Report of Activities - 1999 / 2000

NAC Scientific Working Group on Salmonid Introductions and Transfers

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Miramichi, New Brunswick, Canada

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NAC Scientific Working Group on Salmonid
Introductions and Transfers

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The Scientific Working Group (SWG) met once during this reporting period on May 23, 2000 in St John's, Newfoundland. The purposes of the meeting and other communications were to respond to the North American Commission's (NAC) requests contained in NAC(99)8, Report of the Sixteenth Annual Meeting of the North American Commission, Westport, Ireland. The SWG addressed five tasks: (1) update of the databases for fish disease occurrences and the inventory of introductions and transfers of salmonids within the NAC area; (2) relative to the proposed (June 1998) revisions to the Protocols for the Introduction and Transfer of Salmonids [NAC (92)24 and (94)14], review proposal on containment and recapture methods and consider examples of risk assessment for inclusion in the draft revised Protocols; (3) consider the establishment of a database on aquaculture escapees, including methods of identification; (4) review a report by Canada on the epidemiology of Infectious Salmon Anemia (ISA); and (5) update available information on the Salmon Swimbladder Sarcoma virus (SSSv).

There has been no revisions made to the Draft Protocols during the past year. It is the Working Group's understanding that both Canada and the USA have completed its consultations. However, no direction has been given by the Parties to make modifications.

1. Update of the databases for fish disease occurrences and the inventory of introductions and transfers of salmonids within the NAC area.

A summary of the information received to date on introductions and transfers occurring during 1999 is provided in Table 1. A listing of individual transfers reported for 1999 are presented in Appendix I.

As noted for the two previous years, the importation of milt from a private Icelandic facility to Maine occurred again in 1999. The original stock origin of this milt shipment is "Bolak" (European strain currently cultured in Iceland). The milt was used to fertilize eggs from females held in Maine (stock origin not reported) by two Maine private aquaculture operators. European/North American hybrid fry produced at private a facility in Maine were shipped to a New Hampshire facility to be grown out to the smolt stage, then shipped back to cages in Maine in the Spring of 2000. Thus, reproductively viable European strain ("Landcatch" or "Bolak") or hybrids continue to be farmed in the US, which is contrary to the NAC Protocols. A formal joint recommendation was made May 15, 2000 by the National Marine Fisheries Service and the US Fish and Wildlife Service to US Army Corps of Engineers, which is the Federal permitting agency in the US for sea pen placements, to address the use of reproductively viable non-North American salmon stocks in sea pens. The recommendations were made as part of the pre-listing conference process required under the US Endangered Species Act. If implemented, the

placement of salmon of European genetic origin in all sea pens would phase out by the year 2002, with the last harvesting of any non-North American stocks from pens anticipated to occur by 2004 bringing the US into full compliance with the Protocols.

Reproductively viable rainbow trout (both sex diploids) continue to be introduced into Nova Scotia and New Brunswick for aquaculture operations, which is contrary to the NAC Protocols. All-female diploid rainbow trout were imported into Newfoundland; however, since these are mono-sex strains they would be non- reproductively viable at the population level, unless escapees male rainbow trout occur from other sources.

The matrix displaying historic occurrences of fish pathogens in the NAC area has been updated in Table 2. There were only minor changes in the occurrence of the more common pathogens in the NAC area, none of which are remarkable.

2. Review proposal on containment and recapture methods and consider examples of risk assessment for inclusion in the draft revised Protocols relative to the proposed (June 1998) revisions to the Protocols for the Introduction and Transfer of Salmonids. (Ref. NAC(99)8:7.6).

At the Sixteenth Annual Meeting, the NAC concurred with the SWG's recommendation that the draft Revised Protocols should contain greater reference to containment and recapture measures. The SWG was directed to interact with States and Provinces to review proposals on containment and recapture methods and to include examples of Risk Assessment models in the draft revised Protocols with consultation with experts, States, and Provinces. Although no revision to the Protocols was carried out this past year, there has been activity to report under this item. A Code of Practice for the Containment of Non-Local Strains of Salmonids in Sea Cage Culture in the Atlantic Provinces was drafted in April 1997. The Maine Aquaculture Association and its Member Farms adopted a voluntary Code of Practice in October of 1998. More recently, the Province of Newfoundland and Labrador released, in May 1999, a "Code of Containment for the Use of Non-Local Salmonid Strains in Sea Cage Aquaculture in Bay D'Espoir" followed by a "Code of Containment Implementation Plan" in September 1999. Also of note is the draft "International Guidelines on Containment" prepared by a Work Group of the NASCO/NASFI Liaison Group. There has been no documentation provided of the effectiveness of any of these codes. The SWG decided that it would be appropriate to delay the development of a Code of Containment for the revised Protocols until Guidelines were adopted by the NASCO Council. The SWG supports the ICES ACFM recommendation that monitoring could be enhanced through universal adoption of a marking system that would allow escapees to be readily identified.

An approach to containment recently proposed in the U.S. is to monitor the effectiveness of containment through the establishment of a performance standard. The containment performance standard sought for marine cages and freshwater rearing facilities is to contain fish sufficient to avoid escapees entering salmon rivers.

The SWG did not make progress on the development and incorporation of examples of Risk Assessment models. The SWG notes that Canada is currently undergoing consultation on a National Code on Introductions and Transfers of Aquatic Organisms, May 2000, which incorporates a Risk Analysis approach. The SWG will continue to monitor the acceptance of this Risk Analysis approach and investigate other models.

3. **Establish a database of numbers of aquaculture escapees reported in NAC rivers and include reference to the method used to identify fish as escapees. NAC. (Ref. NAC(99)8:7.3).**

Database. The SWG reviewed information provided to the Group on occurrences of Atlantic salmon and rainbow trout aquaculture escapees in rivers in the NAC Area. Atlantic salmon escapees were reported from rivers in New Brunswick, Nova Scotia, Newfoundland and Maine (Table 3); whereas information for rainbow trout escapees were only available for Newfoundland (Table 4). The SWG recognized that the information on aquaculture escapees in rivers is incomplete and needs to be improved. A more detailed description of the occurrences of rainbow trout in Newfoundland is provided in Appendix II. The origin of these aquaculture escapees is not known. However, it is apparent that rainbow trout can disperse considerable distance from aquaculture sites; as they have been observed on the Northwest coast of NF, more than 500 km from the nearest marine aquaculture pens. There is some concern that at least some of the rainbow trout escapees in rivers on the west coast of NF originated from aquaculture cages in the Maritimes, and are reproductively viable (both sex diploids).

In the absence of any formal mechanism or requirement for reporting escapees the data on escapees is very limited and generally discontinuous within a particular river and over time. The data are commonly collected by agency staff biologists incidental to other field work being conducted. The SWG will continue to maintain the data in future years as presented in Table 3 and 4. The database can be made more useful by establishing a standard reporting format for the agencies in the NAC area and a relational database for storage. However, in the absence of required marking of aquaculture fish and reporting of escapes, the data on the occurrence of escapees in rivers will continue to be minimal and discontinuous in nature.

Identification of escapees. Identification of individual escapees in the field is based on the physical appearance. Characteristics used to identify an aquaculture salmon relate primarily to poor fin condition (deformed dorsal and pectoral fins, shortened caudal or "broom tail"). Other superficial characteristics common to aquaculture escapees include shortened operculums and a body shape and size uncharacteristic of wild fish. Confirmation of identity usually depends on scale analysis, with aquaculture fish showing more rapid and uniform development in both fresh and sea water growth phases. In some cases DNA anaylsis has been used for confirmation. In river systems that receive smolt stockings for wild population enhancement or where aquaculture fish escape from hatcheries into a river at an early development stage (e.g. fry), the use of physical characteristics may not be an effective means for identifying aquaculture escapees in the field. (see Item #4 for update on future DNA-based identification techniques.)

4. **Examine the feasibility of field testing a technique for identifying the portion of river populations that are of aquaculture origin and their continent of origin. (Ref. NAC(99)8:7.8).**

The SWG has made only limited progress on the "molecular beacon" method of DNA field testing. This continues to be a requirement for at least some limited laboratory capability to complete tests for DNA . A field test to determine the Continent of Origin in the west Greenland mixed fishery seems to be a viable option. A few obstacles to field analysis remain, namely a way to denature the DNA to allow a probe (e.g., a molecular beacon) to re-anneal with the target region of mitochondrial DNA. This method would only be effective in North American waters at detecting European origin aquaculture escapees if the fish in question was a pure landcatch strain animal or if the female used in the Local Strain X landcatch hybrid cross was European. This is

because the markers currently proposed for the molecular beacon probe utilize the maternally transmitted mitochondrial DNA molecule. It appears that the best method of detecting Continent of Origin in North American waters, or aquaculture escapees of domesticated strains of Saint John or Penobscot stock currently used by aquaculture is an analysis that utilizes multi-locus genotypes of microsatellite DNA. Baseline datasets are now available from three aquaculture strains (Landcatch/Belak, Saint John, Penobscot) currently in use within the NAC area. Using maximum likelihood assignment tests, the US Geological Survey Laboratory staff have had excellent success identifying probable aquaculture escapees in the Pleasant and East Machias rivers of Maine. In addition to the 24 markers currently available, the USGS is developing additional polymorphic microsatellite DNA markers which will enhance the ability to discriminate among the local wild and aquaculture strains.

5. Update on the "European-like" alleles observed in Maine (Ref. NAC(99)8:7.14)

Work is in progress to determine whether the "European-like" alleles observed in Maine are in fact of European origin or just variants of similar size. We should have an answer to this question to report by next year.

6. Review of Canadian report on the epidemiology of ISA virus. (Ref. NAC(99):7.5)

The day before the Scientific Working Group meeting we received an electronic version of a report on the "Epidemiological Risk Factors for Mortalities in Atlantic Salmon in Areas of New Brunswick Affected with Haemorrhagic kidney Syndrome – Infectious Salmon Anaemia" by K.L. Hammell and I.R. Dohoo. There was insufficient time to completely read the document and some of the Tables and Figures were missing. It was our earlier understanding that this report that was commissioned by Canada would investigate the origin of the introduction of ISA into the Bay of Fundy. However this was not the case. The objectives of the investigations were (a) To describe the mortality patterns in cages experiencing an outbreak of disease attributed to ISAv to provide better predictions of future events given the same circumstances, and (b) To identify management risk factors associated with mortalities attributed to ISAv at the cage and site levels.

The conclusion of the report is as follows:

"… management factors appear to modify the relative risk of experiencing mortalities due to HKS-ISA. Increasing the health and survival of smolt in the first summer in seawater and feeding moist feed during the winter and spring are associated with reduced risk. Aggressive lice control and lower initial stocking numbers may help reduce the probability of HKS-ISA outbreaks. Multiple year class sites and previous exposure at the site are also important risk factors. A standardized farm recording system would enable epidemiologic studies of salmon diseases to occur with much improved efficiency and ability to detect more detail about risk factors."

The SWG noted that the ICES Scientific Working Group provided a summary of ISA detected in escaped and wild salmon in its report CNL(00)11. It states that ISA has now been detected in sea cages in Canada, Norway, Scotland, Faeroe Islands, and in Chile.

ISA has been found in escaped-farmed and wild Atlantic salmon in the Magaguadavic River in New Brunswick and the ISAv has been found in wild Atlantic salmon parr in Scotland. ISAv has been found in a number or of fish species, namely: Atlantic salmon, rainbow trout, coho salmon, brown trout, sea run brown trout, and the European eel.

7. Review of status of Salmon Swimbladder Sarcoma virus. (Ref. NAC(99):7.9)

Continued testing for the Salmon Swimbladder Sarcoma virus (SSSv) in US salmon stocks indicates that the virus is present in some, but not all, river populations at very low levels (18 out of 1,598 tested). No disease symptoms attributable to the virus has been observed except for the single outbreak in a Federal hatchery in Massachusetts that lead to the discovery of the virus. Though there is not yet any evidence of vertical transmission of the virus, when a carrier of the virus is found in captive wild brood stock, that individual fish is removed from the hatchery population. It is still not clear to what extent this virus poses a threat to salmon. A detailed review of the current status of SSSv is contained in Appendix III.

Table 1. Summary of Total Reported Numbers of Eggs and Fish Transferred into the NAC and Between States/Provinces in 116 Shipments During CY 1999.

ARTIC CHAR	Number of Shipments = 13	
CANADA	1,255,001	
USA	0	
TOTAL	1,255,001	
ATLANTIC SALMON	Number of Shipments = 28	
CANADA	26,540,880	
USA	20,233,475	
TOTAL	46,774,355	
BROOK TROUT	Number of Shipments = 5	
CANADA	93,006	
USA	10,000	
TOTAL	103,006	
BROWN TROUT	Number of Shipments = 1	
CANADA	0	
USA	8,000	
TOTAL	8,000	
KOKANEE SALMON	Number of Shipments = 1	
CANADA	0	
USA	101,000	
TOTAL	101,000	
LAKE TROUT	Number of Shipments = 1	
CANADA	0	
USA	594,000	
TOTAL	594,000	
LANDLOCK SALMON	Number of Shipments = 5	
CANADA	0	
USA	70,478	
TOTAL	70,478	
RAINBOW TROUT	Number of Shipments = 64	
CANADA	13,097,480	
USA	3,333,599	
TOTAL	16,431,079	

Table 2. Summary Table of Fish Disease Occurrence in NAC Area at End of Calendar Year 1999

Fish Disease or Agent with Occurrence Codes for each State and Province *(See footer for explanation of "occurrence Codes")*

State or Province	Bacterial Kidney Disease (BKD)	Ceratomyxosis ✖	Enteric Redmouth (ERM)	Furunculosis	Infectious Hematopoietic Necrosis (IHN) ✖	Infectious Pancreatic Necroisis (IPN)	Infectious Salmon Anemia (ISA)	Oncorhynchus Masou Virus ✖	Viral Hemorrhagic Septicemia (VHS) ✖	Whirling Disease	Other CPE viruses (except IPN) ✖	Salmon Swimbladder Sarcoma**
CT	1	0	1	3	0	0	0	0	0	3	0	0
MA	2	0	1	3	0	1	0	0	0	1	0	3
ME	2	0	2	3	0	3	0	0	0	0	3	3*
NB	3	0	2	3	0	3	3	0	0	0	3	0
NF-LAB	1	0	1	3	0	2	0	0	0	0	0	0
NH	3	0	1	2	0	3	0	0	0	1	0	0
NJ	1	0	0	2	0	1	0	0	0	1	0	0
NS	2	0	2	3	0	3	3	0	0	0	3	0
NY	1	0	0	2	1	1	0	0	0	3	0	0
ONT	3	0	3	3	0	0	0	0	0	0	0	0
PEI	1	0	0	0	0	1	0	0	0	0	0	0
QUE	3	0	2	3	0	3	0	0	0	0	0	0
RI	0	0	0	3	0	3	0	0	0	3	0	0
VT	3	0	0	3	0	1	0	0	0	0	0	0

Occurrence Codes
0 = No known historical occurrence within State/ Province
1 = Historical occurrence but no known occurrence within the last 5 years
2 = Has occurred during the past 5 years but not during the last Calendar Year
3 = Verified occurrence during the last Calendar Year within State/Province

✖ indicates an "EMERGENCY DISEASE" under 1998 recommended revisions of NAC Protocols "Emergency" and "Restricted" lists

* Virus found present, but no disease symptoms ever detected.

** New virus; not currently included in NAC Protocols

Table 3. Known occurrences of Atlantic salmon aquaculture escapees in salmon rivers within the NAC area.

River (St/Prov)	Number of escapees (escapees as percent of total sample)							Life Stage
	Prior to 1990	1990 - 1994	1995	1996	1997	1998	1999	
CANADA								
Annapolis (NS)				1				MSW
Baddeck (NS)			23 (6)			5 (3)		1SW & MSW
Bear (NS)	numerous escapees angled in the early 1990's, T. Goff, DFO							
Big Salmon (NB)	1							
Conne (NF)		3			10(2)	2(1)	1(<1)	adult
Conne (NF)		12		59				smolt
Dennis (NB)	presence of escapees suspected by not confirmed, F. Whoriskey, ASF, pers. comm.							
Digdeguash (NB)	juveniles below hatchery, G. Lacroix, pers. comm.							
Gaspereau (NS)		4	1 (3)			1 (4)		MSW
LaHave (NS)	1 (<1)		0	0	0			
Liscomb (NS)			0	0	0	0		
Magaguadavic (NB)		1449(68)	657(84)	195(7)	82 (58)	223(8)	79(77)	1SW & MSW
Margaree (NS)	0	0	0	0				
Middle (NS)						9 (4)		1SW & MSW
Miramichi (NB)	0	0	0	0	0	0	0	
North (NS)			14 (8)			55 (11)		1SW & MSW
Petitcodiac (NB)								
Sackville (NS)				0	0	0		
Saint John (NB)	ed in 1990 at Belle Isle Bay by T. Pettegrew, NBDNRE							
St. Croix (NB/ME) *		98(54)	13(22)	20(13)	27 (39)	25 (38)	23(64)	1SW & MSW
Tusket (NS)						2 (<1)		MSW
Waewig (NB)	acroix, pers. comm. 1 adult found, year unknown.							
St. Mary's (NS)					0	0		
Stewiacke (NS)			7 (33)	0				MSW
UNITED STATES								
Dennys (ME)**		42 (89)***	4 (44)	21 (68)	2 (100)	1 (100)		
Narraguagus (ME)		1(2)***	0	8 (22)	0	0	3 (9)	Sexually mature & immature
Other Maine Rivers	escapees observed in Boyden Str., Pennamaquan R., Hobart Str., E. Machias R., Penobscot R.							

* 1994-96 aquaculture fish were estimated to be 13-54% of the run.

** Partial counts in Dennys

*** Includes 1994 only; no earlier data

Table 4. Observations of Rainbow Trout aquaculture escapees in Newfoundland rivers

River (St/Prov)	Number of escapees							Life Stage
	Prior to 1990	1990 - 1994	1995	1996	1997	1998	1999	
Watts Bight Bk (NF)	3							adult
River of Ponds (NF)	1+	1+	3*				24	adult
Portland Creek (NF)							1	adult
Parsons Pond (NF)							1	adult
Trout River (NF)	4						1+**	adult
Humber River (NF)							3	adult
Serpentine (NF)	2							adult
Flat Bay Brook (NF)			1*				2	adult
Robinsons River (NF)							2	adult
La Poila River (NF)							3	adult
Garia Brook (NF)								adult
Conne River (NF)		77	39	41	61	27	21	adult
Little River (NF)				5			1	adult
Long Harbour R (NF)						1+		adult
Grand Bank Bk (NF)						1+		adult
Biscay Bay Bk (NF)						2		adult

* 1 Male (interally sexed)

** 1 Female (internally sexed)

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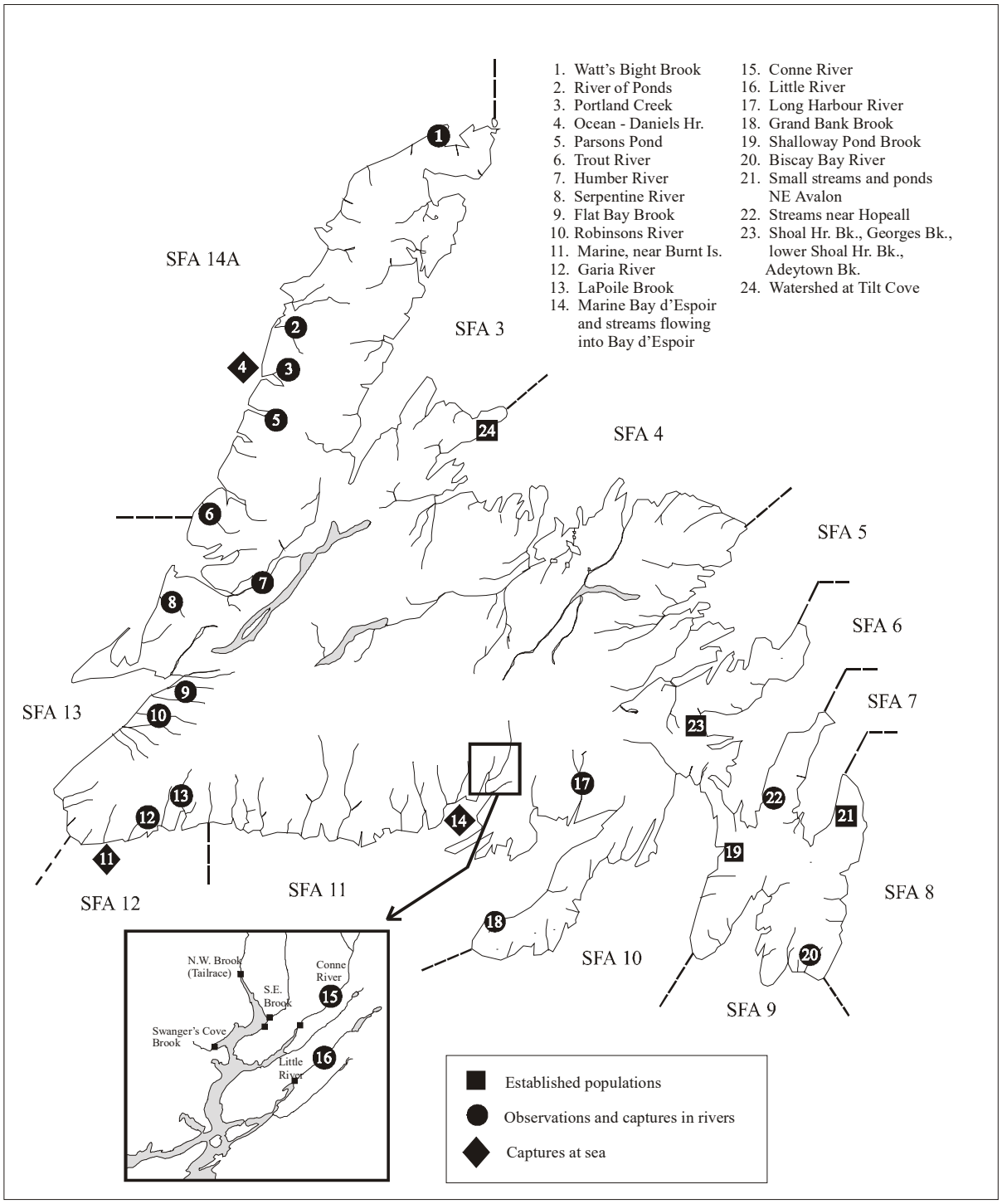
Figure 1. Location of Rainbow trout sightings in Newfoundland.



APPENDIX I

SUMMARY OF SALMONID INTRODUCTIONS AND TRANSFERS IN THE NORTH AMERICAN COMMISSION AREA

1999

Prepared by the

NORTH AMERICAN COMMISSION (NASCO)
SCIENTIFIC WORKING GROUP ON SALMONIDS
INTRODUCTIONS AND TRANSFERS

Report of Salmonid Introductions and Transfers in NAC Area - 1999

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use
CONNECTICUT							
ATLANTIC SALMON							
491	Pittsford NFH (VT)	Penobscot R.	Unknown	Y	21,140	Final Disp. (CT)	Pop. Enhanc. (sea-run)
526	White River NFH (VT)	Penobscot R.	Fry	Y	456,000	Final Disp. (CT)	Pop. Enhanc. (sea-run)
493	White River NFH (VT)	Penobscot R.	Eggs	Y	108,900	Gov-State	Unspecified
490	Richard Cronin NFH (MA)	Penobscot R.	Eggs	Y	32,500	Gov-State	Brood Stock Dev.
RAINBOW TROUT							
492	White Sulphur Springs (WV)	Domestic	Eggs	Y	15,000	Gov-State	Pop. Enhanc. (Inland)
MAINE							
ATLANTIC SALMON							
499	Craig Brook NFH (ME)	Sheepscot wild	Parr	Y	4,800	Final Disp. (ME)	Pop. Enhanc. (sea-run)
511	Green Lake NFH (ME)	Penobscot R.	Adults	Y	2,404	Final Disp. (ME)	Pop. Enhanc. (sea-run)
510	Green Lake NFH (ME)	Penobscot R.	Smolt	Y	20,100	Final Disp. (ME)	Pop. Enhanc. (sea-run)
509	Green Lake NFH (ME)	Penobscot R.	Smolt	Y	21,300	Final Disp. (ME)	Pop. Enhanc. (sea-run)
508	Green Lake NFH (ME)	Penobscot R.	Smolt	Y	567,300	Final Disp. (ME)	Pop. Enhanc. (sea-run)
506	Craig Brook NFH (ME)	Dennys wild	Adults	Y	80	Final Disp. (ME)	Pop. Enhanc. (sea-run)
503	Craig Brook NFH (ME)	Dennys wild	Parr	Y	3,000	Final Disp. (ME)	Pop. Enhanc. (sea-run)
502	Craig Brook NFH (ME)	Machias wild	Parr	Y	1,000	Final Disp. (ME)	Pop. Enhanc. (sea-run)
512	Green Lake NFH (ME)	Penobscot R.	Parr	Y	92,100	Final Disp. (ME)	Pop. Enhanc. (sea-run)
500	Craig Brook NFH (ME)	Dennys wild	Fry	Y	172,400	Final Disp. (ME)	Pop. Enhanc. (sea-run)
498	Craig Brook NFH (ME)	East Machias wild	Parr	Y	1,000	Final Disp. (ME)	Pop. Enhanc. (sea-run)

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use
497	Craig Brook NFH (ME)	East Machias wild	Fry	Y	210,000	Final Disp. (ME)	Pop. Enhanc. (sea-run)
495	Craig Brook NFH (ME)	Sheepscot wild	Fry	Y	301,500	Final Disp. (ME)	Pop. Enhanc. (sea-run)
494	Craig Brook NFH (ME)	Narraguagus wild	Fry	Y	155,000	Final Disp. (ME)	Pop. Enhanc. (sea-run)
501	Craig Brook NFH (ME)	Machias wild	Fry	Y	118,300	Final Disp. (ME)	Pop. Enhanc. (sea-run)
514	Green Lake NFH (ME)	Penobscot R.	Parr	Y	231,100	Final Disp. (ME)	Pop. Enhanc. (sea-run)
515	Green Lake NFH (ME)	Penobscot R.	Fry	Y	160,400	Final Disp. (ME)	Pop. Enhanc. (sea-run)
523	Green Lake NFH (ME)	Penobscot R.	Smolt	Y	50,600	Final Disp. (ME)	Pop. Enhanc. (sea-run)
654	Unspecified private facility	Landcatch-hybr id	Smolt	Y	306,900	Final Disp. (ME)	Aquaculture (sea pen)
513	Green Lake NFH (ME)	Penobscot R.	Parr	Y	47,000	Final Disp. (ME)	Pop. Enhanc. (sea-run)
496	Craig Brook NFH (ME)	Narraguagus wild	Parr	Y	18,200	Final Disp. (ME)	Pop. Enhanc. (sea-run)
505	Craig Brook NFH (ME)	Dennys wild	Eggs	Y	112,900	Gov-Federal (US)	Pop. Enhanc. (sea-run)
504	Craig Brook NFH (ME)	Penobscot R.	Eggs	Y	1,547,300	Gov-Federal (US)	Pop. Enhanc. (sea-run)
653	Stofnfiskur Ltd. (ICE)	European/Icela ndic	Milt	Y	0	Private	Aquaculture (sea pen)
507	Green Lake NFH (ME)	Penobscot R.	Eggs	Y	765,000	Private	Pop. Enhanc. (sea-run)
561	Mactaquac Hatchery (NB)	St John R	Eggs	Y	200,000	Private	Pop. Enhanc. (sea-run)
RAINBOW TROUT							
556	Erwin NFH (TN)	Unknown	Eggs	Y	15,000	Gov-State	Pop. Enhanc. (Inland)
557	Trout Lodge (WA)	Unknown	Eggs	Y	25,000	Private	Research/Education
559	Quinebaugh SFH (CT)	Kamloops	Eggs	Y	75,000	Private	Aquaculture (misc. inland)
558	Pisciculture St Damien (QUE)	Donaldson	Eggs	N	125,000	Private	Aquaculture (FW pen)
560	Pisciculture St Damien (QUE)	Donaldson	Eggs	Y	100,000	Private	Aquaculture (misc. inland)
MASSACHUSETTS							
ATLANTIC SALMON							
652	White River NFH (VT)	Penobscot R.	Fry	Y	579,000	Final Disp. (MA)	Pop. Enhanc. (sea-run)
521	Nashua NFH (NH)	Penobscot R.	Pre-smolt	Y	4,600	Final Disp. (MA)	Pop. Enhanc. (sea-run)

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use
520	Nashua NFH (NH)	Penobscot R.	Eggs	Y	2,558,000	Gov-Federal (US)	Pop. Enhanc. (sea-run)
522	Nashua NFH (NH)	Penobscot R.	Adults	Y	50	Gov-Federal (US)	Brood Stock Dev.
519	White River NFH (VT)	Penobscot R.	Eggs	Y	860,000	Gov-State	Pop. Enhanc. (sea-run)
RAINBOW TROUT							
516	White Sulphur Springs (WV)	Domestic	Eggs	Y	5,000	Gov-Federal (US)	Pop. Enhanc. (Inland)
518	White Sulphur Springs (WV)	Domestic	Eggs	Y	200,000	Gov-State	Pop. Enhanc. (Inland)
517	White Sulphur Springs (WV)	Domestic	Eggs	Y	900,000	Gov-State	Pop. Enhanc. (Inland)
NEW BRUNSWICK							
ARTIC CHAR							
616	Atlantic Sea Smolt (PEI)	Unknown	Eggs	Y	350,000	Private	Aquaculture (Unspecified)
589	Icy Waters (YUK)	Unknown	Eggs	Y	250,000	Private	Aquaculture (Unspecified)
ATLANTIC SALMON							
599	Atlantic Sea Smolt (PEI)	Unknown	Fish	Y	300	Gov-Federal (Can)	Bio-monitoring
588	Strickland Salmon (NS)	St John R	Smolt	Y	110,000	Private	Aquaculture (Unspecified)
620	Gardner Lake Hatchery (ME)	St John R	Fish	Y	60,000	Private	Aquaculture (Unspecified)
617	Rogers Island Site (ME)	St John R	Eggs	Y	500,000	Private	Aquaculture (Unspecified)
613	Broad Cove Cage Site (ME)	St John R	Eggs	Y	850,000	Private	Brood Stock Dev.
611	Rogers Island Site (ME)	St John R	Eggs	Y	500,000	Private	Brood Stock Dev.
598	Bingham Aquaculture Ltd. (ME)	St John R	Fry	Y	500,000	Private	Aquaculture (Unspecified)
592	Merlin Fish Farms (NS)	Unknown	Smolt	Y	45,000	Private	Aquaculture (sea pen)
600	Connors Aquaculture (ME)	St John R	Fry	Y	400,000	Private	Aquaculture (Unspecified)
590	Merlin Fish Farms (NS)	Unknown	Smolt	Y	700,000	Private	Aquaculture (Unspecified)
603	Rogers Island Site (ME)	St John R	Eggs	Y	4,000,000	Private	Aquaculture (Unspecified)
621	AKM Fisheries (NS)	St John R	Smolt	Y	180,000	Private	Aquaculture (Unspecified)
605	Rogers Island Site (ME)	St John R	Eggs	Y	1,300,000	Private	Aquaculture (Unspecified)

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use
614	Broad Cove Cage Site (ME)	St John R	Eggs	Y	1,400,000	Private	Aquaculture (Unspecified)
582	Bingham Aquaculture Ltd. (ME)	St John R	Smolt	Y	100,000	Private	Aquaculture (Unspecified)
609	Broad Cove Cage Site (ME)	St John R	Eggs	Y	6,000,000	Private	Aquaculture (Unspecified)
591	Merlin Fish Farms (NS)	Unknown	Smolt	Y	45,000	Private	Aquaculture (sea pen)
612	Broad Cove Cage Site (ME)	St John R	Eggs	Y	5,500,000	Private	Aquaculture (Unspecified)
610	Aqua Bounty Farms (PEI)	St John R	Fish	Y	480	Research/Educ.	Unspecified
BROOK TROUT							
615	Pisciculture St Damien (QUE)	Unknown	Eggs	Y	30,000	Private	Aquaculture (Unspecified)
607	Pisciculture St Damien (QUE)	Unknown	Eggs	Y	30,000	Private	Aquaculture (Unspecified)
618	Pisciculture St Damien (QUE)	Unknown	Eggs	Y	30,000	Private	Aquaculture (Unspecified)
RAINBOW TROUT							
587	Rainbow Springs Hatchery (ONT)	Unknown	Eggs	Y	2,000	Gov-Federal (Can)	Bio-monitoring
619	Rainbow Springs Hatchery (ONT)	Unknown	Fish	Y	1,500	Gov-Federal (Can)	Bio-monitoring
601	Rainbow Springs Hatchery (ONT)	Unknown	Fish	Y	1,500	Gov-Federal (Can)	Bio-monitoring
597	Rainbow Springs Hatchery (ONT)	Unknown	Fish	Y	1,500	Gov-Federal (Can)	Bio-monitoring
593	Rainbow Springs Hatchery (ONT)	Unknown	Eggs	Y	3,000	Gov-Federal (Can)	Bio-monitoring
585	Rainbow Springs Hatchery (ONT)	Unknown	Fish	Y	1,500	Gov-Federal (Can)	Bio-monitoring
594	Rainbow Springs Hatchery (ONT)	Unknown	Eggs	Y	3,000	Gov-Federal (Can)	Bio-monitoring
584	Rainbow Springs Hatchery (ONT)	Unknown	Fish	Y	1,000	Gov-Federal (Can)	Bio-monitoring
583	Rainbow Springs Hatchery (ONT)	Unknown	Fish	Y	1,500	Gov-Federal (Can)	Aquaculture (Unspecified)
595	Pisciculure St Philemon (QUE)	Unknown	Fish	Y	680	Private	Aquaculture (Unspecified)
606	Pisciculture St Damien (QUE)	Unknown	Eggs	Y		Private	Aquaculture (Unspecified)
580	Pisciculture St Damien (QUE)	Unknown	Eggs	Y	15,000	Private	Aquaculture (Unspecified)
596	Atlantic Sea Smolt (PEI)	Unknown	Fish	Y	1,500	Private	Bio-monitoring
604	Trout Lodge (WA)	Unknown	Eggs	Y	125,000	Private	Aquaculture (Unspecified)
586	Pisciculture St Damien (QUE)	Unknown	Eggs	Y	20,000	Private	Aquaculture (Unspecified)

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use
602	Big Falls Fish Growers (NS)	Unknown	Fish	Y	20,000	Private	Aquaculture (Unspecified)
NEW HAMPSHIRE							
ATLANTIC SALMON							
650	White River NFH (VT)	Penobscot R.	Fry	Y	1,002,000	Final Disp. (NH)	Pop. Enhanc. (sea-run)
528	North Attleboro NFH (MA)	Penobscot R.	Fry	Y	544,800	Final Disp. (NH)	Pop. Enhanc. (sea-run)
529	Nashua NFH (NH)	Penobscot R.	Fry	Y	13,500	Final Disp. (NH)	Pop. Enhanc. (sea-run)
531	Nashua NFH (NH)	Penobscot R.	Adults	Y	2,214	Final Disp. (NH)	Pop. Enhanc. (sea-run)
532	Green Lake NFH (ME)	Penobscot R.	Eggs	Y	6,000	Gov-Federal (US)	Brood Stock Dev.
563	Bingham Aquaculture Ltd. (ME)	St John R	Eggs	Y	300,000	Gov-State	Pop. Enhanc. (sea-run)
527	North Attleboro NFH (MA)	Penobscot R.	Eggs	Y	1,534,500	Gov-State	Pop. Enhanc. (sea-run)
530	Nashua NFH (NH)	Penobscot R.	Adults	Y	487	Gov-State	Pop. Enhanc. (sea-run)
562	Atlantic Salmon of Maine-Solon (ME)	Landcatch-hybrid	Fry	Y	220,000	Private	Aquaculture (sea pen)
572	Atlantic Salmon of Maine-Oquossoc (ME)	Landcatch-hybrid	Fry	Y	208,000	Private	Aquaculture (sea pen)
BROOK TROUT							
571	Pisciculture Lac St-Francois (QUE)	Unknown	Sub-Adult	Y	10,000	Private	Aquaculture (misc. inland)
BROWN TROUT							
567	Fraser Mills (NS)	Unknown	Eggs	Y	8,000	Gov-State	Pop. Enhanc. (sea-run)
RAINBOW TROUT							
566	Ennis NFH (MT)	Erwin	Eggs	Y	308,000	Gov-State	Pop. Enhanc. (Inland)
565	White Sulphur Springs (WV)	Erwin	Eggs	Y	200,000	Gov-State	Pop. Enhanc. (Inland)
524	White Sulphur Springs (WV)	Domestic	Eggs	Y	1,000,000	Gov-State	Pop. Enhanc. (Inland)
525	White Sulphur Springs (WV)	Domestic	Eggs	Y	8,000	Gov-State	Brood Stock Dev.
564	Salisbury SFH (VT)	Wytherille	Eggs	Y	14,499	Gov-State	Brood Stock Dev.
568	Pisciculture St Damien (QUE)	Unknown	Eggs	Y	100,000	Private	Aquaculture (misc. inland)

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use
569	Rainbow Springs Hatchery (ONT)	Stevenson	Sub-Adult	Y	5,000	Private	Aquaculture (misc. inland)
570	Sea Run Hatchery (ME)	Donaldson	Sub-Adult	Y	1,200	Unknown	Aquaculture (misc. inland)
NEW YORK							
ATLANTIC SALMON							
539	Allegheny NFH (PA)	Penobscot R.	Fry	Y	12,000	Final Disp. (NY)	Pop. Enhanc. (Inland)
538	Allegheny NFH (PA)	Penobscot R.	Fry	Y	7,250	Gov-Federal (US)	Research/Education
KOKANEE SALMON							
573	Burlington Hatchery (CT)	Unknown	Eggs	Y	101,000	Gov-State	Pop. Enhanc. (Inland)
LAKE TROUT							
540	Allegheny NFH (PA)	Unknown	Parr	Y	594,000	Final Disp. (NY)	Pop. Enhanc. (Grt Lks)
LANDLOCKED							
535	Allegheny NFH (PA)	W. Grand Lk.	Fry	Y	20,000	Final Disp. (NY)	Pop. Enhanc. (Inland)
533	Allegheny NFH (PA)	Unknown	Adults	Y	258	Final Disp. (NY)	Pop. Enhanc. (Grt Lks)
536	Allegheny NFH (PA)	W. Grand Lk.	Adults	Y	5,780	Final Disp. (NY)	Pop. Enhanc. (Inland)
537	Allegheny NFH (PA)	W. Grand Lk.	Fry	Y	44,000	Gov-Federal (US)	Research/Education
534	Allegheny NFH (PA)	Unknown	Adults	Y	440	Research/Educ.	Research/Education
RAINBOW TROUT							
541	White Sulphur Springs (WV)	Domestic	Eggs	Y	130,000	Gov-State	Pop. Enhanc. (Inland)
542	White Sulphur Springs (WV)	Domestic	Eggs	Y	75,000	Gov-State	Pop. Enhanc. (Inland)
543	White Sulphur Springs (WV)	Domestic	Eggs	Y	10,000	Research/Educ.	Bio-monitoring
544	White Sulphur Springs (WV)	Domestic	Eggs	Y	15,000	Research/Educ.	Research/Education

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use
NEWFOUNDLAND							
ARTIC CHAR							
488	Pisciculture Alleghanys (QUE)	Unknown	Eggs	Y	50,000	Research/Educ.	Research/Education
ATLANTIC SALMON							
477	Connors Aquaculture (ME)	St John	Parr	Y	100,000	Private	Aquaculture (sea pen)
BROOK TROUT							
479	Atlantic Sea Smolt (PEI)	Unknown	Unknown	Y	3,000	Private	Aquaculture (misc. inland)
487	Pisciculture Alleghanys (QUE)	Unknown	Milt	Y	6	Research/Educ.	Research/Education
RAINBOW TROUT							
482	Pisciculture Alleghanys (QUE)	Unknown	Eggs	N	15,000	Private	Aquaculture (misc. inland)
481	Atlantic Sea Smolt (PEI)	Unknown	Sub-Adult	N	8,000	Private	Aquaculture (misc. inland)
484	Rainbow Springs Hatchery (ONT)	Unknown	Unknown	N	20,000	Private	Aquaculture (Unspecified)
476	Big Falls Fish Growers (NS)	Unknown	Parr	Y	700,000	Private	Aquaculture (sea pen)
480	Sugarloaf Fish Farm (NS)	Unknown	Unknown	Y	12,600	Private	Aquaculture (sea pen)
483	Atlantic Sea Smolt (PEI)	Unknown	Unknown	N	30,000	Private	Aquaculture (misc. inland)
485	Atlantic Sea Smolt (PEI)	Unknown	Unknown	N	100	Private	Bio-monitoring
478	Trout Lodge (WA)	Unknown	Eggs	Y	500,000	Private	Aquaculture (sea pen)
473	Atlantic Sea Smolt (PEI)	Unknown	Parr	N	1,500	Private	Aquaculture (misc. inland)
489	Atlantic Sea Smolt (PEI)	Unknown	Unknown	Y	100	Private	Bio-monitoring
NOVA SCOTIA							
ARTIC CHAR							
628	Pisciculture St Damien (QUE)	Unknown	Eggs	Y	50,000	Private	Aquaculture (Unspecified)

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use
608	Pisciculture St Damien (QUE)	Unknown	Eggs	Y	100,000	Private	Aquaculture (Unspecified)
629	Pisciculture St Damien (QUE)	Unknown	Eggs	Y	25,000	Private	Aquaculture (Unspecified)
631	Pisciculture St Damien (QUE)	Unknown	Fish	Y	25,000	Private	Aquaculture (Unspecified)
ATLANTIC SALMON							
627	Maine Aqua Foods Inc (ME)	St John R	Eggs	Y	3,000,000	Private	Aquaculture (Unspecified)
642	Bingham Aquaculture Ltd. (ME)	St John R	Eggs	Y	200,000	Private	Aquaculture (Unspecified)
643	Atlantic Sea Smolt (PEI)	St John R	Fish	Y	400,000	Private	Aquaculture (Unspecified)
626	Oak Bay Hatchery (NB)	St John R	Smolt	Y	180,000	Private	Aquaculture (sea pen)
622	Stolt Sea Farms (NB)	St John R	Fish	Y	250,000	Private	Aquaculture (Unspecified)
649	Atlantic Sea Smolt (PEI)	St John R	Milt	Y	100	Private	Aquaculture (Unspecified)
RAINBOW TROUT							
632	Rainbow Springs Hatchery (ONT)	Unknown	Eggs	Y	100,000	Gov-Provincial	Pop. Enhanc. (Inland)
634	Trout Lodge (WA)	Unknown	Eggs	Y	600,000	Private	Aquaculture (Unspecified)
637	Trout Lodge (WA)	Unknown	Eggs	Y	375,000	Private	Aquaculture (Unspecified)
640	Trout Lodge (WA)	Unknown	Eggs	Y	3,000,000	Private	Aquaculture (Unspecified)
641	Trout Lodge (WA)	Unknown	Eggs	Y	2,500,000	Private	Aquaculture (Unspecified)
635	Trout Lodge (WA)	Unknown	Eggs	Y	459,000	Private	Aquaculture (Unspecified)
636	Trout Lodge (WA)	Unknown	Eggs	Y	417,000	Private	Aquaculture (Unspecified)
638	Trout Lodge (WA)	Unknown	Eggs	Y	250,000	Private	Aquaculture (Unspecified)
639	Pisciculure St Philemon (QUE)	Unknown	Fish	Y	65,000	Private	Aquaculture (Unspecified)
645	Atlantic Sea Smolt (PEI)	Unknown	Eggs	Y	60,000	Private	Aquaculture (Unspecified)
644	Atlantic Sea Smolt (PEI)	Unknown	Fish	Y	60,000	Private	Aquaculture (Unspecified)
648	Rainbow Springs Hatchery (ONT)	Unknown	Eggs	Y	40,000	Private	Aquaculture (Unspecified)
630	Trout Lodge (WA)	Unknown	Eggs	Y	200,000	Private	Aquaculture (Unspecified)
647	Trout Lodge (WA)	Unknown	Eggs	Y	100,000	Private	Aquaculture (Unspecified)
625	Trout Lodge (WA)	Unknown	Eggs	Y	333,000	Private	Aquaculture (Unspecified)

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use
624	Trout Lodge (WA)	Unknown	Eggs	Y	334,000	Private	Aquaculture (Unspecified)
633	Trout Lodge (WA)	Unknown	Eggs	Y	217,000	Private	Aquaculture (Unspecified)
623	Trout Lodge (WA)	Unknown	Eggs	Y	344,000	Private	Aquaculture (Unspecified)
646	Atlantic Sea Smolt (PEI)	Unknown	Eggs	Y	60,000	Private	Aquaculture (Unspecified)
ONTARIO							
ARTIC CHAR							
456	Pisciculture Alleghanys (QUE)	Unknown	Fry	Y	40,000	Private	Unspecified
465	Pisciculture Alleghanys (QUE)	Unknown	Eggs	Y	200,000	Private	Unspecified
457	Atlantic Sea Smolt (PEI)	Unknown	Fry	Y	40,000	Private	Unspecified
RAINBOW TROUT							
458	Trout Lodge (WA)	Unknown	Eggs	Y	250,000	Private	Unspecified
459	Trout Lodge (WA)	Unknown	Eggs	Y	155,000	Private	Unspecified
455	Pisciculture Alleghanys (QUE)	Unknown	Eggs	Y	170,000	Private	Unspecified
460	Troutsprings (WA)	Unknown	Eggs	Y	105,000	Private	Unspecified
461	Troutsprings (WA)	Unknown	Eggs	Y	105,000	Private	Unspecified
462	Troutsprings (WA)	Unknown	Eggs	Y	105,000	Private	Unspecified
464	Troutsprings (WA)	Unknown	Eggs	Y	85,000	Private	Unspecified
452	Pisciculture Alleghanys (QUE)	Unknown	Eggs	Y	150,000	Private	Unspecified
463	Pisciculture Alleghanys (QUE)	Unknown	Eggs	Y	275,000	Private	Unspecified
454	Pisciculture Alleghanys (QUE)	Unknown	Eggs	Y	210,000	Private	Unspecified
466	Pisciculture Alleghanys (QUE)	Unknown	Eggs	Y	50,000	Private	Unspecified
453	Pisciculture Alleghanys (QUE)	Unknown	Eggs	Y	170,000	Private	Unspecified

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use
PENNSYLVANIA							
RAINBOW TROUT							
553	White Sulphur Springs (WV)	Domestic	Eggs	N	400	Gov-Federal (US)	Unspecified
554	White Sulphur Springs (WV)	Domestic	Parr	Y	6,500	Gov-Federal (US)	Unspecified
PRINCE EDWARD ISLAND							
ARTIC CHAR							
579	Pisciculture St Damien (QUE)	Unknown	Milt	Y	1	Private	Aquaculture (Unspecified)
RAINBOW TROUT							
581	Pisciculture St Damien (QUE)	Unknown	Eggs	Y	70,000	Private	Aquaculture (Unspecified)
576	Trout Lodge (WA)	Unknown	Eggs	N	35,000	Private	Aquaculture (Unspecified)
577	Trout Lodge (WA)	Unknown	Eggs	Y	35,000	Private	Aquaculture (Unspecified)
578	Trout Lodge (WA)	Unknown	Eggs	Y	75,000	Private	Aquaculture (Unspecified)
QUEBEC							
ARTIC CHAR							
467	Icy Waters (YUK)	Unknown	Eggs	Y	75,000	Private	Aquaculture (misc. inland)
471	Icy Waters (YUK)	Unknown	Eggs	Y	50,000	Private	Aquaculture (misc. inland)
RAINBOW TROUT							
469	Rainbow Springs Hatchery (ONT)	Unknown	Fry	Y	1,000	Gov-Provincial	Bio-monitoring
468	Trout Lodge (WA)	Unknown	Eggs	Y	50,000	Private	Aquaculture (misc. inland)
470	Rainbow Springs Hatchery (ONT)	Unknown	Fry	Y	1,500	Private	Bio-monitoring
545	North Attleboro NFH (MA)	Penobscot R.	Fry	Y	627,600	Final Disp. (RI)	Pop. Enhanc. (sea-run)

File #	Facility Of Origin	Stock/Strain	LifeStage	Reprod.	Number Shipped	Receiving Facility Type	Planned Use
RHODE ISLAND							
ATLANTIC SALMON							
574	White River NFH (VT)	Domestic	Sub-Adult	Y	650	Gov-State	Pop. Enhanc. (Inland)
VERMONT							
ATLANTIC SALMON							
547	White River NFH (VT)	Penobscot R.	Smolt	Y	1,100	Final Disp. (VT)	Bio-monitoring
575	Roxbury SFH (VT)	Connecticut R.	Fry	Y	27,600	Final Disp. (VT)	Pop. Enhanc. (sea-run)
651	White River NFH (VT)	Penobscot R.	Fry	Y	2,640,000	Final Disp. (VT)	Pop. Enhanc. (sea-run)
549	Whittemore SFH (CT)	Penobscot R.	Eggs	Y	559,600	Gov-Federal (US)	Pop. Enhanc. (sea-run)
548	Roger Reed SFH (MA)	Penobscot R.	Eggs	Y	822,400	Gov-Federal (US)	Pop. Enhanc. (sea-run)
551	North Attleboro NFH (MA)	Penobscot R.	Eggs	Y	1,070,300	Gov-Federal (US)	Pop. Enhanc. (sea-run)
550	White River NFH (VT)	Penobscot R.	Eggs	Y	116,800	Gov-Federal (US)	Pop. Enhanc. (sea-run)
546	Richard Cronin NFH (MA)	Penobscot R.	Eggs	Y	786,800	Gov-Federal (US)	Pop. Enhanc. (sea-run)

APPENDIX II

Observations of Rainbow Trout (*Oncorhynchus mykiss)* in Newfoundland 1976 to 1999

Compiled by: T. R. Porter

- Rainbow trout are not native to Newfoundland. Populations were established through stocking programs in the late 1800s and early 1900s in several small watersheds on the Northeast Avalon Peninsula, several small streams in the Clarenville area, Shalloway Pond Brook (Placentia Bay) and a watershed at Tilt Cove, Baie Verte Peninsula (Table 1). These populations are freshwater resident populations, other than the populations near Clarenville and Shalloway Pond Brook, which are known to have an anadromous component.

- A small aquaculture operation for rainbow trout was established at Hopeall, Trinity Bay, in the mid-1970's. The initial broodstock was resident wild populations from the Northeast Avalon Peninsula. Anglers captured rainbow trout that had escaped from cage rearing operations in the late 1970's and 1980's. Few rainbow trout are being angled in recent years.

- There are no known reports of rainbow trout being observed outside these areas before 1979.

- From 1979 to 1995, small numbers of rainbow trout have been reported captured on the West Coast of NF (Table 2).

- On the south coast triploid rainbow trout have been observed in rivers in Bay d'Espoir since 1990 shortly after marine cage rearing of triploid rainbow trout began in the late 1980s. The first reported occurrence of rainbow trout on the South Coast outside Bay d'Espoir occurred in 1998 (Table 2).

- The distribution of rainbow trout in rivers along the South and West coasts of Newfoundland that contain Atlantic salmon populations appear to be more extensive in 1999 than in previous years.

- There were observations or reports of rainbow trout in 6 rivers on the West Coast of Newfoundland in 1999 (Table 2).

- On the South coast, rainbow trout were angled in 5 rivers as well as captured in a commercial fishermen's bait net (Table 2)

- Only one specimen (Trout River) was biologically sampled, in 1999. It was 25 cm in length and sexed as an immature female.

- There is no definitive evidence to confirm the origin of the rainbow trout observed. The circumstantial evidence would suggest that some, if not all, of those fish on the West Coast of Newfoundland are of Maritime origin. The evidence is as follows: 1) there are no known populations established on the West Coast; 2) some occurrences were before the development of the aquaculture industry in Bay d'Espoir; 3) some of the specimens that were sampled were identified as diploid male rainbow trout; 4) marine cage in Bay d'Espoir have used all-female triploid rainbow trout.

- There is concern that straying of reproductively viable diploid rainbow of both sexes from the Maritimes could result in the successful establishment of rainbow trout in Newfoundland, particularly on the West Coast where environmental conditions are most conducive to successful reproduction. The risk of such an occurrence would increase with the marine cage rearing of all-female diploid rainbow trout in Newfoundland. Colonisation of rainbow trout could have a serious negative impact on the productivity of indigenous Atlantic salmon and brook trout populations.

Table 1. Areas where rainbow trout are known to have established populations**.**

Map #	Year	Location	**Comments**
21	Late 1800's	Several small steams and ponds NE Avalon	Population established from stocking in late 1800's and early 1900's.
23	Early 1900's	Shoal Harbour Bk, Georges Bk, lower Shoal Harbour Bk, Adeytown Bk.	Population established from stocking in early 1900's. Samples collected in 1974. One male trout found dead in lower Shoal Harbour River July 6, 1984
24	Early 1900's	One watershed at Tilt Cove	Population established from stocking. Date unknown. Samples collected in 1987
19	Early 1900's	Shalloway Pond Brook	Population established from stocking. Date unknown

Table 2. Observed and reported occurrences of rainbow trout outside river systems where there are established populations.

Map #	Year	**Location**	Sex	Number	Comments
22	1976–85	Steams near Hopeall			Angled during late 1970's and early 1980's. Assumed to be escapes from aquac
1	1979	Watt's Bight Brook	M (1) (external)	3	Angled (late May)
4	1980	Ocean - Daniels Harbour	M (internal)	1	Caught in commercial salmon net July 2, 1980
8	1980	Serpentine River		2	Angled in early July
6	1981	Trout River	F (1) (external)	4	Angled in early September. One fish sampled. definitely hatchery origin
2	1985-95	River of Ponds			Fisheries Officer reports rainbow trout have been angled in Aug in lower part of river1985-95, average weight 1.5-2 lbs
15	1990	Conne River		3	1 – downstream trap; 1 – upstream trap 1- found dead on beach
15	1991	Conne River		47	18 angled; 3 – upstream trap; 5 – downstream trap; 21 observed in river. There maybe some double counting.
15	1992	Conne River		3	2 in downstream and 1 in upstream trap
15	1993	Conne River		11	8 in downstream and 3 in upstream trap.
	1994	Conne River		13	6 in downstream and 5 in upstream trap; 2 captured electrofishing
15	1995	Conne River		39	5 in downstream and 16 in upstream trap; 16 underwater observations; 2 dead on fence. There maybe some double counting.
2	1995	River of Ponds	M (1)	3	Angled in August. Only one sampled
5	1995	Parsons Pond			Angled
9	1995	Flat Bay Brook	M (1)	1	Caught in upstream trap. 38.7 cm
15	1996	Conne River		41	2 in downstream and 16 in upstream trap; 22 observed underwater; 1- mortality at fence. There maybe some double counting.
16	1996	Little River		5	5 in upstream trap
15	1997	Conne River		61	5 in downstream and 3 in upstream trap; 51 observed underwater; 2- mortality at fence. There maybe some double counting.
15	1998	Conne River		27	1 in downstream and 3 in upstream trap; 21 observed underwater; 2- mortality at fence. There maybe some double counting.
17	1998	Long Harbour River		1+	Angled in lower river.
18	1998	Grand Bank Bk		1+	Several angled in estuary
20	1998	Biscay Bay Bk		2	Angled in lower river.
2	1999	River of Ponds		24	Angled
3	1999	Portland Creek		1	Angled
6	1999	Trout River	F (1)	1+	Several angled in August
7	1999	Humber River		3	Angled
9	1999	Flat Bay Brook		2	Observed during spawner survey
10	1999	Robinsons River		2	Observed during spawner survey
11	1999	Marine, near Burnt Island		6 or 7	Caught in commercial bait net

Table 2 con't. Observed and reported occurrences of rainbow trout outside river systems where there are established populations.

Map #	Year	**Location**	Sex	Number	Comments
13	1999	La Poile River		3	Angled
12	1999	Garia Brook		3	Angled
15	1999	Conne River		3 18	Upstream trap Angled April 23- Aug 12
14	1999	Marine Bay d'Espoir and streams flowing into Bay d'Espoir		3,650	Angled trout reported by Guardians
16	1999	Little River		1	Upstream trap

APPENDIX III

Status of Salmon Swimbladder Sarcoma Virus (SSSv) - Spring 2000

Background

In April 1999 Polymerase Chain Reaction (PCR) tests detected pro-viral DNA indicating infection with Salmon Swimbladder Sarcoma Virus (SSSv) in 7 Atlantic salmon (ATS) at Craig Brook National Fish Hatchery (CBNFH), East Orland, Maine. These fish were part of a group of fish capture in the wild as parr and held as captive stocks for Maine's Downeast River Program. Random samples from each river stock were tested because clinical signs of an unknown disease were observed in captive Pleasant River stocks held in isolation at the North Attleboro National Fish Hatchery (NANFH), Massachusetts from 1996 to 1998. Clinical signs at NANFH included hemorrhaging around the fins, patches on the skin, large tumors on the swimbladder, and lethargy. These fish suffered mortalities exceeding 20% in 1997 and 1998 and a virus, later named SSSv, was isolated from swimbladder tumors by Cornell University researchers. This lot of Pleasant River fish was held at NANFH because CBNFH was already holding wild stocks from five other river populations and did not have space enough to hold this sixth stock in isolation. The disease occurrence in this stock sparked concern that the fish had been infected in their home river in Maine, and that other Downeast River Atlantic salmon may be carrying the virus as well. Although no clinical signs had been observed in any captive stocks at CBNFH, those fish were tested to determin if the viral agent believed to cause the condition in the Pleasant River stocks at NANFH existed in other river stocks collected from the wild. The Pleasant River fish were depopulated from NANFH and 40 fish showing clinical signs were transported live to Leetown National Fish Health Research Lab for further study. The remaining fish were destroyed. As of May, 2000 there has been no clinical signs of the disease observed in any other salmon.

Wild salmon are held for egg production following their capture as parr from their respective rivers. Fish are held in isolation for one year before being moved to production raceways earmarked for specific river stocks. Eggs from each river stock are incubated in separate rooms. CBNFH is presently undergoing construction of an adult broodstock facility which will meet complete isolation requirements for each of the rivers involved in the Downeast River specific broodstock program.

Species of Fish Affected: Wild Atlantic salmon (*Salmo salar*) from the Pleasant River, Maine, are the only fish to exhibit disease believed to be caused by SSSv. Wild fish captured from the Dennys River, Narraguagus River, East Machias, Machias Rivers, and Sheepscot River as well as hatchery-origin Penobscot River stock have been tested for the presence of the SSSv usin PCR technology by Cornell University. The virus was found in carrier state in < 1% of fish sampled from the Penobscot, Machias, East Machias and Narraguagus Rivers.

Age of fish affected: Both captive wild parr, adults and captive sea run fish have been found to be infected. Test of fry from all rivers in 1999 were negative. No SSSv was detected in smolt lots which were obtained as eggs from CBNFH Downeast stocks and reared at two private aquaculture facilities.

Prevalence: PCR tests performed on blood from ATS at CBNFH in March 1999 and September 1999 showed that less than 1% (0.8-0.9%) of the total number of Downeast river captive adults at CBNFH tested positive for SSSv (see Table below). Positive findings are not consistent among any particular stock. In addition, two captive adults which tested positive in March 1999, tested negative in September.

Other samples tested from CBNFH since March 1999 include 60 fry from the Machias and East Machias lots as well as 60 fry from 1998 Penobscot River sea runs (the broodstock of which had not been tested for SSSv). Fry heart tissues were pooled and tested and found negative prior to fry releases.

Results of Blood Testing using Polymerase Chain Reaction (PCR) for detection of Salmon Swimbladder Sarcoma virus performed on Atlantic salmon stocks at Craig Brook National Fish Hatchery in 1999

	MARCH 1999			SEPTEMBER 1999		
Group Tested	**Population**	**# Tested**	**Positive Results**	**Spawning Population**	**# Tested**	**Pos. Results**
Dennys Captive Adult	233	50	-	107	107	-
Narraguagus Capt. Adult	514	55	-	308	308	5
E.Machias Captive Adult	279	50	1	147	147	-
Sheepscot Captive Adult	232	50	-	148	148	-
Machias Captive Adult	456	55	1	295	295	2
Dennys Captive Smolt	150	50	-		NT	
Narrag. Captive Smolt	241	50	1		NT	
E.Machias Captive Smolt	142	50	-		NT	
Sheepscot Captive Smolt	142	50	-		NT	
Machias Catpive Smolt	248	50	4		NT	
Dennys Searun Kelts	-	NT		7	7	-
Sheepscot Searun Kelts	-	NT		16	16	2
Penobscot Sea Runs	-	NT		460	60	2

NT - No Test performed.

In September of 1999, all individual fish (bearing identifying tags) of wild stock origin used to meet egg production needs for each river system were tested. Any positive fish were removed from the spawning population. Also, 60 Penobscot 2SW broodstock (originally released as hatchery smolt in 1997) were sampled from the recaptured spawning population of 460 at CBNFH. Two of 60 Penobscot 2SW fish sampled tested positive by PCR for SSSv, indicating a low level of prevalence of SSSv in the Penobscot sea run adults.

Pathogen Status: Salmon Swimbladder Sarcoma virus (SSSv) is in the class of retro viruses that are rarely vertically transmitted. Clinical signs of disease**,** as noted in the Pleasant River fish prior to death, have not been seen in fish at Craig Brook NFH. Very little is presently known about this virus. The following outlines information that has been gathered to date, as well as some speculations offered by Cornell University experts:

1. Mode of Transmission -
    a. To date, horizontal transmission studies at Leetown NFHRL using NANFH Pleasant River ATS surviving the SSSv outbreak in cohabitation with brook trout and ATS have indicated very low horizontal transmission to ATS only.
    b. Testing results of fish held several years at CBNFH indicate a very slow rate of horizontal transmission, if any, among salmon reared reared under typical culture conditions.
    c. Vertical transmission has not yet been established - to date, no hatchery produced offspring (fry and smolt) from CBNFH broodstock have tested positive for SSSv.

2. Epizootiology - UNKNOWN

3. Virulence -

a. Mortality among Pleasant River stocks at NANFH were at a low level and chronic, but over time exceeded 20% of the sub-adult population in 1997 and 1998.
b. Detection level at CBNFH is less than 1% of total ATS captive population from all Downeast stocks combined, with no clinical signs as observed at NANFH.

4. Seasonality -
   a. Detection of the virus in individual fish varies over time. Detection of SSSv in Pleasant River fish moved from NANFH to Leetown Laboratory dropped dramatically following their transfer. Two captive adults which tested positive at CBNFH in March tested negative 6 months later, just prior to spawning.
   b. Speculation that spawning and/or other stresses may be factors influencing detection of virus, evident by the mortality pattern observed in Pleasant river stocks at NANFH.
   c. Table (above) indicates that during March sampling, smolt groups appeared to exhibit greater detectable prevalence, while adults in September showed an increase in detectable prevalence just prior to spawning.

5. Distribution in the wild -
   a. UNKNOWN but experts at Cornell University suspect wide distribution in the environment.

6. Species specificity - UNKNOWN but suspect specificity to *Salmo salar*

7. Detection on Cell Culture - NOT at present; development in progress.

8. Detection Methods Available - PCR ONLY (test not validated)

9. Confirmation test available - NO

10. Rivers' Postulates fulfilled - NO

Actions being taken to contain/eradicate the pathogen

SSSv Management Plan for CBNFH

1. Testing of spawning Downeast River broodstock prior to spawn
   a. All river specific broodstock have been individually marked for identification with PIT (Passive-Integrated-Transponder) Tags.
   b. In September 1999, blood was drawn from 1,028 spawning broodstock(see attachment)
   c. Testing was completed on October 29, 1999 (see attachment), indicating no increase of prevalence since previous sampling in March
      1) All positive fish will be removed from the spawning population.
      2) Fish culled from the population will be destroyed unless they are needed for research purposes.
      3) Carcasses will be disposed of by burial in a limed pit, away from any water drainage.
   d. Because of the costs involved and the present limitations of the test, the screening of large numbers of pre-spawn broodstock using PCR is not an effective tool for management of SSSv, and therefore is not recommended. A less expensive, serologically-based screening tool is reportedly being developed by researchers at Cornell University.

2. Testing of Sea-run Penobscot Broodstock
   a. Since sea-run broodstock are not tagged, a 60 fish sample was taken in September 1999 (95% confidence that SSSv will be detected if present in 5% of population).
   b. Two sea-run ATS were found to be positive for SSSv.
   c. Since the positive fish cannot be identified and removed from the population, fry testing will be conducted at CBNFH and Green Lake National Fish Hatchery prior to fry release in the spring of 2000.

3. Spawning of Downeast stocks activities will commence following removal of positive fish, as stated above. Penobscot sea-run spawning will commence when fish are ready.

4. Stocking of Atlantic salmon fry in the State of Maine for Spring, 2000
    a. Any indication of clinical disease in any group of river specific ATS broodstock not attributed to pathogens presently listed in state regulations will preclude stocking of progeny until testing for SSSv can be accomplished
    b. All groups of fry to be released in 2000 from the five Downeast River Specific stocks, Narraguagus, Dennys, East Machias, Machias and Sheepscot Rivers, will originate from broodstock that have been screened by PCR tested blood samples for SSSv provirus and found negative.
    c. Prior to stocking each year, all fry lots at Craig Brook NFH will be sampled to satisfy requirements set by all Fish Health policies, guidelines and regulations in effect at that time. .
        1) Presently this involves a sample which would detect a pathogen if 5% of the population is infected with 95% confidence of detection
        2) Fry lots must test negative for pathogens of policy and Regulatory Concern (Maine Salmonid Fish Health Inspection Regulations, Section 2.04-A) before released.
        3) In the spring of 2000, fry from Penobscot River sea-runs will be tested for SSSv by PCR prior to release.