Vice Chairman, Committee on Appropriations
United States Senate
Washington, D.C. 20510-2402

Dear Mr. Vice Chairman:

We are pleased to transmit a report from the National Aquatic Animal Health Task Force (Task Force) on infectious salmon anemia virus (ISAV), as requested by Congress in the conference report accompanying the Consolidated and Further Continuing Appropriations Act of 2012.

In accordance with the request, this report examines the risk ISAV poses to wild Pacific salmon and the coastal economies that rely on these fish. It also establishes research objectives for further study, which were created in partnership with the Government of Canada and our Federal, state, local, and tribal partners.

The Task Force that developed this report is comprised of subject matter experts and senior leaders from the three Federal agencies that share responsibility to protect the health of U.S. aquatic animals: the Department of Agriculture, Animal and Plant Health Inspection Service (APHIS); the Department of Commerce, National Oceanic and Atmospheric Administration; and the Department of the Interior, U.S. Fish and Wildlife Service.

Should you or your staff have any questions about this report, you may contact Mr. Brian Baenig, Assistant Secretary for Congressional Relations, Department of Agriculture, at (202) 720-7095.

Similar letters and a copy of the report are being sent to Senators Rockefeller, Hutchison, and Inouye, and Representatives Hastings, Markey, Rogers, and Dicks.

Sincerely,

Ken Salazar
Secretary
Department of the Interior

Thomas J. Vilsack
Secretary
Department of Agriculture

Rebecca M. Blank
Acting Secretary
Department of Commerce

Enclosure



OCT 12 2012

The Honorable Doc Hastings
Chairman, Committee on Natural Resources
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

We are pleased to transmit a report from the National Aquatic Animal Health Task Force (Task Force) on infectious salmon anemia virus (ISAV), as requested by Congress in the conference report accompanying the Consolidated and Further Continuing Appropriations Act of 2012.

In accordance with the request, this report examines the risk ISAV poses to wild Pacific salmon and the coastal economies that rely on these fish. It also establishes research objectives for further study, which were created in partnership with the Government of Canada and our Federal, state, local, and tribal partners.

The Task Force that developed this report is comprised of subject matter experts and senior leaders from the three Federal agencies that share responsibility to protect the health of U.S. aquatic animals: the Department of Agriculture, Animal and Plant Health Inspection Service (APHIS); the Department of Commerce, National Oceanic and Atmospheric Administration; and the Department of the Interior, U.S. Fish and Wildlife Service.

Should you or your staff have any questions about this report, you may contact Mr. Brian Baenig, Assistant Secretary for Congressional Relations, Department of Agriculture, at (202) 720-7095.

Similar letters and a copy of the report are being sent to Senators Rockefeller, Hutchison, Cochran, and Inouye, and Representatives Rogers, Markey, and Dicks.

Sincerely,

Ken Salazar
Secretary
Department of the Interior

Thomas J. Vilsack
Secretary
Department of Agriculture

Rebecca M. Blank
Acting Secretary
Department of Commerce

Enclosure



OCT 12 2012

The Honorable Edward J. Markey
Ranking Member, Committee on Natural Resources
U.S. House of Representatives
Washington, D.C. 20515

Dear Representative Markey:

We are pleased to transmit a report from the National Aquatic Animal Health Task Force (Task Force) on infectious salmon anemia virus (ISAV), as requested by Congress in the conference report accompanying the Consolidated and Further Continuing Appropriations Act of 2012.

In accordance with the request, this report examines the risk ISAV poses to wild Pacific salmon and the coastal economies that rely on these fish. It also establishes research objectives for further study, which were created in partnership with the Government of Canada and our Federal, state, local, and tribal partners.

The Task Force that developed this report is comprised of subject matter experts and senior leaders from the three Federal agencies that share responsibility to protect the health of U.S. aquatic animals: the Department of Agriculture, Animal and Plant Health Inspection Service (APHIS); the Department of Commerce, National Oceanic and Atmospheric Administration; and the Department of the Interior, U.S. Fish and Wildlife Service.

Should you or your staff have any questions about this report, you may contact Mr. Brian Baenig, Assistant Secretary for Congressional Relations, Department of Agriculture, at (202) 720-7095.

Similar letters and a copy of the report are being sent to Senators Rockefeller, Hutchison, Cochran, and Inouye, and Representatives Hastings, Rogers, and Dicks.

Sincerely,

Ken Salazar
Secretary
Department of the Interior

Thomas J. Vilsack
Secretary
Department of Agriculture

Rebecca M. Blank
Acting Secretary
Department of Commerce

Enclosure



OCT 12 2012

The Honorable Harold Rogers
Chairman, Committee on Appropriations
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

We are pleased to transmit a report from the National Aquatic Animal Health Task Force (Task Force) on infectious salmon anemia virus (ISAV), as requested by Congress in the conference report accompanying the Consolidated and Further Continuing Appropriations Act of 2012.

In accordance with the request, this report examines the risk ISAV poses to wild Pacific salmon and the coastal economies that rely on these fish. It also establishes research objectives for further study, which were created in partnership with the Government of Canada and our Federal, state, local, and tribal partners.

The Task Force that developed this report is comprised of subject matter experts and senior leaders from the three Federal agencies that share responsibility to protect the health of U.S. aquatic animals: the Department of Agriculture, Animal and Plant Health Inspection Service (APHIS); the Department of Commerce, National Oceanic and Atmospheric Administration; and the Department of the Interior, U.S. Fish and Wildlife Service.

Should you or your staff have any questions about this report, you may contact Mr. Brian Baenig, Assistant Secretary for Congressional Relations, Department of Agriculture, at (202) 720-7095.

Similar letters and a copy of the report are being sent to Senators Rockefeller, Hutchison, Cochran, and Inouye, and Representatives Hastings, Markey, and Dicks.

Sincerely,

Ken Salazar
Secretary
Department of the Interior

Thomas J. Vilsack
Secretary
Department of Agriculture

Rebecca M. Blank
Acting Secretary
Department of Commerce

Enclosure



OCT 17 2012

The Honorable Norman D. Dicks
Ranking Member, Committee on Appropriations
U.S. House of Representatives
Washington, D.C. 20515

Dear Representative Dicks:

We are pleased to transmit a report from the National Aquatic Animal Health Task Force (Task Force) on infectious salmon anemia virus (ISAV), as requested by Congress in the conference report accompanying the Consolidated and Further Continuing Appropriations Act of 2012.

In accordance with the request, this report examines the risk ISAV poses to wild Pacific salmon and the coastal economies that rely on these fish. It also establishes research objectives for further study, which were created in partnership with the Government of Canada and our Federal, state, local, and tribal partners.

The Task Force that developed this report is comprised of subject matter experts and senior leaders from the three Federal agencies that share responsibility to protect the health of U.S. aquatic animals: the Department of Agriculture, Animal and Plant Health Inspection Service (APHIS); the Department of Commerce, National Oceanic and Atmospheric Administration; and the Department of the Interior, U.S. Fish and Wildlife Service.

Should you or your staff have any questions about this report, you may contact Mr. Brian Baenig, Assistant Secretary for Congressional Relations, Department of Agriculture, at (202) 720-7095.

Similar letters and a copy of the report are being sent to Senators Rockefeller, Hutchison, Cochran, and Inouye, and Representatives Hastings, Rogers, and Markey.

Sincerely,

Ken Salazar
Secretary
Department of the Interior

Thomas J. Vilsack
Secretary
Department of Agriculture

Rebecca M. Blank
Acting Secretary
Department of Commerce

Enclosure

REPORT TO 112th CONGRESS of the United States

Committee on Commerce, Science and Transportation of the Senate Committee on Natural Resources of the House of Representatives

Prepared by the National Aquatic Animal Health Task Force

July 23, 2012

Executive Summary

Background

In October 2011, university researchers from British Columbia, Canada, reported finding a geographically new and potentially harmful fish virus called infectious salmon anemia virus (ISAV) in wild salmon from British Columbia. If confirmed, this would be the first report of ISAV from the Pacific Northwest and also from wild Pacific salmon. Canadian officials with the Canadian Food Inspection Agency (CFIA) quickly responded to further investigate these claims and contacted U.S. officials that are part of the National Aquatic Animal Health Task Force (Task Force). The Task Force is comprised of subject matter experts and senior leaders from the three Federal agencies that share responsibility to protect the health of U.S. aquatic animals: the Department of Agriculture, Animal and Plant Health Inspection Service (APHIS); the Department of Commerce, National Oceanic and Atmospheric Administration, (NOAA); and the Department of the Interior, Fish and Wildlife Service (FWS).

If ISAV were found on the Pacific Coast of North America, it would be the first isolation from wild Pacific salmon and also in the Pacific Northwest. ISAV has caused devastating losses in Atlantic salmon farming operations in Norway, eastern Canada, Maine, Chile, and other locations where Atlantic salmon is farmed.

In response to concerns about ISAV in the Pacific Northwest, report language was included in the conference report accompanying the Consolidated and Further Continuing Appropriations Act, 2012, which asked the Task Force to submit a report that assesses the risk infectious salmon anemia (ISA) poses to wild Pacific salmon and the coastal economies that rely on them. Further, Congress asked that the Task Force establish research objectives that assess 10 specific points. This report is submitted by the Task Force in response to that request.

Summary of Findings

Canada could not confirm the ISA detections in British Columbia using internationally recognized laboratory methods. No widespread die-offs of fish, either wild or farmed, have been observed. Although other species have been shown to carry the virus, clinical disease has been seen only in farmed Atlantic salmon. Research has shown that Pacific salmonid species are relatively resistant to ISAV.

Despite the fact that the detections were not confirmed, the suspect positive results warrant additional surveillance and research. It is possible that a novel virus similar to ISAV is generating positive test results even though it may not cause clinical illness in fish.

In collaboration with States, Tribes, and the government of Canada, the Task Force has developed an enhanced surveillance plan, including appropriate screening tests, for ISAV in the Pacific Northwest. The proposed strategy builds on existing State, Tribal, Federal, and industry health infrastructures and activities whenever possible. The plan focuses on the States of Washington and Alaska due to their close proximity to British Columbia, the location of recent suspect ISAV findings. Future investigations in Oregon, California, and Idaho may be recommended depending on the results of this initial surveillance activity. Briefly, the strategy involves geographically distributed biannual sampling of Pacific salmonids native to the Pacific Northwest for 2 years, as well as enhanced sampling of commercial Atlantic salmon and rainbow trout.

Part I. Assessing the Risk to Wild Pacific Salmon and Coastal Economies

Background on the Disease

Infectious salmon anemia (ISA) is a disease of farmed salmon caused by a virus of the same name (ISAV). Disease outbreaks caused by this virus have occurred historically in Maine, New Brunswick, Canada, Chile, Norway, and other European countries. These outbreaks have resulted in severe mortality to farmed Atlantic salmon (*Salmo salar*) in these regions, and economic impacts have been significant to the aquaculture industries where outbreaks occurred. ISA outbreaks have not been documented in any wild fish populations anywhere in the world. ISA virus is not a human health concern.

Detections in British Columbia

On October 17, 2011, Professor Rick Routledge from Simon Fraser University in British Columbia, Canada, announced results from a long-term sampling effort of wild Pacific juvenile sockeye salmon (*Oncorhynchus nerka*) on the British Columbia central coast (marine waters) as part of an investigation of fluctuating returns of sockeye salmon adults to the Fraser River watershed. Two out of 48 sockeye salmon juvenile collected during the summer of 2011 and submitted for pathogen testing were positive for ISAV using a real-time (quantitative) polymerase chain reaction (PCR) test. The testing was conducted at the Atlantic Veterinary College in Prince Edward Island, Canada, by Dr. Fred Kibenge. PCR is a DNA-based molecular laboratory technique that in this case looks for a virus-specific RNA gene sequence. An additional finding in adult Coho salmon (*O. kisutch*) was reported on October 28, 2011. The PCR tests identified a European strain of ISAV.

The specific quantitative PCR protocol used to identify ISAV in these detections is not a validated¹ diagnostic test for ISAV testing. To confirm a case of ISAV, the World Organization for Animal Health (OIE) requires multiple lines of evidence that can include a combination of clinical signs consistent with the disease and/or multiple approved diagnostic tests. The sockeye salmon sampled were positive by one diagnostic test using a non-validated protocol.

CFIA, as the competent authority, has conducted a follow-up investigation into the ISAV detections. CFIA tested the diagnostic samples that were submitted to Atlantic Veterinary College and obtained additional salmon from Simon Fraser University and the college. CFIA tested the samples using a PCR diagnostic test that differs from the one used by the college but that has been validated by the Canadian National Reference Laboratory to screen for ISAV. CFIA was unable to confirm the presence of ISAV per the OIE definition and therefore has not reported this suspect case to the OIE.

¹ The term *validated* refers to evaluating a diagnostic test for fitness for purpose (in this case, how well the diagnostic technique can identify the virus in a wild fish), and the rate of false positive and false negative results. Guidance on how to validate a diagnostic test for fitness for purpose is provided by the OIE (http://www.oie.int/fileadmin/Home/eng/Health_standards/aahm/2010/2.3.05_ISA%a20.pdf).

Potential Impact of ISA

If ISAV were found to be present on the Pacific coast of North America, it would be of concern due to the potential impact on farmed and wild salmonids, especially because of ISA's high mortality rate in farmed Atlantic salmon. ISAV is a member of the *Orthomyxoviridae* family of viruses, which includes the influenza viruses. Therefore, we cannot rule out the possibility that the virus could evolve or mutate into a form capable of infecting and potentially causing disease in Pacific salmon. However, both Atlantic and Pacific salmon are farmed in Chile, and ISAV has caused disease only in the Atlantic salmon. These findings indicate that if ISA were to emerge on the Pacific coast of North America, it would most likely emerge in farmed Atlantic salmon rather than Pacific salmon, wild or farmed. A nonpathogenic form/strain of ISAV has also been documented. This nonpathogenic form cannot be grown in cell culture and would likely not be detected by standard viral screening tests that rely on this technique.

It is important to stress that, as of the date of this report, there has been no indication, clinical evidence, disease, mortality, or signs of ISA on the Pacific coast, including Canada or the United States. Further, while some Canadian scientists have reported tests that indicate the presence of ISAV, there has been no actual isolation of the ISA virus nor has CFIA (the official competent animal health authority for Canada) been able to confirm these suspect findings as actually being ISAV. There remains the possibility that these isolations are a new or avirulent strain of ISAV, or a novel virus similar to ISAV, that is previously unknown or undetected in the Pacific Northwest. While ISA disease events have occurred in other parts of the world in farmed Atlantic salmon, there is no evidence of an ISA disease outbreak ever occurring in wild populations of salmon, including Atlantic salmon or in other, non-salmonid fish species.

The National Aquatic Animal Health Task Force

The Federal Departments of Agriculture (APHIS), Commerce (National Marine Fisheries Service, or NMFS), and Interior (FWS) comprise the National Aquatic Animal Health Task Force (Task Force). All three agencies share roles and responsibilities regarding farmed and wild aquatic animals, particularly when issues cross State and international boundaries. The agencies serve an important role in coordinating communication and response among States and Tribes. Should ISA emerge in the Pacific Northwest, it is within a State's or Tribe's jurisdiction working with its co-managers to determine how to address the issue. However, should the issue escalate to where the three Federal agencies feel an animal health emergency has arisen, or at the request of a State or Tribe, the three agencies can act under various authorities. The authorities are summarized here and can be found in more detail in the memorandum of understanding (MOU) between the three Agencies regarding collaboration on aquatic animal health (Appendix 1).

APHIS has authority for farm-raised aquatic animals, as well as animals that have the potential to impact farm-raised animals. NOAA's NMFS has authority for wild marine species of aquatic animals. FWS has authority for wild freshwater aquatic species that are not in the jurisdiction of

a State, such as fish listed by the Endangered Species Act. Both NMFS and FWS have authority for fish that spend part of their life cycle in fresh water and part of their life cycle in salt water.

APHIS' authority can be invoked to require the depopulation and disposal of animals infected with a disease of regulatory significance, i.e., diseases listed as reportable to the World Organization for Animal Health or foreign animal diseases (FAD). For example, at the request of the State of Maine, APHIS became involved in the control and management of ISA. APHIS accessed \$8.6 million in Commodity Credit Corporation funds after declaring an animal health emergency when ISA emerged in farmed salmon in Maine. Funds covered the development of an ISA control program, depopulation, disposal, and indemnification. Clinical disease of ISA has not been detected in Maine since 2006, and APHIS maintains an ongoing surveillance program for the disease in cooperation with the State and industry.

NMFS has authority for managing living marine organisms and their habitats in the United States. Authority for activities related to infectious disease control is contained within the Lacey Act (16 U.S.C. 3371-3378) and the Endangered Species Act (16 U.S.C. 1531 et seq.). The authority for infectious disease control in Federal marine waters is documented in the Magnuson-Stevens Fishery Conservation and Management Act and is being used to write aquaculture disease regulations for permits that may be issued under the Gulf of Mexico Fishery Management Plan for Offshore Aquaculture. NMFS collaborates with APHIS and other Federal agencies in investigation, coordination, and implementation of infectious disease control programs. Via an MOU with APHIS, the NMFS Seafood Inspection Program has responsibilities for the issuance of human and animal health certificates for the export of seafood and seafood products to the European Union.

The FWS has the authority for infectious diseases under the Lacey Act and Title 50 (title 50, Code of Federal Regulations, section 16.13). FWS has additional regulatory authority in the areas of fish and wildlife. The Fish and Wildlife Act of 1956 (16 U.S.C. 742f) requires the Department of the Interior (DOI) to take steps "required for the development, advancement, management, conservation, and protection of fishery resources." In addition, the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), the Wildlife Coordination Act (16 U.S.C. 661-666c), and the Anadromous Fish Conservation Act (16 U.S.C. 757a-757g) each authorize DOI to initiate cooperative agreements with stakeholders, protecting fishery resources.

Part II. Research and Surveillance

Congress has charged the Task Force to establish ISA research objectives, in collaboration with the Government of Canada, and Federal, State, and Tribal governments, including the Department of Fish and Wildlife of Washington and the Department of Fish and Game of Alaska to assess 10 specific points. To that end, the Task Force convened sub-groups to develop a surveillance plan and to set research priorities to assess the topics as directed by Congress. Our responses to the specific points follow.

- (1) The prevalence of ISA in both wild and aquaculture salmonid populations throughout Alaska, Washington, Oregon, California, and Idaho.

At the time of this report, there are no confirmed reports of ISA disease or the causative virus, ISAV, in the Pacific Northwest. Due to concerns about the possibility of ISAV occurring in Pacific salmon, the Task Force proposes the implementation of a pathogen surveillance plan that would indicate if the disease ISA and/or the pathogen that causes ISA, ISAV, is present in the waters of the Pacific Northwest. ISA experts from the member agencies of the Task Force have proposed focusing this search on Washington and Alaska. These States are proximate to British Columbia; thus, ISAV would likely be found in these areas if it is present in Canada.

The Task Force reviewed historic pathogen surveillance information from Alaska and Washington.

- (2) Genetic susceptibility by population and species.

Much research has been conducted on ISA since it first emerged in Norway in 1983. Findings are summarized below.

- The presence of virus does not equate to the clinical disease caused by the virus.
- Atlantic salmon are the natural host species for the virus. The virus actively replicates in farmed Atlantic salmon. Clinical signs, when present, can include anemia, swelling, and hemorrhaging of the kidney and spleen, and ascites fluid in the peritoneal cavity. The disease has caused up to 100-percent mortality in challenge trials.
- Wild Atlantic salmon (Nylund et al., 1995), brown trout (Nylund et al., 1994; Nylund et al., 1995; Rolland et al., 1998; Snow et al., 2001); and rainbow trout (Nylund et al., 1997; Snow et al., 2001) are more resistant to ISAV infection than their farmed counterparts, based on controlled challenge studies and detection of virus in wild fish in the absence of disease (Nylund et al., 2003). In general, wild fish are able to recover from the infection, and only a small percentage actually die from the disease in controlled laboratory studies. No die-offs in wild populations have ever been attributed to ISA.
- Controlled laboratory studies indicate Pacific salmon (steelhead trout [*O. mykiss*], Coho salmon [*O. kisutch*], Chinook salmon [*O. tshawytscha*], and chum salmon [*O. keta*]) are more resistant to ISA infection than Atlantic salmon (*Salmo salar*) (Rolland et al., 2003).
- Controlled laboratory studies indicate that Arctic char (*Salvelinus alpinus*), turbot (*Psetta maxima*) and two species of wrasse (*Labrus berggylta* and *Centrolabrus exoletus*) are resistant to ISA infection (Hjeltnes, 1993; Snow et al., 2001).
- The ISA virus may be able to propagate in herring but does not cause any clinical disease (Nylund et al., 2002).

- Alewife (*Alosa pseudoharengus*), sea bass (*Dicentrarchus labrax*), European eel (*Anguilla anguilla*), American eel (*Anguilla rostrata*), Atlantic herring (*Clupea harengus harengus*), Atlantic mackerel (*Scomber scombrus*), Atlantic cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), Atlantic halibut (*Hippoglossus hippoglossus*), pollock (*Pollachius virens*), American shad (*Alosa sapidissima*), winter flounder (*Pseudopleuronectes americanus*), and lumpfish (*Cyclopterus lumpus*) samples have all been tested for susceptibility for ISA from fish located in or near sites with Atlantic salmon exhibiting clinical ISA disease (MacLean et al. 2003). With the exception of a sample from pollock and cod, all other tests were negative. All samples include gill tissue, and since gill is in contact with the water, it is theorized the positive results came from surface contamination with the virus, as there was no evidence of clinical disease, and the fish were in close contact with clinically ill Atlantic salmon.
- A publication by Kibenge et al. in 2001 reported a finding of ISA from Coho salmon in Chile. However, this particular finding of ISAV was not confirmed in follow-up testing of either Coho or Atlantic salmon in the area, nor was ISAV associated with later experiences with icterus syndrome (Smith et al., 2003 and 2006).

(3) Susceptibility of (salmonid) populations to ISA from geographic and oceanographic factors.

Farmed Atlantic salmon are the host species for the ISA virus. ISA was first identified in Norway in 1983 and subsequently has emerged in other areas of the world where Atlantic salmon are raised, such as Ireland, Scotland, Faroe Islands, eastern Canada, eastern United States, and Chile. ISA has never been identified in Atlantic salmon raised on the Pacific coast of the United States or Canada, and ongoing diagnostic testing of these populations has not shown ISA is present. Additionally, as outlined in section 2, although other species may propagate the virus (such as wild Atlantic salmon, brown trout, and rainbow trout), these species are more resistant to clinical disease than farmed Atlantic salmon. Controlled laboratory studies indicate that Pacific salmon species are also more resistant to ISA than Atlantic salmon.

Recently, work has been done at the FWS Olympia Fish Health Center to determine whether or not existing diagnostic routines used by FWS, Washington Department of Fish and Wildlife, the Northwest Indian Fisheries Commission, and the Alaska Department of Fish and Game to test returning wild salmonid stocks for pathogens would be sufficient to detect the ISA virus. Preliminary work indicates that existing diagnostic routines would, at the least, detect the North American strain of ISAV. Specifically, the CHSE-214 cell line routinely used for viral screening by the aforementioned State and Tribal agencies is sensitive to the North American strain of ISAV. Work is ongoing to determine whether or not the existing diagnostic routines would also detect European strains of ISAV.

- (4) Potential transmission pathways between infectious Canadian sockeye and uninfected salmonid populations in U.S. waters.

ISA has not been confirmed in British Columbia, Canada. If ISAV or other aquatic pathogens were to be found in Pacific salmon that originated in Canada, there is a pathway, albeit a limited one, by which Canadian salmon could infect Pacific salmon of U.S. origin. Juvenile salmon migrate down rivers in the Pacific Northwest to marine waters from both British Columbia and U.S. Pacific coastal States. This life stage of salmon is known as smolts. Upon arrival in marine waters, many stocks/populations of salmon migrate north through Canadian waters to the Gulf of Alaska. Salmon of Canadian origin have a similar migration pattern and rear in the same waters in the Gulf of Alaska. It is in these marine waters off Alaska that the salmon feed, grow to maturity, and then begin their journey back to their freshwater natal streams to spawn and complete the life cycle of the salmon. During migration through Canada and while feeding in the marine waters of Canada and Alaska, it is possible that salmon originating from streams in the U.S. could commingle with salmon that originated from Canadian streams. The possible pathway for pathogen transmission would be from fish-to-fish through the water column.

- (5) Management strategies to rapidly respond to potential ISA outbreaks in both wild and aquaculture populations, including securing the water supplies at conservation hatcheries to protect hatchery fish from exposure to the ISAV present in incoming surface water.

Various management strategies can be implemented at conservation hatcheries, as well as in aquaculture facilities to respond to infectious salmon anemia. These strategies rely on increasing biosecurity at facilities where fish are located. Biosecurity factors include ensuring personnel use dedicated equipment at farm sites, disinfecting shared equipment, promptly removing any infected animals, using a pathogen-free source of water (where feasible), controlling access to sites, etc.

In 2002-2003, APHIS became involved with ISA in Maine at the request of the State and industry. At the time, ISA was widespread in the salmon farming industry, and in order to control the disease, the following measures were implemented: biosecurity measures, disease surveillance with Federal oversight, testing at approved laboratories using validated tests, mandatory disease reporting, quarantines on sites that met the program standard definition for positive, depopulation of infected sites, and indemnity to producers for animals destroyed. Cleaning and disinfection measures were instituted for facilities, work structures, and work vessels. Facilities were restocked with fish certified free of ISAV.

An ongoing control program was instituted and carries on today. The elements of the ISA program in Maine include site, vessel, and diving biosecurity plans; site-specific ISA action

plans; a sea lice integrated pest management program; a veterinary client-patient relationship; minimum monthly surveillance visits; periodic biosecurity audits; and data sharing related to inventory and mortality with APHIS. A detailed description of the ISA program can be found at www.aphis.usda.gov/animal_health/animal_dis_spec/aquaculture/downloads/isa_standards.docx.

Background on management of ISA in hatcheries and facilities can be found in a USDA document entitled "International Response to Infectious Salmon Anemia: Prevention, Control and Eradication" (http://www.aphis.usda.gov/animal_health/animal_dis_spec/aquaculture/downloads/isa_standards.pdf).

Management strategies for an ISA outbreak in wild populations are not possible due to the nature of free-ranging populations in the aquatic environment.

(6) Potential economic impacts of ISA.

The economic impact of ISA in areas that have experienced outbreaks varies based on the size of the industry impacted, the life stage of fish affected, and how quickly the disease is brought under control.

In 2001 and 2002, 17 marine net-pen sites, with a total of approximately 1.5 million fish, were depopulated due to ISA in Maine. The United States spent \$8.6 million combating ISA in the State between 2001 and 2007, including the cost of indemnifying farmers for animals destroyed.

The value of the salmon fishery in Alaska is worth over \$600 million annually (<http://www.adfg.alaska.gov/index.cfm?adfg=commercialbyfisherysalmon.salmoncatch>). As mentioned previously, the management of ISA in free-ranging populations is not feasible, and the potential economic impact of ISA on wild salmon cannot be estimated. However, there is much evidence that wild stocks of various fish species are resistant to clinical ISA infection, as well as laboratory evidence that Pacific salmon are also resistant to ISA infection.

(7) Any role foreign salmon farms may have in spreading ISA to wild populations.

As previously mentioned, ISA is a disease of farmed Atlantic salmon. There is no evidence in regions of the world that have ISA that it has spread to wild populations in marine waters. Further, the disease has yet to be found in the waters of the Pacific Northwest in either Canada or the United States. Historic disease surveillance programs, both active and passive in the Pacific Northwest (the United States and Canada) have not confirmed either ISA or the

virus that causes ISA. There is evidence for fish pathogens other than ISAV to spread from fish farms or from public/tribal hatcheries to wild stocks, particularly “wild” fish that are residing in the outfall from freshwater hatcheries. However, it is also known that wild fish can spread disease to farmed fish (Anderson et al. 2000).

Given that ISA has not been found in the Pacific Northwest, it would be difficult to develop research objectives to answer this question. Surveillance by NMFS and FWS in the vicinity of fish farms in Maine undergoing ISA outbreaks has produced only two examples of presence of ISAV in a wild fish. These observations were not concomitant with disease or clinical condition in the fish that showed presence of ISAV.

(8) The identity of any potential Federal, State, and international research partners.

Several research groups working with ISAV are established nationally and internationally that represent potential collaborators:

- U.S. Geological Survey (USGS) Western Fisheries Research Center, Seattle, Washington
- USGS National Fish Health Research Laboratory, Kearneysville, West Virginia
- USDA APHIS National Veterinary Services Laboratories, Ames, Iowa
- Kennebec River Biosciences, Richmond, Maine
- Atlantic Veterinary College, Charlottetown, Prince Edward Island, Canada
- Pacific Biological Station, Nanaimo, British Columbia, Canada
- Research and Productivity Council, Fredericton, New Brunswick, Canada
- Fisheries Research Services Marine Laboratory, Aberdeen, United Kingdom
- National Veterinary Institute, Oslo, Norway
- University of Bergen, Bergen, Norway

(9) Available baseline data, including data from collaborating entity(ies).

To date, there have been no confirmed cases of ISAV in the U.S. Pacific Northwest. However, there are gaps in knowledge, and surveillance monitoring for ISAV is warranted. The strongest evidence of regional ISAV status in the U.S. Pacific States derives from (1) passive surveillance at marine Atlantic salmon farms, (2) active testing of enhancement hatchery populations and anadromous adults of native species returning to spawn in freshwaters.

1. Based on experience in Maine as well as in foreign countries, ISA disease in Atlantic salmon marine net-pens typically escalates once introduced to a point clearly requiring disease investigation and coordinated response. Consequently, if a pathogenic strain of ISAV were introduced to Atlantic salmon net-pens in the Pacific Northwest, passive surveillance should be sufficient to ensure its eventual detection. This assertion, however, depends on a well-functioning veterinary or fish

health professional/industry partnership and passive surveillance and reporting infrastructure. Periodic Federal or State government audits of this system would ensure its credibility as evidence for future disease freedom claims, whether ISAV or other pathogens of concern. Routine diagnostic testing of moribund fish would further augment confidence in early disease detection.

2. However, given the limited distribution of farmed Atlantic salmon populations on the U.S. west coast, it is prudent to also consider the ISAV infection status of native species that could serve as ISAV reservoirs. ISA infection is unlikely to produce clinical signs in marine populations of Pacific salmonid species, and/or freshwater populations of any salmonid (including Atlantic salmon), but high sample volumes between State, USFWS, and Tribal monitoring activities provide strong confidence that we would have detected the North American genotype if it were present in the Pacific Northwest. Future inclusion of salmon head kidney (SHK) or Atlantic salmon kidney (ASK) cell lines, concurrent with existing (or even reduced) sampling, would allow us to also surmise the absence of the European genotype. Though export facilities include SHK cell lines that should also detect the European genotype, these closed facilities are not likely to reflect disease status in the surrounding region.

To conclude, existing surveillance efforts provide substantive evidence of absence of the ISAV North American genotype in the Pacific Northwest. It is important to note that the ability to isolate ISAV in cell culture is highly dependent on the amount of virus in the sample, and nature of the virus present: and, not all ISAV strains can be isolated in cell culture (reviewed in Kibenge et al., 2004; Plarre et al., 2005). However, the historical testing volume compensates for some of the limitation in sensitivity. From July 2010 to June 2011 alone, over 36,000 salmonids from 51 watersheds were tested in Washington (State and Tribe co-manager report). By comparison, just 1,200 fish would be sufficient to substantiate 95-percent confidence of disease absence at a detection threshold of 1 percent even if diagnostics are credited with only 25-percent sensitivity (FreeCalc Version 2, online software, <http://www.ausvet.com.au/content.php?page=software#freecalc>). Consequently, despite the relatively low sensitivity of cell culture, the high volume of ongoing State, Tribal, and Federal efforts to oversee native populations provides credible general evidence of North American ISAV genotype absence. However, one cannot extend this assurance to the European genotype of ISAV. Currently utilized cell lines (epithelioma papulosum cyprinid [EPC] and Chinook salmon embryo [CHSE]) do not produce cytopathic effects when infected with some European strains and may not support replication of other strains of the European genotype. Hatcheries that produce salmonid eggs for export do include SHK cell lines in their health certification testing. However, these facilities are closed to their surroundings and therefore less representative of regional disease status. Consequently, current regional knowledge of European ISAV status rests predominantly on the absence of

passive surveillance findings in marine Atlantic salmon net-pens, which are limited in geographic distribution. Further, because reverse transcription polymerase chain reaction for ISAV is not routinely employed in this region, we have even less knowledge regarding the presence or absence of the putative non-cultivable, non-pathogenic strains. Consequently, we propose a State-Tribal-Federal-Industry coordinated enhanced surveillance strategy to formally assess ISAV status in the Pacific Northwest.

(10) Other ISA research priorities.

The Task Force has also developed a proposed research plan. The plan has three stages and is dependent upon isolation of virus: 1) Determine additional genetic information about the virus, if present; 2) Develop improved detection tools for the virus, if present; 3) Assess the risk of the strain of virus, if present, in Pacific salmon. The last stage is dependent upon the results of the previous two, and the overall plan is closely linked with surveillance.

References

- Hjeltnes, B. 1993. IIA – en laksesykdom som ikke spres av andre arter. Havforsknings nytt 22. Bergen, Norway: Havforskningsinstituttet. 2 p.
- Kibenge, F.S.B.; Gárate, O. N.; Johnson, G.; Arriagada, R.; Kibenge, M.J.T.; Wadowska, D. 2001. Isolation and identification of infectious salmon anaemia virus (ISAV) from coho salmon in Chile. *Diseases of Aquatic Organisms* 45: 9-18.
- Kibenge, F.S.B., K. Munir, M.J.T. Kibenge, T. Joseph, and E. Moneke. 2004. Infectious salmon anaemia virus: causative agent, pathogenesis and immunity. *Animal Health Research Reviews* 5. 65-78.
- MacLean, S. A.; Bouchard, D. A.; Ellis, S. K. 2003. Survey of nonsalmonid marine fishes for detection of infectious salmon anemia virus and other salmonid pathogens. In: Miller, O.; Cipriano, R. C., tech. cords. International response to infectious salmon anemia: prevention, control, and eradication: proceedings of a symposium; 3-4 September 2002; New Orleans, LA. Tech. Bull. 1902. Washington, DC: U.S. Department of Agriculture, Animal and Plant Health Inspection Service; U.S. Department of the Interior, U.S. Geological Survey; U.S. Department of Commerce, National Marine Fisheries Service: 135-143.
- Nylund, A.; Alexandersen, S.; Løvik, P.; Jakobsen, P. 1994. The response of brown trout (*Salmo trutta* L.) to repeated challenge with infectious salmon anaemia (ISA). *Bulletin of the European Association of Fish Pathologists* 14: 167-170.

- Nylund, A.; Alexandersen, S.; Rolland, J. B.; Jakobsen, P. 1995. Infectious salmon anemia virus (ISAV) in brown trout. *Journal of Aquatic Animal Health* 7: 236–240.
- Nylund, A.; Jakobsen, P. 1995. Sea trout as carrier of infectious salmon anemia virus. *Journal of Fisheries Biology* 47: 174–176.
- Nylund, A.; Kvenseth, A. M.; Krossøy, B. 1995. Susceptibility of wild salmon (*Salmo salar* L.) to infectious salmon anaemia (ISA). *Bulletin of the European Association of Fish Pathologists* 15: 152-156.
- Nylund, A.; Kvenseth, A. M.; Krossøy, B.; Hodneland, K. 1997. Replication of the infectious salmon anemia virus (ISAV) in rainbow trout *Oncorhynchus mykiss* (Walbaum). *Journal of Fish Diseases* 20: 275-279.
- Nylund, A.; Devold, M.; Mullins, J.; Plarre, H. 2002. Herring (*Clupea harengus*): A host for infectious salmon anemia virus (ISAV). *Bulletin of the European Association of Fish Pathologists* 22: 311-318.
- Nylund, A.; Devold, M.; Aarset, M.; Fridell, F.; Plarre, H. 2003. Prevalence of infectious salmon anaemia virus (ISAV) in wild salmonids in western Norway. [Abstract.] In: Abstracts of the 11th international conference of the European Association of Fish Pathologists: 21-26 September 2003; St. Julians, Malta. [Place of publication unknown]; EAAP 2003: O-57.
- Plarre, H.; Devold, M.; Snow, A.; Nylund, A. 2005. Prevalence of infectious salmon anaemia virus (ISAV) in wild salmonids in western Norway. *Diseases of Aquatic Organisms* 66: 71-79.
- Rolland, J. B.; Nylund, A. 1998. Sea running brown trout: carrier and transmitter of the infectious salmon anemia virus (ISAV). *Bulletin of the European Association of Fish Pathologists* 18: 50-55.
- Rolland, J. B.; Winton, J. R. 2003. Relative resistance of Pacific salmon to infectious salmon anemia virus (ISAV). *Journal of Fish Diseases* 26: 511-520.
- Smith, P.; Larenas, J.; Contreras, J.; Cassigoli, J.; Venegas, C.; Rojas, M. E.; Guajardo, A.; Troncoso, O.; Macías, D. 2002. (Infectious?) hemolytic anemia of salmon: an emerging disease occurring in seawater cultured coho salmon (*Oncorhynchus kisutch*) in Chile. [Abstract.] In: Proceedings of the 4th international symposium on aquatic animal health; 1–5 September 2002, New Orleans, LA. New Orleans, LA: Louisiana Sea Grant College Program: P. 213.
- Smith, P. A.; Rojas, M. E.; Pérez, S.; Díaz, S.; Contreras, C.; Larenas, J.; Macías, D. 2003. Infectivity trial to reproduce infectious hemolytic anemia of salmon (IHAS) in coho salmon (*Oncorhynchus kisutch*), rainbow trout (*Oncorhynchus mykiss*), and Atlantic salmon (*Salmo salar*). [Abstract.] In: Abstracts of the 11th international conference of the European Association

of Fish Pathologists; 21–26 September 2003; St. Julians, Malta. [Place of publication unknown]: EAFP 2003: P-254.

Smith, P.A.; Larenas, J.; Conreras, J.; Cassigoli, J.; Venegas, C.; Rojas, M.E.; Guajardo, A.; Perez, S.; Diaz, S. 2006. Infectious haemolytic anaemia causes jaundice outbreaks in seawater-cultured coho salmon, *Oncorhynchus kisutch* (Walbaum), in Chile. *Journal of Fish Diseases* 29: 709-715.

Snow, M.; Raynard, R. S.; Bruno, D. W. 2001. Comparative susceptibility of Arctic char (*Salvelinus alpinus*), rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*) to the Scottish isolate of infectious salmon anaemia virus. *Aquaculture* 196: 47–54.

Snow, M.; Raynard, R.; Bruno, D. W.; van Nieuwstadt, A. P.; Olesen, N. J.; Levold, T.; Wallace, C. 2002. Investigation into the susceptibility of saithe (*Pollachius virens*) to infectious salmon anemia virus (ISAV). Potential role as a vector for viral transmission. *Diseases of Aquatic Organisms* 50: 13-18.

Appendices

Appendix 1: MOU between APHIS, FWS, and NOAA Fisheries

Appendix 1

**MEMORANDUM OF UNDERSTANDING
ON SHARED AQUATIC ANIMAL HEALTH ROLES AND RESPONSIBILITIES
BETWEEN
THE UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE (APHIS),
THE UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL MARINE FISHERIES SERVICE (NOAA FISHERIES)
AND
THE UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE (FWS)**

Purpose:

Recognizing the legal authorities and mandates of the respective Federal Departments and associated Agencies for the management of aquatic animal health in the United States and its territories, this memorandum of understanding (MOU) between the United States Department of Agriculture Animal Plant Health Inspection Service (APHIS), United States Department of Commerce National Oceanic and Atmospheric Administration Fisheries Service(NOAA Fisheries), and the United States Department of the Interior, United States Fish and Wildlife Service (FWS), will formally pledge our shared commitment to promoting and facilitating national aquatic animal health in the context of good environmental stewardship and the facilitation of our aquaculture industry's growth.

Legal authorities allowing APHIS to enter into this MOU:

APHIS enters into this agreement pursuant to the Department of Agriculture's statutory authorities to participate in such activities including the Animal Health Protection Act (7 USC 8301-8316).

Legal authorities allowing NOAA Fisheries to enter into this MOU:

NOAA Fisheries enters into this agreement pursuant to the Department of Commerce's statutory authorities to participate in such activities including the Agriculture Marketing Act of 1946, as amended (7 USC 1621-1627), the Fish and Wildlife Act of 1956, as amended (16 USC 742e), the Reorganization Plan No. 4, dated 1970 (84 Stat. 2090), and the National Aquaculture Policy Act of 1980 (16 U.S.C. sec. 2801 et seq.).

Legal authorities allowing FWS to enter into this MOU:

FWS enters into this agreement pursuant to the Department of Interior's statutory authorities to participate in such activities including the Fish and Wildlife Act of 1956, as amended (16 USC 742e) and the Fish and Wildlife Coordination Act (16 USC 661 et seq.).

Overarching Objectives

APHIS, NOAA Fisheries, and FWS recognize the need to efficiently apply our Agencies' complementary skills and resources to ensure the health of aquatic species within our jurisdictions. The health of aquatic species is not only of concern relative to wild aquatic animals, but also for aquatic animals being reared in private and public facilities, aquatic animals being exported to other countries and aquatic animals moving between States and other jurisdictions within our country. We are also concerned about the health of aquatic animals being imported into our country, as they may ultimately affect the health of both domestic wild and cultured aquatic animals.

To ensure aquatic animal health, this MOU is intended to:

- Provide the foundation for a consistent, internationally recognized national aquatic animal health plan (NAAHP) for the well-being of our commercial aquaculture industries and our national aquatic resources;
- Provide general guidance for our Agencies to develop and implement such a NAAHP through a commitment to complete cooperation and consultation between our Departments, and with our various public and private sector partners and stakeholders;
- Formally recognize the Joint Subcommittee on Aquaculture, as authorized by the National Aquaculture Act of 1980 and the National Aquaculture Improvement Act of 1985 and its task force, the National Aquatic Animal Health Task Force on Aquaculture (NAAHTF) as the proper medium through which our concerted efforts should be directed; and
- Formally pledge our Agencies commitment to working with each other to be strong environmental stewards and facilitators of private aquaculture industry growth.

Specific Objectives

By virtue of this MOU, new or revised regulations, policies, and/or guidelines; and/or additional need-specific MOUs, we will minimally do the following to ensure the health of our Nation's aquatic animals:

1. Identify our respective roles and responsibilities, minimizing overlapping and/or redundant functions;
2. Engage in full and open inter-Agency cooperation and consultation under all conditions;
3. Identify existing authorities and amendable regulations needed to achieve our shared goals;
4. Develop a consistent approach to disease detection and certification procedures for import, export and interstate movement of aquatic species, which is consistent with international standards;
5. Establish joint and/or shared competent authorities consistent with the World Organization for Animal Health (OIE) guidelines;

6. Establish a prioritization of aquatic animal diseases/pathogens vis-à-vis importation, exportation and interstate movement protocols, and domestic and international reporting disease/pathogen status; and
7. Establish a designated Agency staff-position (if one does not already exist) for these activities and empower that person to make decisions on behalf of their respective Agency for ongoing activities of the NAAHTF. The scope of these activities could include approving elements of the NAAHP, approving import/export protocols and permits, participating in day-to-day interagency consultations on aquatic animal health decisions, and other decisions that are required for cooperatively operating a health management program, recognizing that all of these activities are within the scope of the existing legal authorities for the respective Agency.

General Provisions

Nothing in this MOU is intended to obligate any appropriated funds from any agency in conflict with any federal law or regulation.

Length of time for MOU to be in force:

This MOU shall be in effect for a period of not more than 5 years, commencing on the effective date of this agreement. By written agreement of the signatories, the MOU may be extended for an additional 5 years at the end of the first 5 years of this agreement.

Effective date of agreement:

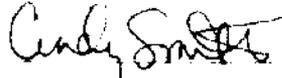
This MOU between APHIS, FWS, and NOAA Fisheries shall become effective by the signatures of the representing authorities on the date of signature by the Directors/Administrator.

Termination of memorandum of understanding

Nothing herein is intended to conflict with the current authorities of the parties. If the terms of this memorandum of understanding are inconsistent with existing directives of the respective Agencies entering into this agreement, then those portions of the agreement which are determined to be inconsistent may be considered to be invalid, but the remaining terms and conditions of this agreement not affected by inconsistency shall remain in full force and effect. At the first opportunity for review of the memorandum of understanding, such changes as deemed necessary will be accomplished by either an amendment or entering into a new agreement, whichever is deemed expedient by the parties.

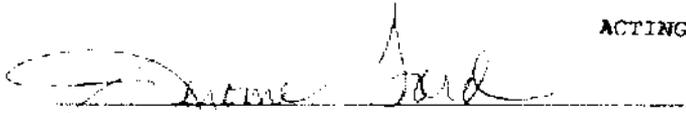
Any signatory to this memorandum of understanding wishing to terminate their participation may do so thirty (30) days following the written notification of the other signatory parties.

Authorized Signatories to this MOU on shared Federal responsibilities for aquatic animal health in the United States.



Ms. Cindy Smith, Administrator
Animal Plant Health Inspection Service

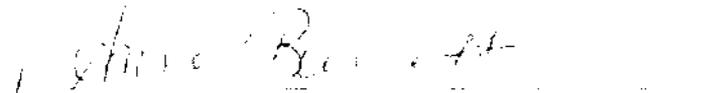
11-14-08
Date



ACTING

Mr. H. Dale Hall, Director
U.S. Fish and Wildlife Service

8/8/09
Date



James W. Balsiger, Ph.D., Acting Assistant Administrator for
Fisheries, National Oceanic and Atmospheric Administration

10-24-08
Date