

# NEWSLETTER

## Occurrence of White Sturgeon Iridovirus (WSIV) Infection in Idaho Snake River White Sturgeon

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In 1987 a cooperative program was started in Idaho to investigate the potential for white sturgeon (*Acipenser transmontanus*) culture. Participants in the program included Idaho Department of Fish and Game (IDFG), the commercial aquaculture industry, and College of Southern Idaho (CSI), Twin Falls, Idaho. The objectives of the program were to provide sturgeon to enhance and expand the resource and to examine the potential of this species in commercial aquaculture. Wild sturgeon adults captured from the Snake River were successfully spawned in 1988, 1990, and 1991. Larvae were distributed to several commercial operations each year for experimental, small scale sturgeon culture. The private aquaculture companies returned a portion of the resulting yearling sturgeon to IDFG for enhancement and stocking. As part of this program the health of sturgeon under culture was monitored.

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Clinical specimens of the 1991 broodyear Snake River white sturgeon were obtained from CSI Aquaculture Program during a period of increased fingerling mortality. Additional samples were obtained from CSI and two commercial producers (CST and ARK) located in the Thousand Springs area of the Hagerman Valley, Idaho. Sturgeon samples were also obtained from morbid animals from the Kootenai River stock in northern Idaho. All methods followed have been described previously (Amos, K. 1985. Procedures for the detection and identification of certain fish pathogens, 3rd edition. American Fisheries Society, Fish Health Section,

Corvallis, Oregon) or are considered general procedures for routine diagnostic examinations of fish with modifications as indicated below. Briefly, gills, spleen and kidney were cultured for bacteria on tryptic soy agar and cytophaga agar supplemented with 10% bovine serum and incubated at 15°C. Virology samples included skin, gill and pools of kidney, spleen, and liver tissues which were homogenized 1:10 in a balanced saline solution and centrifuged prior to inoculation and incubation at 18°C. Two

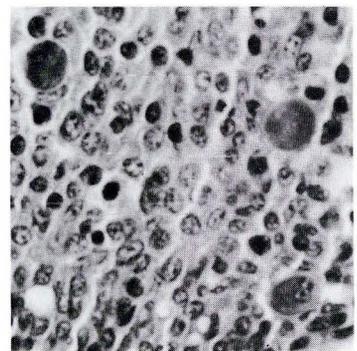


Fig. 1. White sturgeon enlarged gill epithelium cells. (x200).

cell lines established from white sturgeon (WSS-2 and WSSK-1) (Hedrick, R.P., T.S. McDowell, R. Rosemark, D. Aronstein, and C.N. Lannan. 1991. Transactions of the American Fisheries Society 120:528-534) and the CHSE-214 and EPC cell lines were used for primary isolation and

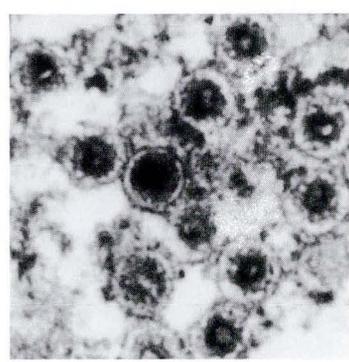


Fig. 2. Iridovirus-like particles in gill epithelium (uranyl acetate, x 44,500)

subculturing of suspect samples. Tissues to be used in histological examinations were fixed in Bouin's solution for 24-48 h, rinsed and stored in 70% ethanol before paraffin embedding, sectioning and staining (Humason, G.L. 1979. Animal tissue techniques. W.H. Freeman Co., San Francisco.). Tissue and cell culture specimens for electron microscopy were placed in Karnovsky's fixative for 1 h at room temperature or 2.5% glutaraldehyde in phosphate buffered saline (PBS), rinsed and stored in PBS at 4°C. Specimens were rinsed twice in buffer and then post-fixed in 1% aqueous OsO<sub>4</sub>, dehydrated through a graded ethanol series, infiltrated and embedded in epoxy resin. Thin sections (10 to 20 nm) were stained with 4% uranyl acetate and lead acetate prior to examination.

Bacteria detected included *Aeromonas sp.* and *Pseudomonas sp.* These bacteria were not considered primary pathogens and no additional analyses were done. Subtle cytopathic effects (CPE) were observed 8 d post-inoculation on the CHSE-214 cell line. Subculturing on the WSS-2 and WSSK-1 cell lines appeared to produce CPE but this could not be passed. No definitive results were obtained from examination of infected and control cells by electron microscopy. Microscopic examination of fish from CSI and ARK exhibited lesions typical of white sturgeon iridovirus (WSIV) infection (Figure 1)(Hedrick, R.P., J.M. Groff, T.S. McDowell, and W.H. Wingfield. 1990. An iridovirus from the integument of white sturgeon. Diseases of Aquatic Organisms 8:39-44). Electron microscopic examination of sturgeon tissue obtained from fish after increased mortality had subsided yielded no definitive evidence of iridovirus infection. However, tissues from fish at ARK used for the original histological diagnosis were deparaffinized and processed as above for electron microscopic examination and did reveal the presence of iridovirus-like particles, approximately 270 nm in diameter, in epithelial cells of the skin and gills (Figure 2). Skin and gill tissues obtained from 20 morbid animals at facilities (Sandpoint Hatchery, Kootenai Facility, and Cabinet Gorge) rearing Kootenai stock white sturgeon exhibited no evidence of WSIV infection.

About six months after the first diagnosis, 10 additional morbid and/or apparently healthy appearing sturgeon of the same broodyear were examined from CSI, CST, and ARK. No evidence of WSIV infection was observed in specimens obtained from CSI and CST after histological analysis. However signs of the virus were observed in some fish from ARK but were much less severe than previously detected. In California, WSIV is thought to be primarily a pathogen of young sturgeon and has rarely been detected in fish older than one year. The fish from Idaho were about 13 months old when sampled. Additional fish from this broodyear will be examined in the future but it is likely that no further detections will be made using current diagnostic methods

because of the apparent preference of the virus for younger sturgeon.

**Table 1. Total number of 1991 broodyear Snake River white sturgeon examined by histological methods and number positive for the white sturgeon iridovirus (WSIV) in fish obtained from the College of Southern Idaho (CSI) Aquaculture Program, Clear Springs Trout (CST) Company Research and Development Program, and Babbington Enterprises (ARK).**

<u>Location</u>	<u>Total Fish Examined</u>	<u>Percent (Proportion) With Signs of WSIV</u>
CSI	26	88 (23/26)
CST	71	0 (0/71)
ARK	12	92 (11/12)

The source of WSIV that infected the juvenile sturgeon is unknown. In California, WSIV has been detected at several commercial aquaculture farms and the current hypothesis is that the original source of virus was wild sturgeon adults held for broodstocks. This is supported by observation of infections in some of the first artificially spawned progeny from these wild stocks in archival histological material beginning as early as 1983 (Hedrick, R.P., T.S. McDowell, J.M. Groff, S. Yun, and W.H. Wingfield. 1992. Isolation and some properties of an iridovirus-like agent from white sturgeon *Acipenser transmontanus*. Diseases of Aquatic Organisms 12:75-81). The CSI program has held 2-6 wild adult sturgeon obtained from the Snake River on site each year since 1987. This may be the source that originally infected juvenile fish being reared at CSI. Gill specimens obtained non-lethally from about twelve adult sturgeon caught from the Snake River were examined with no evidence of WSIV infection (Keith Johnson, Idaho Department of Fish and Game, personal communication) which is consistent with observations in California. Examinations of wild adult fish are limited by the number of fish sampled, specimens that can be obtained non-lethally, diagnostic techniques available, and lack of knowledge about the virus. Possibly when more fish are examined with more sensitive diagnostic techniques asymptomatic adult sturgeon with WSIV will be detected.

Sturgeon detected as WSIV-positive at ARK were received from CSI in October, 1992, and the virus may have been transferred to this area with the movement of the sturgeon. Both CSI and ARK receive spring water influents and their effluents drain into Rock Creek and Billingsly Creek,

respectively, and into the Snake River. Because the virus most likely originated from sturgeon obtained from the Snake River there should be minimal impacts to resident fish stocks. No other transfers of sturgeon from CSI have occurred since the increase in mortality and the presumptive diagnosis of WSIV.

One commercial producer, CST, received 4,000 larval sturgeon that resulted from the same two mating pair crosses as CSI and ARK fish however, WSIV has not been detected. A possible explanation for WSIV not being detected at CST is the limited diagnostic procedures available and lack of information about the virus and its biology. Additionally, CST has never had any Snake River adult sturgeon on site and did not exhibit increased mortality during the same period as the CSI and ARK sturgeon. At least twice as many fish were examined from CST at various stages of development and WSIV was not detected (Table 1).

Another potential source of WSIV could have been Sacramento or lower Columbia River white sturgeon which were transferred into the area in 1983-84 and 1986, respectively, before WSIV had been known to occur. Larvae of both stocks were brought to CST and kept isolated from other groups for the first nine months. Currently CST has about 20 Sacramento and 90 Columbia River sturgeon from different brood years. Recently, ten adult fish from each stock were non-lethally sampled for gill and opercular tissue. No tissue changes consistent with WSIV infection were observed. College of Southern Idaho has about 60 Columbia River fish which they obtained from CST in 1987. Ten of these fish were examined by IDFG in 1991 and no evidence of WSIV was obtained. Additionally, 50 juvenile sturgeon from the Kootenai River stock being reared at CSI were examined in 1990 with similar results (Keith Johnson, Idaho Department of Fish and Game, personal communication). Since both CST and CSI have had these fish on site for extended periods but only CSI has recently had WSIV detected in young sturgeon, the potential for the Columbia or Sacramento River fish to be the source of virus appears minimal. Sturgeon examined from the Kootenai River stock in northern Idaho showed no evidence of WSIV. This stock could be virus-free. The white sturgeon iridovirus was detected in 1991 by histological examination of sturgeon reared in Oregon on Columbia River water (Dr. R.A. Holt, Oregon Department of Fish and Wildlife, personal communication). WSIV is possibly enzootic in the Sacramento, Columbia, and Snake Rivers. This seems plausible given the long life spans and migratory patterns of this species. Continued monitoring of wild and hatchery reared sturgeon will be required before any conclusions can be made.

## Infectious Hematopoietic Necrosis Virus (IHNV) In Steelhead Trout at Spawning and During Two Epizootic Outbreaks at Leaburg Fish Hatchery: Detection and Transmission

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This report details two IHNV epizootics and points out limitations of current virus detection methods. It also highlights the usefulness in early detection of a coagglutination assay, and a possible occurrence of vertical IHNV transmission.

In 1990 the first confirmed case of IHNV at Leaburg Fish Hatchery on the McKenzie River occurred in spawning summer run steelhead rainbow trout (*Oncorhynchus mykiss*). IHNV was found in every subsequent spawning of this stock from December, 1990 through March, 1991. An overall IHNV prevalence of 38% was found by individual sampling of ovarian fluids and milts during eight spawnings of 256 fish. IHNV was diagnosed using tissue culture methods described in the Fish Health Blue Book (Amos, 1985). IHNV was confirmed through indirect immunofluorescent antibody tests (IFAT) using a monoclonal antibody to IHNV (B9/C6 provided by C. Lannan, Hatfield Marine Science Center). This Type 2 IHNV strain was confirmed by SDS-polyacrylamide gel electrophoresis of purified virus and by IFAT utilizing type specific monoclonal antibodies to the IHNV N-protein (provided by S. Ristow, Washington State University; Ristow and Arzen, 1989). Type 2 IHNV is commonly found at IHNV-positive sites in the Willamette River drainage (Hsu et al., 1986; Engelking and Kaufman, unpublished results).

Then on March 19, 1991 dying steelhead trout fry from both IHNV-positive and negative parents were examined. No IHNV was detected (Table 2, exam 1). However, one week later, March 26, IHNV was detected in 25 mortalities in two baskets of the fry from the same parents. IHNV continued to be found, during 7 more exams on a total of 1,330 fry (Table 2, exams 3 to 9). All IHNV-positive groups were destroyed in mid-April. Nine of 22 baskets containing about 162,000 infected steelhead fry died or were destroyed. The viruses isolated during the entire period were Type 2 by IFAT with monoclonal antibody 2NH105B.

The remaining steelhead fry were continuously monitored on

a weekly basis from April 22 to June 7 with no IHNV (Table 2, exams 10-16). No further losses occurred. Concurrently from February to May spawning adults, fry, and dead cutthroat trout (*O. clarki*; stock CT/119) were examined for viral presence. A total of 14 exams on 296 fish during a three and one-half month period were examined and no evidence of virus was detected. Similarly rainbow trout (*O. mykiss*; stock RB/72) mortalities at the hatchery were also examined for IHNV. During a two month period a total of 441 fish were examined and no evidence of virus was detected. Summer steelhead fry again began dying on June 15 in one Canadian trough (C8). Whole fry homogenates were tested by the rapid Staphylococcal coagglutination assay (Bootland and Leong, 1992). The coagglutination assay detected IHNV in 2 of 5 pooled fish samples. This rapid method detected IHNV within 30 minutes of the samples being received in the virology laboratory. The samples were also assayed by tissue culture methods as suggested in the Fish Health Blue Book (Amos, 1985). By these methods, IHNV was not detected until three days post tissue culture inoculation however IHNV was recovered in all five samples (Table 2, exam 17). The two samples testing positive by coagglutination contained more than  $10^6$  pfu per gram of tissue as enumerated from EPC cells (Table 3). A second sample set obtained two days later from trough C8 was coagglutination positive and positive by tissue culture two days post inoculation. The 40,000 fry in the infected trough were destroyed. Sampling of the remaining steelhead fry twice in July was negative by both detection methods. No further IHNV losses occurred in these fish.

These IHNV occurrences raise several important questions. What was the mode of transmission responsible for these epizootics? Secondly, in spite of extensive examination, no IHNV was found in any stock of fish at the hatchery for two months after the first epizootic. Why? Finally, the Staphylococcal coagglutination assay provided immediate evidence of an IHNV outbreak, while the suggested AFS Blue Book procedure took several days to complete. Should the more rapid test become part of our routine testing?

Did these steelhead fry become infected through vertical transmission and the progeny of negative parents subsequently become infected by horizontal transmission? Although eggs were surface disinfected by water hardening with iodophore (100 ppm for 15 min.), which at other locations has proven effective in preventing IHN disease (LaPatra et al., 1989), two epizootic losses from IHNV occurred. Vertical transmission may have occurred in this outbreak at Leaburg Hatchery. Meyers and co-workers (1990) have noted that vertical transmission of IHNV does occur at a very low level in sockeye salmon (*Oncorhynchus nerka*) in Alaska. Also at Lyons Ferry Hatchery in Washington examples of apparent vertical transmission among steelhead trout have been reported (S. Roberts,

personal communication). However, the possibility of horizontal transmission from the water supply also exists. The Leaburg hatchery water supply is not treated and infected fish may live in the water source. Unfortunately the source of infections reported herein could not be conclusively determined.

Another aspect of transmission that remains a mystery is the point source of the virus during the two months from mid-April to mid-June prior to the second IHNV epizootic. Rainbow, cutthroat and steelhead trout (1273 fish) were examined with no evidence of virus detected during this period. If IHNV were present in the water supply, why did it only affect the steelhead fry while exposed cutthroat fry, of a susceptible size were not affected? Did infection fail because of virus strain-host specificity? Host preference by strains of IHNV has been documented by some investigators through virulence bioassays (LaPatra et al., 1990, Chen et al., 1990). Perhaps the steelhead fry were latently infected? If so, even extensive sampling efforts failed to detect the virus. This indicates that the virus must have been present at levels below the sensitivity of the assays, or it was incapable of replication in tissue culture.

This laboratory has found the Staphylococcal coagglutination test a useful and rapid means of IHNV detection during significant epizootics. This method is now used routinely when IHNV-epizootics are suspected. The limitation of the method is its low sensitivity.  $10^6$  plaque forming units (pfu) per gram of tissue are required for IHNV detection. However high viral titers are typical during significant IHNV epizootics. For instance in March, 1992, we detected IHNV by the coagglutination test in mortalities in three tanks of steelhead fry obtained from IHNV positive parents at Round Butte Hatchery. The titers were greater than  $1 \times 10^7$  pfu per gram. All tests were confirmed by tissue culture assays and IHNV-IFAT. Although tissue culture assays remain most sensitive, for early detection of IHNV during epizootics a single positive is all that may be necessary diagnostically. We have had no false positive coagglutination reactions to date. The assay appears to be definitive, as well as simple and rapid. It allows quick management decisions to be made in regards to destruction of fish.

These results indicate the need for more rapid and sensitive IHNV assays, and continued research of the IHNV life-cycle. Research concerning transmission, maintenance, and detection of IHNV will increase understanding and allow better management of this virus.

Table 3. Steelhead rainbow trout fry examined for IHNV at the Leaburg Fish Hatchery during 1991.

EXAM NUMBER	DATE	NUMBER	RESULT OF TISSUE CULTURE EXAM
1	3/13/91	12 FISH	2/2 BASKET NEV
2	3/26/91	25 FISH	2/2 BASKETS IHNV
3	3/29/91	270 FISH	2/9 BASKETS IHNV
4	4/1/91	200 FISH	5/10 BASKETS IHNV
5	4/4/91	200 FISH	2/21 BASKETS IHNV
6	4/9/91	10 FISH	1/1 TROUGH IHNV
7	4/12/91	200 FISH	9/22 BASKETS IHNV
8	4/15/91	250 FISH	6/22 BASKETS IHNV
9	4/17/91	200 FISH	8/20 BASKETS IHNV
10	4/22/91	100 FISH	0/13 BASKETS NEV
11	4/30/91	70 FISH	0/7 TROUGHS NEV
12	5/6/91	70 FISH	0/8 TROUGHS NEV
13	5/13/91	40 FISH	0/8 TROUGHS NEV
14	5/20/91	80 FISH	0/8 TROUGHS NEV
15	5/29/91	80 FISH	0/8 TROUGHS NEV
16	6/4/91	186 FISH	0/8 TROUGHS NEV
17	6/17/91	18 FISH	5/5 SAMPLES IHNV
18	6/19/91	25 FISH	C8 TROUGH IHNV
19	7/1/91	35 FISH	0/4 RACEWAYS NEV
20	7/15/91	20 FISH	0/4 RACEWAYS NEV

NEV means no evidence of virus.

Table 4. Staphylococcal coagglutination and tissue culture examinations for IHNV in dying steelhead fry.

<u>Fish Sample</u>	<u>Coagglutination</u>	<u>PFU / GRAM</u>
A	++	$1.7 \times 10^6$
B	--	$4.8 \times 10^4$
C	--	$1.5 \times 10^4$
D	++	$1.2 \times 10^6$
E	--	$1.0 \times 10^4$

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## The Presence of Low Titers of anti-IHNV Antibody in the Serum of Steelhead Trout and Chinook Salmon Broodstock Spawned at Dworshak National Fish Hatchery during 1990-1991

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Epizootics of infectious hematopoietic necrosis virus have been a perennial problem at Dworshak National Fish Hatchery since 1982. Variable losses have been experienced from year to year in both juvenile steelhead and chinook salmon reared at the station. Although ovarian fluids from female broodstock and splenic homogenates from male broodstock are routinely screened for the presence of the virus by the plaque assay (*Fish Health Bluebook*), a serological survey for the presence of antibody titers to the virus in the parental fish has not previously been reported. We reasoned that it might be both useful and interesting to determine the percentage of broodstock with ELISA titers to the virus and to see whether a positive titer in an anti-IHNV ELISA correlated with a positive result in the plaque assay.

All serum samples were obtained from the caudal vein of the fish at the time of spawning. The ELISA on serum samples was performed by coating each of the wells of Immulon I microtiter plates with 0.1 microgram of the 220-90 isolate of IHNV (original isolate obtained from Scott LaPatra, Clear Springs Trout Co.). The wells were blocked with a solution of 3% bovine serum albumin (BSA) in phosphate buffered saline containing 0.05% Tween-20 (PBST) for two hours at room temperature. Dilutions of serum were incubated on the washed plates for 16 hours at 16°C. After washing five times with PBST, biotinylated antibody [Monoclonal antibody 114 recognizing salmonid Immunoglobulin] (DeLuca et al. *European Journal of Immunology*, 13, 546, 1983) was added and the plates incubated for 1 hour. After five more washes, streptavidin peroxidase in PBST-1%BSA was added. This step was followed by the addition of substrate, 5-amino salicylic acid. Plates were read in a plate reader spectrophotometer at 490nm. All tests were performed in duplicate. The anti-IHNV titer of each serum sample was recorded as the reciprocal of the highest dilution of the serum which was twice the background (control value).

The plaque assay on dilutions of each male spleen homogenate and on each ovarian fluid was performed at the Dworshak Fish Health Laboratory and the result was recorded as positive or negative.

The results of our survey are recorded in tables 1, 2 and 3.

A total of 414 samples of serum were obtained from chinook salmon during the summer and early fall of 1990 (Table 1). Of this group of sera, 157 samples (38%) tested ELISA

TABLE 1. Chinook Salmon Spawned at Dworshak - 1990

Date	ELISA Positive	Plaque Positive	ELISA and Plaque Positive	ELISA Titer Distribution						
				1/10	1/20	1/40	1/80	1/160	1/320	1/640
8/20/90	3/15	1/15	0/15	2	1					
8/27/90	46/96	9/96	7/96	10	6	16	10	2		2
8/28/90	42/102	15/102	11/102	11	23	5	2			1
9/4/90	42/94	8/94	2/94	17	9	8	4	3		1
9/5/90	22/96	19/96	8/96	6	12	3	1			
9/7/90	2/11	0/11	0/11	0	1	1				
Totals	157/414	52/414	28/414	46	52	33	17	5		4

TABLE 2. Steelhead Trout Spawned at Dworshak - 1991

Date	ELISA Positive	Plaque Positive	ELISA and Plaque positive	ELISA Titer Distribution						
				1/10	1/20	1/40	1/80	1/160	1/320	1/640
1/31/91	5/51	16/51	1/51	1	4					
2/6/91	2/21	2/21	0/21	1	1					
2/27/91	33/108	1/108	0/108	6	17	7	2			
3/6/91	25/113	2/113	1/113	8	10	4	1	1		1
3/12/91	3/4	0/4	0/4	1	0	1				
3/19/91	25/62	0/62	0/62	9	11	3	1	1		
3/27/91	25/72	4/72	0/72	10	8	4	0	1	1	1
4/3/91	20/69	0/69	0/69	4	9	3	1	1	2	
4/9/91	19/62	0/62	0/62	6	7	5	1			
4/23/91	12/74	17/74	1/74	6	5	1				
5/1/91	10/78	11/78	2/78	4	2	2	1	1		
Totals	179/714	53/714	5/714	56	74	30	7	5	4	1

TABLE 3. Chinook Salmon Spawned at Dworshak - 1991

Date	ELISA Positive	Plaque Positive	ELISA and Plaque positive	ELISA Titer Distribution						
				1/10	1/20	1/40	1/80	1/160	1/320	1/640
8/27/91	40/52	5/52	4/52	11	6	8	10	5		
8/30/91	18/49	0/49	0/49	6	10	1		1		
9/4/91	11/57	2/57	1/57	3	1	2	3	1		1
9/6/91	50/62	2/62	2/62	12	8	13	9	6		2
Totals	119/220	9/220	7/220	32	25	24	22	13		3

positive at one of the dilutions, 1/10 through 1/320. Fifty nine of the samples (14 %) gave positive antibody responses at dilutions greater than or equal to 1/40. (It should be noted that chinook salmon serum samples generally show a higher background than the steelhead trout samples. The test we developed is based on serum from rainbow trout of known anti-IHNV titer.). Of the total of 414 samples, 52 (13%) of the samples were positive in the plaque assay, while 28 samples (7%) possessed both positive serum titers in the ELISA and were positive in the plaque assay.

Likewise, a total of 714 samples of serum were obtained from steelhead trout during the 1991 winter (Table 3). Of this group, 179 samples (25%) tested positive at one of the dilutions, 1/10 through 1/320. Forty seven samples (7% of the samples) showed positive antibody response at dilutions greater than or equal to 1/40. Of the total of 714 samples, 53 (7%) of the samples were positive in the plaque assay; however only 5 of the total of 714 steelhead trout (0.7%) possessed both positive serum titers and were positive in the plaque assay.

A total of 220 samples of serum were obtained from chinook salmon during the summer and early fall of 1991 (Table 3). Of this group of sera, 119 samples (54%) tested ELISA positive at one of the dilutions, 1/10 through 1/320. Sixty two (28%) samples gave positive antibody responses at dilutions greater than or equal to 1/40. Of the total of 220 samples, only 9 samples (4%) were positive in the plaque assay while 7 samples (3%) possessed both positive serum titers and were positive in the plaque assay.

Overall, our results indicate that there was a high frequency of low positive titers against IHNV in serum samples taken at Dworshak during 1990-1991. More fish had positive serum titers against IHNV than positive plaque titers. We observed that a positive serum ELISA did not necessarily correlate with a positive plaque assay from the ovarian fluid or a positive splenic homogenate from the same fish. A positive serum titer, however, does indicate that the fish had been previously exposed (infected?) to IHNV.

The 1991 season was uneventful for IHN losses at Dworshak. Ponds which sustained losses from the virus were random in all systems. Losses were generally very low and overall production losses were insignificant. It was a very good year for the hatchery.

Our results suggest that on the average, returning broodstock possess low titers of antibody against IHNV. It is possible that the prevalence of these relatively low titers rather than high titers are due to the stress of returning from the ocean and confinement at the hatchery. Circulating antibodies are only one immune parameter which indicates immunity against viruses. Other immune functions which

were not measured in the present study include T cell immunity and nonspecific responses such as the action of nonspecific cytotoxic cells, phagocytic activity, and complement dependent functions. It will be important in the future to note the relative contribution of these other functions of the immune system against IHNV.

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## Susceptibility of Brook Trout and Rainbow Trout x Brook Trout Hybrids to Infectious Hematopoietic Necrosis Virus

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Buhl, Idaho 83316

Infectious hematopoietic necrosis (IHN) is a viral disease of certain species of salmon and trout. Of the salmon found in North America, only coho salmon *Oncorhynchus kisutch* have been shown to be resistant to clinical infections of infectious hematopoietic necrosis virus (IHNV). Recent studies examining the IHNV susceptibility of trout and char in the genus *Salvelinus* have suggested that certain species within this group may be resistant as well.

The viral infection susceptibility of hybrids from resistant and susceptible species has also been studied. Several studies found that rainbow trout *Oncorhynchus mykiss* x coho salmon hybrids exhibited increased resistance to viral hemorrhagic septicemia virus (VHSV) and IHNV. Other reports suggested that salmonid hybrids between other species may also exhibit greater viral disease resistance. Dorson, M., B. Chevassus, and C. Torhy (1991. Diseases of Aquatic Organisms 11:217-224) found that rainbow trout x brook trout *Salvelinus fontinalis* hybrids were resistant to European isolates of VHSV and IHNV. The objectives of this study were to determine the susceptibility of rainbow trout x brook trout hybrids to a North American isolate of IHNV and to evaluate the susceptibility of pure species brook trout to IHN disease.

Diploid and heat-induced triploid treatment groups of rainbow trout, brook trout, and reciprocal hybrid crosses were produced from ova and sperm obtained from two different brook trout stocks and our own stock of rainbow trout. The first study utilized brook trout gametes obtained from the College of Southern Idaho Aquaculture Program, Twin Falls, Idaho. All crosses using brook trout ova failed to

survive. Additional pure species diploid brook trout from a different stock were obtained from Idaho Department of Fish and Game (IDFG). Susceptibility studies of the treatment groups to a 1990 IHNV isolate from the Hagerman Valley, Idaho, were conducted using a standardized waterborne exposure procedure at two different mean body weights. Replicate 25-fish groups (2 or 3) were exposed to 100,000 plaque forming units (PFU)/mL in a volume of water that was 10x the total weight (in grams) of the fish. Virus exposures were conducted in a closed system for 1 h with aeration added. Each group was subsequently placed in a separate 19 L aquaria receiving constant temperature (15°C), ultra-violet disinfected, single pass spring water and fed *ad libitum* (4x) daily. The study was repeated using brook trout ova and sperm provided by IDFG. In the second study, triploid hybrids and diploid and triploid rainbow trout were evaluated for susceptibility to IHNV at two mean ages. Pure species diploid brook trout were evaluated only at 10 weeks post-hatching because of the limited number of animals available. Fish in each test were monitored daily for mortality for 28 d after virus exposure. A minimum of 20% of each days mortality was individually examined for virus by EPC cell plaque assay. Virus concentrations of whole fish or kidney-spleen-liver (KSL) homogenates were determined for some of the dead fish examined in each test. Cumulative percent mortality and mean number of days to death of the replicates were analyzed by chi-square analysis and analysis of variance. When the second study was terminated, KSL specimens from 2-6 surviving fish were examined individually or in pools by plaque assay for IHNV.

In the first study, diploid brook trout and triploid rainbow trout female x brook trout male hybrids showed a significant increase in IHNV resistance when compared to pure species diploid and triploid rainbow trout groups (Table 1). Similar results were obtained when the study was repeated (Table 2). Virus was isolated from 92% (142/154) of the dead fish examined. No virus was isolated from any of the brook trout exposed to IHNV. Virus was detected in 92% (23/25) of the triploid rainbow trout x brook trout hybrids. Virus concentrations detected in tissue homogenates ranged from  $10^{2.3}$  to  $>10^{7.3}$  PFU/g with a mean of  $10^{6.4}$  PFU/g. Virus was detected in 67% (4/6) of the surviving triploid hybrids in concentrations that ranged from  $10^{3.4}$  to  $10^{5.3}$  PFU/g but was not detected in any of the surviving diploid brook trout examined.

Our results from tests examining the susceptibility of triploid rainbow trout female x brook trout male hybrids to IHNV showed increased resistance to infection, in agreement with previous reports. Furthermore, the stock of diploid brook trout we used appeared to be completely resistant to the IHNV isolate used in this study. Virus was not detected in any brook trout mortalities or in surviving fish. Until recently

no formal reports have been published previously which document the susceptibility of brook trout to IHNV. Goldes and Mead (1992. American Fisheries Society Fish Health Section Newsletter 20(1):4) reported a low level of mortality in brook trout due to IHNV after a waterborne infection trial. Yamamoto and Clermont (1990. Journal of Aquatic Animal Health 2:261-270) stated 1-month-old brook trout became infected with IHNV by immersion, unfortunately no data was reported. They also report that Lake trout *Salvelinus namaycush* exhibit intermediate resistance to IHNV and it has been shown that arctic char *Salvelinus alpinus* are completely resistant to IHNV (T.R. Meyers, Alaska Department of Fish and Game, personal communication).

The apparent genetic transfer of virus resistance from brook trout to an intergeneric hybrid with rainbow trout suggests that host species factor(s) can impact resistance to IHNV. Future studies should identify possible resistance factors and develop transfer mechanisms for these factors without the disadvantages of hybridization.

Tables on pages 10 and 11.

## Microcystin LR: Possibly the Cause of Netpen Liver Disease of Seawater Pen-reared Salmon

M.L. Kent<sup>1</sup>, R.J. Andersen<sup>2</sup>, S.C. Dawe<sup>1</sup>, D.E. Williams<sup>2</sup>, M. Le Blanc<sup>2</sup>, and F.J.R. Taylor<sup>2</sup>

1. Department of Fisheries, Biological Sciences Branch, Pacific Biological Station, Nanaimo, B.C. Canada, V9R 5K6
2. Department of Oceanography, University of British Columbia, Vancouver, B.C. Canada, V6T 1Z4

Netpen liver disease (NLD) is prevalent in Atlantic salmon during their first summer in sea water at several sea water netpen sites in B.C. and at one site in Washington State (Kent 1990). Observations and experimental evidence suggest that NLD is caused by a natural toxin, perhaps an algal toxin, that is prevalent in the summer months (Kent et al. 1988; Kent 1990). The hallmark pathological change of NLD is prominent, diffuse hepatic megalocytosis. Affected livers also exhibit a variety of toxicopathic changes, including necrosis and vacuolation of hepatocytes, inflammation, and ceroid deposition.

Our recent studies with NLD suggest that microcystin LR, or a very closely related toxin, may be the cause of the disease. This toxin is produced by blue-green algae

Table 1. Mean cumulative percent mortality (CPM) and mean number of days to death (MDD) in triplicate groups of diploid brook trout, triploid rainbow trout *Oncorhynchus mykiss* x brook trout *Salvelinus fontinalis*, and diploid and triploid rainbow trout waterborne exposed to a 1990 isolate of infectious hematopoietic necrosis virus (IHNV) from the Hagerman Valley, Idaho at 100,000 plaque forming units/mL. nm = no mortality.

Fish Species	Polidy	Mean Weight (g)	Infected CPM	Infected MDD	Control CPM
Brook trout	2N	1.2	8 <sup>a</sup> (5/65)	12	nm
Rainbow trout x brook trout	3N	2.9	10 (7/71)	18	nm
Rainbow trout	2N	5.2	54 (38/70)	11	nm
Rainbow trout	3N	4.5	56 (20/60)	12	nm

<sup>a</sup>IHNV was not detected.

(cyanobacteria) and is well recognized as a cause of liver damage in terrestrial animals that drink water containing the algae (Carmichael 1988). The isolation of the cyclic pentapeptide motuporin from a tropical marine sponge (de Silva et al. 1992) and the recent detection of microcystin LR in mussels from B.C. (Chen et al. 1992) was the first demonstration that members of the microcystin/nodularin class of hepatotoxins are present in the marine environment. The mussels were collected near a site that has experienced severe NLD, which suggested that microcystin LR might be the cause of NLD. In addition, the toxin was detected in liver tissue from a fish with NLD, whereas the toxin was not detected in unaffected fish maintained in fresh water or sea water (Andersen et al. 1992).

A laboratory experiment also indicated microcystin LR may be the cause of NLD. Twenty-five Atlantic salmon (avg wt. 18 g) were given 3 interperitoneal injections of microcystin LR (Sigma, St. Louis) at 555 µg/kg fish/injection, spaced 3 days apart. Thus, each fish received a total exposure of 1.66 mg microcystin LR/kg. The inoculum was prepared by diluting the toxin in sterile 0.8% saline at 20 µg/ml, and injecting each fish with 0.5 ml/injection. The fish were maintained in brackish water (15 ppt salinity) at 10°C in open system tanks. Ten control salmon were injected with saline (0.5 ml/fish) and maintained in a similar manner. All fish were fed daily with a commercial salmon diet.

Livers of exposed fish were collected for histopathology at 8 d, 15 d, 27 d, and 36 d PI (post initial exposure). In addition, 1 dead fish (collected 9 d PI) and one moribund fish (collected 23 d PI) were also examined. Control fish were collected 15 d after saline injection. Livers were preserved in Davidson's solution, processed using standard techniques, and sections were stained with hematoxylin and eosin.

The livers of fish injected with microcystin LR exhibited histopathological changes consistent with hepatotoxin exposure. At 8 d PI, 4 of 5 livers exhibited severe, diffuse necrosis, hydropic degeneration, and hypertrophy of the hepatocytes, while the remaining liver was mildly affected. In subsequent samples necrotic changes were reduced, but most fish exhibited loss of the normal tubulosinusoid architecture of the liver, nuclear pleomorphism of hepatocytes and hepatic megalocytosis. Some affected livers showed diffuse inflammation and pseudoinclusions (cytoplasmic invaginations) within the nuclei of hypertrophied hepatocytes. No significant pathological changes were observed in the control livers. The histopathological changes observed in Atlantic salmon injected with microcystin LR were similar to those seen in NLD (Kent et al. 1988; Kent 1990), which further suggests that microcystin LR is the cause of NLD. Although there have been several reports on the histological affects of microcystins on the livers of mammals (Carmichael 1988)

Table 2. Mean cumulative percent mortality (CPM) and mean number of days to death (MDD) in duplicate groups of 6 and 10 week old triploid rainbow trout *Oncorhynchus mykiss* x brook trout *Salvelinus fontinalis* hybrids, and diploid and triploid rainbow trout waterborne exposed to a 1990 isolate of infectious hematopoietic necrosis virus (IHNV) from the Hagerman Valley, Idaho at 100,000 plaque forming units/mL. nm = no mortality.

#### 6 WEEKS POST-HATCH

Fish Species	Polidy	Mean Weight (g)	Infected CPM	Infected MDD	Control CPM
Rainbow trout x brook trout	3N	0.5	34 (19/40)	17	nm
Rainbow trout	2N	0.7	92 (44/48)	9	nm
Rainbow trout	3N	0.6	100 (51/51)	7	nm

#### 10 WEEKS POST-HATCH

Fish Species	Polidy	Mean Weight (g)	Infected CPM	Infected MDD	Control CPM
Brook trout	2N	0.4	2 <sup>a</sup> (1/44)	13	nm
Rainbow trout x brook trout	3N	2.0	7 (3/44)	15	nm
Rainbow trout	2N	3.4	74 (37/50)	11	nm
Rainbow trout	3N	3.2	73 (35/48)	7	nm

<sup>a</sup>IHNV was not detected.

and fish (Phillips et al. 1985; Rabergh et al. 1992), this is the first report that we are aware of that links exposure to microcystin LR with hepatic megalocytosis.

Epizootics of NLD have already occurred this year at netpen sites in B.C. Studies to further examine the role of microcystin LR in NLD are underway.

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## President's Report To the Executive Committee of the Fish Health Section

The Fish Health Section continues to be an active and productive group of professionals. We currently have 512 members and are in good financial shape.

Our Newsletter continues to be an excellent avenue for information exchange and I would like to thank Randy MacMillan and committee for the excellent job. In addition, I'd like to express my appreciation for the two new editors,

Leni Oman and Chris Wilson, who will assume editorial responsibilities in the Fall 1992. Charlie Smith was able to obtain \$2,000 from feed companies for financial support of the Newsletter. If anyone has other avenues to be explored in regards to this type of support please let me know and I will be glad to write letters soliciting funds.

The *Journal of Aquatic Animal Health* also continues to be excellent publication. Quality papers can be published in about eight months. I think the editors, Bill Rogers, John Plumb and John Grizzle, deserve our thanks.

The Blue Book Committee continues work on the next edition. The first draft has been reviewed by 20 people and comments, corrections etc. are not being incorporated. When this is completed the next draft will be reviewed by the Technical Review Committee.

Pat Chapman, the new Chair of the Membership Committee, sent a draft of the new Membership Directory to the EXCOM members for comment. It is hoped this will be available soon.

The S.F. Snieszko Student Awards Committee awarded 3 travel grants this year - two to students from Japan. This continues to be an excellent means to have students, who have limited financial resources, attend and present papers at our annual meetings.

Four highly qualified individuals were considered for the S.F. Snieszko Distinguished Service Award and one award will be made. In addition, there will be a Special Achievement Award given for the first time. This award is a recently initiated award to recognize individuals who have made special contributions either in service or scientific findings. There are many deserving individuals and I would strongly encourage the membership to submit nominations for this award.

This year has seen some very important initiatives in the aquaculture area which will probably impact all of us involved in the fish health area. These are areas which the Fish Health Section has a vested interest and in which I believe we should become seriously involved. As many of you know the Joint Sub-Committee on Aquaculture, a sub-committee of the Federal Coordinating Council on Science, Engineering and Technology, was recently formed with representatives from a number of federal agencies including USDA, Depts. of Commerce, Interior, Health and Human Services, EPA and others. This sub-committee has initiated the formation of two groups in which members of FHS serve. Randy MacMillan and myself (and a number of others) are part of the Working Group for Quality Assurance in Aquaculture. This group is interested in a number of areas including problems associated with usage

and clearance of drugs and chemicals; quality assurance programs for producer groups and the production and dissemination of information on quality assurance programs in aquaculture. The FHS agreed to petition FDA on behalf of all aquaculturists for clarification on various compounds. Randy took the lead for this assignment and clarification was requested for compounds where regulatory action is questionable or has been inconsistent and where there has been jurisdictional confusion. I would like to second Randy's opinion (Editorial, Spring 1992 Newsletter) that as fish health professionals we are the most familiar with "quality assurance" problems and if we do not actively participate in the development of these programs, we will be excluded from the process. FDA is presenting a half-day workshop at our annual meeting and this should be an opportunity for people to become familiar with the latest information in this area.

A second group is the Fish Health Management Task Force which has appointed a National Aquatic Animal Health Strategy Steering committee co-chaired by Jim Warren and Meryl Broussard (USDA). The mission of this committee is to prepare a strategy for a comprehensive National Aquatic Animal Health Program to protect and manage aquatic animal health and improve long-term productivity and sustainability of both natural and cultured aquatic animal resources in the United States. Obviously, this is an important initiative and again, an area where the FHS can make important contributions. If we don't make them, someone else will. There will also be a presentation by Jim Warren at the annual meeting explaining this program.

One area I believe the FHS needs to consider in light of the recent developments in the aquaculture arena is the certification requirements. I have had a number of calls (from USDA and FDA officials) requesting information on the requirements of our certified Fish Pathologists for training in drug and chemical administration, pharmacology etc. To my knowledge there are no formal requirements in these areas at this time. In light of the possibility of stricter laws, perhaps we should require training - either university course work or our own continuing education courses.

One last effort I would like to mention is the attempt to assess future research needs and priorities in fish health. This is being funded by USDA and Ron Thune will be explaining the process and intended outcomes of this project. This is also an area where input by members of the FHS will be beneficial.

*Vicki Blazer, President*

## **Blue Book Advisory Committee Report**

I am pleased to announce that the Blue Book has just been through a 30 day public review process. Comments have been returned to the committee members, who will work with their respective authors to incorporate comments from the 20 reviewers. This will take approximately 30 days to complete.

Overall I feel the review went real well. Most comments were positive and suggested rewording was provided. General consensus was that this edition is a real step forward. The main concern was the typo's. This has been discussed with the publisher and a more conscientious effort will be given from here on out.

After each committee member has finished, a final draft will be sent to me. I will incorporate these into finished format for the publisher. After completion the next draft will be sent to the Technical Review Committee for final review before publishing.

We are hoping to have this edition out in the very near future.

*John C. Thoesen, Chairperson*

## **Professional Standards Committee Report**

During the past year, a comprehensive pathologist examination was given for the first time which included 20 color 35 mm slides. The 175 question exam was the result of two years work and, in the future, will probably be expanded to 200 questions, 25-50 of which will be 35 mm slides. Questions and slides were obtained from authorities in all of the disciplines related to fish health and were written according to criteria established by the Professional Standards Committee.

In addition to the normal duties of issuing certificates and recertification seals, efforts also have been directed at the continuing education program. Craig Olson has taken over from Mike Kent and will continue developing this important program.

Changes being made to the AFS/FHS inspector and pathologist certification programs, along with the comprehensive examination and upcoming continuing education program, will continue to strengthen all those who provide fish health services. As the International Standards Committee seeks to produce an international certification program, it is likely that it will be modeled after that of the AFS/FHS.

*John D. Cvitanich, Chairperson*

## Board of Certification Report

Since the previous report of May 20, 1991, there have been 8 applications for Fish Health Inspector. Five of these applicants have been certified and the remaining three are in the process of either completing their application materials or being voted upon by the Board of Certification. One Fish Health Inspector has applied for recertification and 5 others have allowed their certifications to lapse. Presently there are 43 active Fish Health Inspectors and 12 inactive (certifications expired or FHI retired).

One new Fish Pathologist has been certified and two other applications are pending successful completion of the written certification examination. No Pathologist recertification applications were received this past year. Currently there are 55 active Fish Pathologist and 7 inactive (certifications expired or FP retired).

There were no expenditures incurred that were related to Board activities during this report period.

### BOARD OF CERTIFICATION SUMMARY DATE:

#### Fish Health Inspectors

Total number applicants	85
Number applicants certified	55
5 year recertification	14
10 year recertification	10
Number inactive	12

#### Fish Pathologists

Total number applicants	91
Number applicants certified	62
5 year recertification	44
Number inactive	7

*Ted Meyers, Chairperson*

## Membership Committee

The membership committee consists of Kathy Hopper, Beth MacConnell and myself. Committee activities during the year include:

- 1) Kathy Hopper stepped down as committee chairperson following last year's annual meeting. She remains an active member of the committee, however. Pat Chapman replaced her as chairperson.
- 2) A draft of the membership directory was completed in December, 1991 and sent to Excom members for

comment in January. Corrections and additions were made and a final draft was sent to Randy MacMillan in May. Randy is investigating printing and mailing options. We hope to distribute the directory this summer.

The directory will include FHS bylaws, officers, executive and standing committees, lists of certified fish pathologists and fish health inspectors, certification procedures and all members as of December, 1991.

*Pat Chapman, Chairperson*

## Scientific Journal Committee

The Journal of Aquatic Animal Health is being published on schedule now with no back log of papers. Well-written papers can be expected to be published within about eight months. Not as many papers were submitted last year as there were the previous year. However, the number of submissions so far this year is ahead of both of the last two years.

We express our appreciation to the reviewers for the excellent support.

*W.A. Rogers, Chairperson*

*J.A. Plumb*

*J.M. Grizzle*

## FHS Newsletter and Publications Committee

The FHS Newsletter continues to be an opportunity for fish and shellfish health professionals to communicate new research findings, disease problems or voice various concerns. The FHS Newsletter is published quarterly and accepts submissions from throughout the world.

Two new editors, Ms. Leni Oman and Dr. Chris Wilson, will assume complete editorial responsibilities commencing with the fall 1992 newsletter issue. The section should applaud their willingness to serve in this capacity.

Financial contributions to support the newsletter have been solicited and received. In exchange, we acknowledge the contributions by printing the companies logo. Contributions to date are \$2,000.

*Randy MacMillan, Chairperson*

## Time and Place Committee

The next annual meeting of the Fish Health Section will occur in July or August, 1993 in Denver, Colorado.

*Ed Noga, Chairperson*

## Finance Committee Report

As of June 4, 1992 we have a total of \$6,653.52 in the General Account (West One Bank, Buhl, Idaho) and \$335.40 in the Blue Book Account (AFS Office, Bethesda, Maryland). A detailed accounting of this year's income and expenses are listed below.

	<u>Transactions</u>	<u>Subtotal</u>	<u>Total</u>
<b>FHS General Account</b>			
Beginning Balance			4304.29
<b>Credits</b>			
Monies from 1990 meeting	150.00		
Section dues	3289.50		
Certificates	300.00		
Feed Co.	2000.00		
Interest	137.08	5876.58	10180.87
<b>Debits</b>			
Newsletter	2228.39		
AFS Plaque/Cert Seal	36.50		
Blue Book Meet Exp	305.89		
FHS Directory	870.75		
Misc Postage	54.02		
Xeroxing	31.80	3527.35	
<b>Ending Balance of General Account</b>			<b>6653.52</b>
<b>Blue Book Account</b>			
Beginning Balance			5623.90
<b>Debits</b>			
12-4-91 Invoice	5268.50		
<b>Ending Balance of Blue Book Account</b>			<b>335.40</b>

Past-president Charlie Smith should be commended for his efforts to obtain contributions from four major fish food manufacturers. BioProducts, Moore-Clark, Nelson's, and Rangen Inc. each contributed \$500 to the AFS FHS General Account. In recognition of their financial support, their logo's were printed on the back page of the newsletter. This is an excellent way to obtain additional operating monies for the section without raising membership dues. Section members should be encouraged to solicit these type of contributions whenever possible.

*Scott E. LaPatra, Chairperson*

## Awards Committee

The Awards Committee of the AFS/FHS has considered four highly qualified nominees for the S.F. Snieszko Distinguished Service Award and has made a recommendation to the Executive Committee that one of those four be selected for this award. One nominee was considered and has been recommended for the Special Achievement Award, which will be given for the first time in 1992. Both awards will be presented at the annual Fish Health Section meeting to be held at Auburn University, June 16-19.

*David O. Locke, Chairperson*

## 1992 Award Winners

S.F. Snieszko- Trevor Evelyn

Special Achievement- Terrence Bradley

*Congratulations*

## The 25th Annual Workshop for Fish Pathologists, Rybnoye, Russia (CIS) In Honor of Dr. Vera A. Musselius

During February, 1992, the 25<sup>th</sup> annual workshop for fish pathologists was held at Rybnoye, Russia in honor of Dr. Vera Musselius, well known disease scientist, who died the year previous. The distinguished Russian Ichthyopathologist did most of her research at the All-Union Research Institute of Pond Fisheries at Rybnoye. During my trip to the CIS (1989), I spent four days at the Institute talking to Dr. Musselius about common research problems.

Investigations of fish diseases performed by Dr. Musselius and those under her supervision were at first devoted exclusively to fish parasites but later she extended her efforts to other fields of fish pathology, hematology, virology, bacteriology, mycology, and mycotoxicology, and non-communicable diseases. Since the early 1970s her laboratory was transformed into a multidisciplinary one and become the scientific school for many soviet pathologists.

Thirteen research papers were presented during the workshop including topics on bacteria, protozoa, cestodes, immunology and host-parasite interactions. I have copies of the articles (in Russian).

*Richard A. Heckmann, Ph.D.*  
Dept. of Zoology  
Brigham Young University  
Provo, UT 84602

## A Special Seminar on Saprolegnia in Salmon

Sponsored by the Mycological Society of America and  
The Bonneville Power Administration  
August 8, 1992  
Portland Convention Center, Portland, Oregon

**Morning Session.** Chair: **L. GUY WILLOUGHBY**

9:00 to 9:10 a.m. Welcome and Introduction.

Organizer

9:10 to 9:40 **GILBERT C. HUGHES.** Saprolegniasis: Then and now. Department of Botany and Institute of Oceanography, University of British Columbia, Vancouver, Canada.

9:40 to 10:10 **G.W. BEAKES, A.W. BURR and S.E. WOOD.** Features which characterize *Saprolegnia* isolated from salmonid fish lesions. The University of Newcastle upon Tyne, U.K.

10:10 to 10:40 **ALAN D. PICKERING.** Factors which predispose salmonid fish to saprolegniasis. Institute of Freshwater Ecology, Windermere Laboratory, U.K.

10:40 to 11:00 Coffee Break

11:00 to 11:30 **K. HATAI and G.-I. \*HOSHAI.** Pathogenicity of *Saprolegnia parasitica* Coker. Nippon Veterinary and Animal Science University, Tokyo, Japan; \*Miyagi Prefectural Fisheries Experimental Station, Ishinomaki, Japan.

11:30 to 12:00 **L.G. WILLOUGHBY and \*R.J. ROBERTS.** Zoospore motility, its loss and recovery, in an isolate of *Aphanomyces* from a diseased fish in Thailand. Institute of Freshwater Ecology, Ambleside, Cumbria, U.K.: \*Institute of Aquaculture, University of Stirling, Stirling, Scotland.

12:00 to 1:30 p.m. Lunch

**Afternoon Session.** Chair: **GORDON W. BEAKES**

1:30 to 2:00 p.m. **D.J. ALDERMAN.** Control of Oomycete pathogens in aquaculture. Ministry of Agriculture, Fisheries and Food, Fish Diseases Laboratory, Weymouth, Dorset, U.K.

2:00 to 2:30 **L.L. MARKING.** Search for Antifungal agents in fish culture. U.S. Fish and Wildlife Service. National Fisheries Research Center, La Crosse, Wisconsin.

2:30 to 3:00 **L.W. OLSON and A. PETERSEN.** Screening for bacterial antagonists against *Saprolegnia parasitica* with BASF pluronic polyol F 127. Institut for Sporeplanter, University of Copenhagen, Denmark.

3:00 to 3:30 Coffee Break

3:20 to 3:50 **G.J. MUELLER AND H.C. WHISLER.** Fungal parasites of salmon from the Columbia River Watershed. Department of

Botany, University of Washington,  
Seattle, Washington.

3:50 to 4:20 **FINN LANGVAD.** *Saprolegnia*  
in Norwegian Fish Farming.  
Department of Microbiology and  
Plant Physiology, University of  
Bergen, Bergen, Norway

4:20 to 5:00 **P.R. SMITH.** *Saprolegnia* in  
Ireland. Fish Disease Group,  
Department of Microbiology,  
University College, Galway,  
Ireland.

## Salmon Management in the 21<sup>st</sup> Century: Recovering Stocks in Decline

This is the theme for the 1992 Northeast Pacific Chinook and Coho Salmon Workshop. This gathering is hosted biennially by a Western Division chapter(s). The 1992 workshop will be held in Boise, Idaho, at the Owyhee Plaza by the Idaho Chapter of the AFS and the Idaho Water Resources Research Institute. September 27 will be a field trip to the Stanley Basin. The workshop will begin September 28 and will conclude at 1 p.m., September 30. Topics will be relative to the status, research, and management of Northeast Pacific chinook and coho. This will be a forum to discuss realistic approaches to recovering our salmon stocks. All disciplines of salmon management are welcome. A proceedings of the workshop will be published. For registration information, please contact Sharon W. Kiefer, Idaho Department of Fish and Game, P.O. Box 25, Boise, Idaho, 83707, 208-334-3791; Fax: 208-334-2114. Registrations by mail must be received by September 1, 1992.

## Passages

**Leni Oman** has become the Spill Response Coordinator for the Washington Department of Wildlife. Her new address is Washington Dept. Wildlife, 600 Capitol Way N., Olympia, Washington 98504

## Job Announcements

**Position:** Fish Disease Diagnostic and Research Assistant  
Professor, Tenure track

**Location:** Mississippi State University  
Delta research and Diagnostic Laboratory  
Delta Branch Experiment Station

Stoneville, MS 38776

**Responsibilities:** Duties involve providing diagnostic services for the catfish industry. Activities include receiving specimens, consultation with farmers, necropsy, diagnoses of diseases, examination of specimens, conduct of diagnostic tests, reporting of results and providing treatment recommendations. Responsibilities include obtaining the most recent and pertinent information for catfish farmers from specialists throughout the country and providing it to the Extension specialist. The successful candidate will be expected to participate in both research and diagnostic activities on a 50/50 basis. Aquatic (catfish) pathobiology experience emphasizing toxicology, microbiology, immunology, parasitology, physiology, epidemiology, nutrition or management or any combination of these are desired. Candidate must be capable and willing to work with other diagnosticians, students, and research scientists of other departments and divisions of the university.

**Qualifications:** Advanced training in aquatic pathobiology. Preferred qualifications include DVM and MS degrees with experience in warm water (catfish) disease problems and fish pathologist certification or eligibility.

**Salary and Rank:** Dependent on qualifications and experience.

**Application Procedure:** Applications are being accepted as of July 1, 1992, and will continue until a suitable candidate is found. Qualified applicants should send a letter of application including a current curriculum vitae, a statement or career goals and the names of three (3) references to:

Dr. H. Graham Purchase, Director  
Veterinary Medical Research  
College of Veterinary Medicine  
Post Office Drawer V  
Mississippi State, MS 39762  
Phone 601-325-3432

**Job Title:** Fish Disease Diagnostician

**Position Available:** Sept. 1, 1992, ending Sept. 1, 1993.

**Work Location:** School of Veterinary Medicine, LSU,  
Baton Rouge, Louisiana.

**Brief Job Description:** The Fish Diagnostician works independently of other diagnostic services of the School of Veterinary Medicine and communicates directly with commercial aquaculturists, fish farmers, ornamental fish keepers, bioassay labs and owners of recreational ponds in the state of Louisiana to assist them in solving fish health related problems. Assistance is also provided to the Louisiana Department of Wildlife and Fisheries, the Louisiana Cooperative Extension Service and the Louisiana Department of Agriculture in fish kill investigations. Some specific tasks are:

- perform necropsies on fish specimens to determine the causes of mortality
- perform bacteriological procedures on fish specimens or tissues including primary isolation, culture, antimicrobial susceptibility and identification.
- perform virological procedures on fish specimens or tissues
- assist in various research projects

**Training and Experience:** Minimum qualifications are DVM or Master of Science in Fisheries Management, Marine Science, or Microbiology. Experience in commercial aquaculture, aquaculture research, fish diagnostics or fish health research.

**Salary:** Salary will be commensurate with training and experience.

Applications should be sent to:

Dr. Ron Thune  
Department of VMP  
School of Veterinary Medicine  
Louisiana State University  
Baton Rouge, LA 70803

## Editorial

*During my brief tenure in the Fish Health Section and as editor of the FHS Newsletter, I have observed several changes in our section. Our diversity has become more evident with a variety of views on the Blue Book and its purpose. We have a more diverse membership with veterinarians more vocal and desirous of a role in fish health management. We still have our research elements but fish health managers in both public and commercial aquaculture are more prevalent. The science of fish health management has changed as well. Federal and state regulatory requirements regarding therapeutants and water treatments, not so common in the 1960's and 1970's, have become a key factor in how we do business. Food safety issues receive greater scrutiny than ever before.*

*These changes, while they may be challenging, are opportunities for us as individuals and as a section. We must continue to work together exercising our collective wisdom for the improvement of our fish resources. Opportunities must be created for professional improvement. Consensus becomes even more important than ever before.*

*Effective communication is a key element and the FHS Newsletter can be an important means of communication. I encourage all fish health professionals to utilize this newsletter to maximize the airing of opinions, to debate the issues confronting us and to communicate new research findings. Case histories are enlightening for all of us. The Newsletter is available and, usually, timely.*

*This is the last newsletter for which I will serve as editor. It has been enlightening and a privilege to have served in this capacity. I regret that the newsletter has not been as timely as wished for but, in self defense, this is a voluntary position. I appreciate the support our membership and parent society has given me and the publications committee. I particularly hope that the two new editors, Ms. Leni Oman and Dr. Chris Wilson, will have a rewarding time during their tenure.*

*Randy MacMillan, FHS President-elect*

**The deadline for the fall edition of the FHS Newsletter is Sept. 15, 1992**

**Address submissions to:**

**Ms. Leni Oman  
Spill Response Coordinator  
Washington Dept. Wildlife  
600 Capitol Way N.  
Olympia, WA 98504**

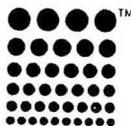
or

**Dr. Chris Wilson  
Fisheries Experiment Station  
Utah Division of Wildlife Resources  
1465 West 200 North  
Logan, Utah 84321-6263**

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### Fish Health Section Newsletter

The Fish Health Section Newsletter is a quarterly publication of the Fish Health Section of the American Fisheries Society. Submissions of any length on a topic of interest to fish health specialists are encouraged with the understanding that material is not peer reviewed. Submissions should be addressed to the editors or to a member of the publications committee.

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