SOUTH DAKOTA FISHERIES

# 2005 and 2006
# WHITLOCKS BAY SPAWNING STATION
# REPORT

**South Dakota**
**Department of**
**Game, Fish and Parks**
**Wildlife Division**
**Joe Foss Building**
**Pierre, South Dakota 57501-3182**

**Annual Report**
**No. 07-05**

# 2005 and 2006
## WHITLOCKS BAY SALMON SPAWNING STATION REPORT

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# PREFACE

This report discusses the data collected during the Chinook salmon spawning season in 2005 and 2006 season and previous data showing trends during 20 years of station operation. The author would like to acknowledge all those who assisted with spawning operations, data collection, and maintenance of the facility in 2005 and 2006. The author would like to thank John Aberle, Brian Beel, Butch Schunot, Aaron Leingang, John Lott, Dan Jost, Jason Jungwirth and Kyle Potter for assisting with the coded-wire-tag (CWT) reading and boat electrofishing.

## Summary Table

| Summary of Spawn-Taking Effort in 2005 | | | | | |
|---|---|---|---|---|---|
| Species | Number shocked | Females spawned | Eggs taken | Total cost of spawn | Cost per 1000 eggs |
| Chinook salmon | 372 | 116 | 377,301 | ---- | ---- |

*Does not include green, spent, or over-ripe females spawned

| Summary of Spawn-Taking Effort in 2006 | | | | | |
|---|---|---|---|---|---|
| Species | Number shocked | Females spawned | Eggs taken | Total cost of spawn | Cost per 1000 eggs |
| Chinook salmon | 993 | 338 | 1,015,447 | ---- | ---- |

*Does not include green, spent, or over-ripe females spawned

The table represents spawning operations that typically occur at Whitlocks Bay Spawning Station. However due to low water conditions all of the fish in 2005 and 2006 were collected by boat electrofishing. Shocked salmon were transported to the station and eggs were collected in the facility.

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## Introduction

In the early 1970's, the South Dakota Department of Game, Fish and Parks attempted to develop a salmonid sport fishery in Lake Oahe that would utilize the lake's coldwater habitat and diversify the existing fishery. Introductions of kokanee salmon, Bonneville cisco, opossum shrimp, lake herring and lake whitefish were made in hopes of establishing a prey base for a large predator species. These stockings, except for lake trout, were generally unsuccessful. Lake trout were selected because of the possibility that sufficient natural reproduction might occur to maintain a fishery without the need for annual maintenance stockings. However, minimal success was achieved with this species and no natural reproduction of this species was documented. In 1971, 7,500 adult Lake Superior rainbow smelt were stocked into Lake Sakakawea North Dakota and by 1976 smelt had established a self-sustaining population in downstream Lake Oahe. Chinook salmon had also reached Lake Oahe, as early as 1979, from Lake Sakakawea. As a result of the success of Lake Sakakawea rainbow smelt and Chinook salmon introductions, the South Dakota Department of Game, Fish and Parks implemented its own Chinook salmon program in 1982.

Chinook salmon from the Little Manistee Hatchery in Michigan and a hatchery in Wisconsin had been stocked as smolts into Lake Sakakawea, North Dakota in 1978. The origination of these Great Lakes Chinook were from two ocean-run strains from the state of Washington. The first was a Tule' strain Chinook which migrated up the Columbia River and spawned in the feeder streams of the Cascade Mountain Range at Spring Creek Hatchery. The second was a Puget Sound strain from Washington's Green River Hatchery. After three years of successful planting of smolts from these West Coast eggs, Michigan became self-sufficient for Chinook salmon production. By 1979 Chinook salmon stocked in Lake Sakakawea had reached Lake Oahe and by 1981 they were abundant enough that South Dakota Department of Game, Fish and Parks personnel collected 100,000 eggs from 54 female Chinook salmon at Whitlocks Bay, Lake Oahe, SD, October 19-22, 1981. Cleghorn Springs Hatchery incubated the eggs and produced 31,280 smolts which were stocked in Whitlocks Bay, April 1982. An additional 260,870 smolts produced from Lake Michigan eggs were also stocked in Lake Oahe. South Dakota has been relatively self-sufficient for salmon eggs since 1984.

The purpose of Whitlocks Bay Spawning Station (WBS) is to collect spawning adults of Chinook salmon so that annual egg-production needs could be met, and a sport fishery in Lake Oahe could be maintained. Artificial propagation of Chinook salmon is necessary because suitable spawning habitat is not available in Lake Oahe's warm and turbid incoming tributaries. The station was used for spring steelhead and rainbow trout egg collection from 1987 thru 2000; however, all spring trout stocking and egg collection operations were discontinued in 2001 due to low returns to anglers. The station has also been used to collect brown trout eggs; however, brown trout have not been stocked in Lake Oahe since 1990. Brown trout have not returned to the station since 1994.

Construction of Whitlocks Bay Spawning Station began in 1982 and the station was fully operational in April, 1984. The station is located 18 miles west of Gettysburg on Lake Oahe at Whitlocks Bay (Figure 1). The Whitlocks Bay Spawning Station consists of a fish ladder (artificial stream), four concrete holding ponds (45' X 8' X 4'), a crowding raceway, a 28' X 48' spawning building, and a water supply system (Figure 2). Two submersible pumps, capable of delivering a total of 2,600 gallons of water per minute (depending on lake elevation), are mounted on a skid that is pushed into the reservoir before the pumping season and removed when not in use. Water is pumped from the bay into the station where it

gravity flows through raceways and down the fish ladder into the reservoir. The station is typically operated from approximately September 15th through the first week of November. Personnel needed at the facility include a manager and a conservation technician. Considerable time is spent explaining department fisheries programs and providing guided tours to the public. In the fall, four to six additional people are needed during days of salmon egg collection.

This report discusses the 2005 and 2006 Chinook salmon spawn and previous data showing trends during the twenty years of station operation. For a summary of previous operations, refer to annual reports for the years 1984-2004.

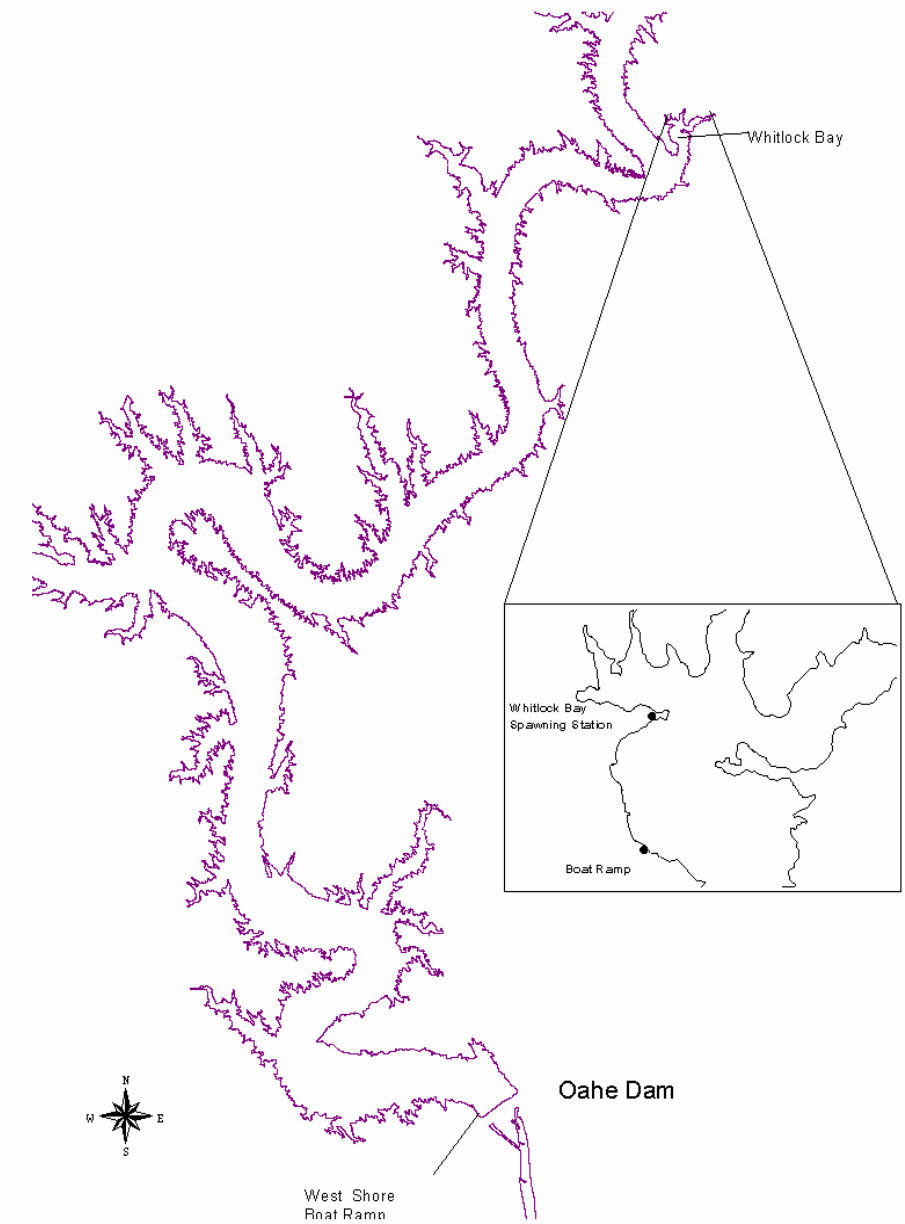


Figure 1. Location of Whitlocks Bay Spawning Station.

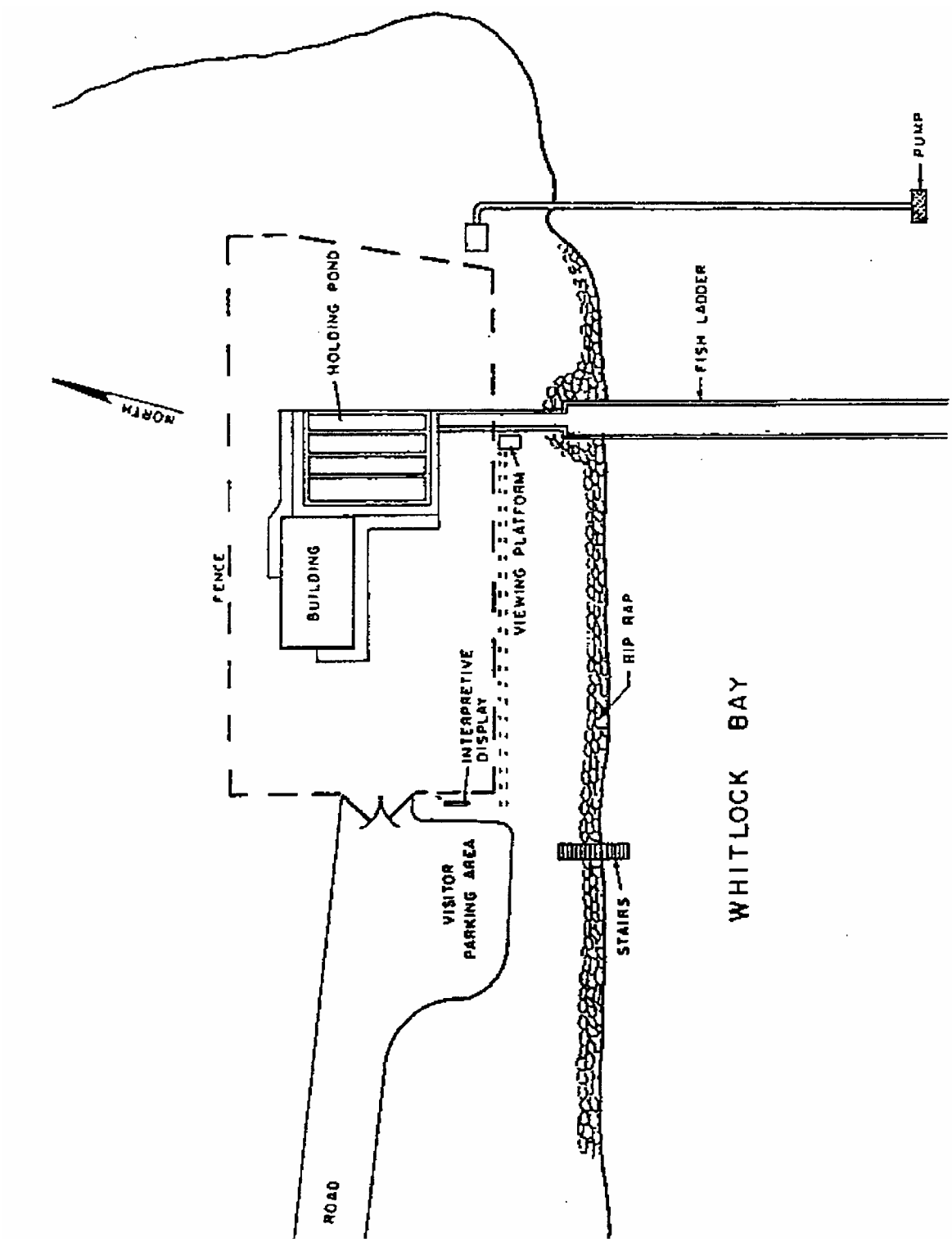


Figure 2. General layout of Whitlocks Bay Spawning Station.

## 2005 Chinook Salmon

### Stocking

One hundred and nineteen thousand three hundred and sixty-three juvenile Chinook salmon were stocked in Lake Oahe in 2005 totaling 1,494 kg (3,292lbs). For a more detailed summary of current and past Chinook salmon stockings, refer to Appendices A, B, D and E.

### Station Returns and Egg Collection

Record low lake elevations in 2005 (September elevation 1572 ft.msl.) made Whitlocks Bay Station inoperable. Boat electrofishing was conducted weekly, from October 6 to 26$^{th}$. October 18$^{th}$ is typically the peak of the salmon run in South Dakota. A total of 116 female salmon were collected from four, day time electrofishing collections using two Smith-Root electrofishing boats. For a summary of past Chinook salmon returns, egg collection efforts, and percent egg eye-up for WBS spawning operations, refer to Appendix E.

Table 1. Number of female Chinook salmon spawned and eggs collected, by electrofishing. Due to record low lake levels the Whitlocks Bay Spawning Station was inoperable in 2005.

| Date | Spawned | Green | Spent | Bad | Eggs collected | Water Temp F |
|---|---|---|---|---|---|---|
| 10/6 | 7 | 23 | 0 | 0 | 21,014 | |
| 10/12 | 51 | 2 | 0 | 2 | 163,179 | 57 |
| 10/17 | 37 | 3 | 0 | 8 | 125,708 | 55.5 |
| 10/26 | 21 | 5 | 7 | 6 | 67,400 | 52.5 |
| Total | 116 | 33 | 7 | 16 | 377,301 | |

### Age and Growth

Biological data was collected from 113 CWT Chinook salmon to provide information on age, growth, and stocking-and-rearing history (Table 2). The ratio of male to female CWT salmon collected in 2005 was 1.4:1 compared to 9.4:1 in 2004. Of the CWT males that were spawned in 2005 >50% of the total fish collected were age 2 fish. The male to female ratio was lower than in past years; however, the electrofishing crews were instructed to target females biasing the ratio toward females. The 2005 run was composed of an approximately even split of age 2 and 3 year old male Chinook salmon. The age composition of 2 and 3 year old male CWT salmon have composed up to 100% of total CWT males returning to the station during a spawn (Marrone and Stout 1995). Weight of age 2 male Chinook salmon increased to 2,577 grams in 2005 compared to 1,544 grams in 2004 which was above the twenty-two year average of 1,535 grams (Figure 3).

Table 2. Age composition, length and weight of 113 coded-wire tagged Chinook salmon collected by electrofishing, fall 2005.

| Age | Sex | Brood year | Number | Mean length (mm) | Range | Mean weight* (g) | Range |
|---|---|---|---|---|---|---|---|
| 1 | Male | 2004 | 2 | 286 | 285-286 | 263 | 255-271 |
| 2 | Male | 2003 | 34 | 597 | 557-638 | 2,557 | 1,697-2,752 |
| 3 | Male | 2002 | 29 | 744 | 635-836 | 3,839 | 2,250-5,609 |
| | Female | | 44 | 725 | 608-840 | 3,426 | 2,264-5,512 |
| 4 | Male | 2001 | 0 | ---------- | ---------- | ---------- | ---------- |
| | Female | | 4 | 798 | 749-838 | 4,085 | 3,220-5,000 |
| 5 | Male | 2000 | 0 | ---------- | ---------- | ---------- | ---------- |
| | Female | | 0 | ---------- | ---------- | ---------- | ---------- |

*Female weight is post-spawn.
Note- Seven of the coded wire tagged salmon originated in Lake Sakakawea, North Dakota.

A breakdown of the total number, size at stocking, and number of CWT salmon stocked in Lake Oahe, South Dakota from 1997 to the present can be found in Appendix D. In addition, South and North Dakota CWT codes and numbers of tagged fish can be found in Appendices E and F. Detailed breakdowns of treatment groups, number of fish marked, and research objectives for marking can be found in Appendix G. A complete summarization and analyses of CWT returns from 1987 – 1996 can be found in a report by Lott et al. (1997).

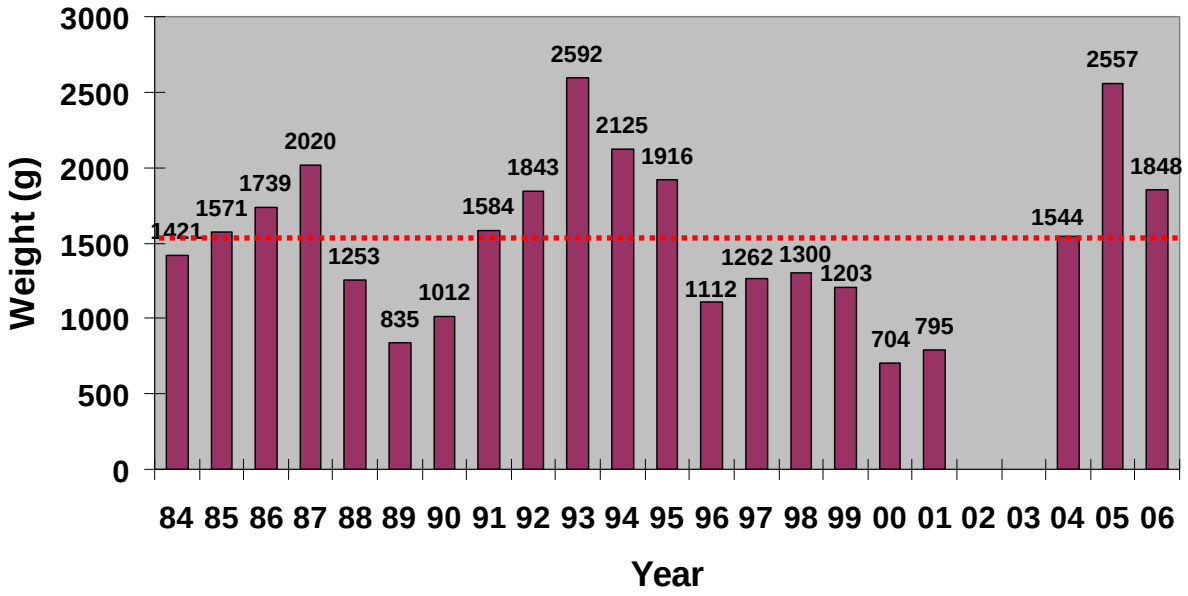


Figure 3. Average weight of age-2 Chinook salmon collected and spawned from 1984 – 2006 returns to Whitlocks Bay Spawning Station and collected by fall electrofishing. The dotted line represents mean weight (1,535 g) of age-2 salmon.

**Contribution of North Dakota Salmon**

Of the 113 CWT Chinook salmon captured by electrofishing in 2005, seven were from North Dakota. A percentage was determined using the known number of North Dakota fish tagged from each stock and calculating a percent return from the number (captured in the South Dakota portion of Lake Oahe) of North Dakota fish spawned in South Dakota. In 2005 it was estimated that 76 (i.e., approximately 20%) of the 372 salmon captured were North Dakota fish. This estimate provides a very rough picture of the contribution of North Dakota salmon to the South Dakota Chinook salmon spawn.

Estimated contributions of North Dakota fish from 1998 to 2004 have ranged from 0 to 42%. In 2005, coded-wire-tag verification revealed that all four, four-year-old females originated from Lake Sakakawea, ND. This agrees with the total number of South Dakota stocked salmon available to spawn being limited to $\leq$ age 3 males and females.

## 2006 Chinook Salmon

### Stocking

One hundred and eighty-five thousand one hundred and ninety-four juvenile Chinook salmon were stocked in Lake Oahe in 2006 for a total of 2,978 kg (6,565 lbs) stocked. For a more detailed summary of current and past Chinook salmon stockings, refer to Appendices A, B, D and E.

### Station Returns and Egg Collection

Lake elevations in 2006 gradually increased from a new record low elevation of 1571.4 ft. msl. at the end of September to 1572.5 ft msl. by the end of the October which made Whitlocks Bay Station inoperable. To date, this was the lowest lake elevation salmon have been successfully collected and spawned on Lake Oahe. Electrofishing was conducted weekly, from October 4$^{th}$ to the 25$^{th}$. Spawn operations started just before water temperatures decreased from 11.1-13.9°C (52-57°F) and it was speculated that fish from the first spawn had staged for some time in the shallow warm water (Appendix K). A total of 566 female salmon were collected from eight Lake Oahe electrofishing efforts (two electrofishing crews collected fish on four different dates). For a summary of past Chinook salmon returns, egg collection efforts, and percent egg eye-up for WBS spawning operations, refer to Appendix E.

Table 3. Number of female Chinook salmon spawned and eggs collected, by electrofishing. Due to record low lake levels the Whitlocks Bay Spawning Station was inoperable in 2006.

| Date | Spawned | Green | Spent | Bad | Eggs collected | Water Temp F |
|---|---|---|---|---|---|---|
| 10/4 | 56 | 50 | 0 | 21* | 188,750 | 58 |
| 10/12 | 93 | 16 | 2 | 37 | 282,073 | 57 |
| 10/17 | 118 | 8 | 1 | 28 | 345,720 | 52 |
| 10/25 | 21 | 6 | 0 | 80 | 198,904 | 48 |
| Total | 338 | 80 | 3 | 145 | 1,015,447 | |

*Eggs from 17 of these females were discarded due to overripe eggs, broken eggs and unusual looking ovarian fluid.

### Age and Growth

Biological data was collected from 192 CWT Chinook salmon to provide information on age, growth, and stocking-and-rearing history (
Table 4). The ratio of male to female CWT salmon that were collected by electrofishing in 2006 was 1:1. The male to female ratio was lower than in years past; however, electrofishing crews specifically targeted female fish versus males when collecting fish which skewed the ratio toward females. In 2006, 3 and 4 year old South Dakota stocked salmon were available in the system and were represented in the spawn. The majority of the spawn were composed of 3-year old females (92%) and the remaining were 4-year old females (8%;
Table 4). The age composition of 2 and 3 year male CWT salmon in 2006 made up 100% of the total CWT males collected which is the same result as the male salmon returns to the station in 1995

(Marrone and Stout 1995). Weight of age 2 male Chinook salmon was 1,848 grams in 2006 which was above the twenty year average of 1,462 grams

Table 4. Age composition, length and weight of 192 coded-wire tagged Chinook salmon collected by electrofishing, fall 2006.

| Age | Sex | Brood year | Number | Mean length (mm) | Range | Mean weight* (g) | Range |
|---|---|---|---|---|---|---|---|
| 1 | Male | 2005 | 0 | ---------- | ---------- | ---------- | ---------- |
| 2 | Male | 2004 | 51 | 538 | 381-619 | 1,848 | 584-2,770 |
| 3 | Male | 2003 | 46 | 750 | 687-815 | 3,609 | 2,568-4,588 |
| | Female | | 87 | 720 | 630-800 | 3,188 | 1,605-5,115 |
| 4 | Male | 2002 | 0 | ---------- | ---------- | ---------- | ---------- |
| | Female | | 8 | 781 | 721-858 | 3,801 | 2,805-4,989 |
| 5 | Male | 2001 | 0 | ---------- | ---------- | ---------- | ---------- |
| | Female | | 0 | ---------- | ---------- | ---------- | ---------- |

*Female weight is post-spawn.
Two of the coded wire tagged salmon were fish stocked in Lake Sakakawea, North Dakota.

A breakdown of the total number, size at stocking, and number of CWT salmon stocked in Lake Oahe, South Dakota from 1990 to the present can be found in Appendix D. In addition, South and North Dakota CWT codes and numbers of all tagged fish, for approximately the last ten years, can be found in Appendices E and F. Detailed breakdowns of treatment groups, number of fish marked, and research purposes behind marking can be found in Appendix G. A complete summarization and analyses of CWT returns from 1987 – 1996 can be found in a report by Lott et al. (1997).

**Contribution of North Dakota Salmon**

Of the 192 CWT Chinook salmon captured by electrofishing in 2006, two were from North Dakota. A percentage was determined using the known number of North Dakota fish tagged from each stock along with a approximate percent return from the number (captured in the South Dakota portion of Lake Oahe) of North Dakota fish spawned in South Dakota. In 2006 it was estimated that 22 (i.e., approximately 2%) of the 993 salmon captured were North Dakota fish. This estimate provides an indication of the contribution of North Dakota salmon to the South Dakota Chinook salmon spawn.

Estimated contributions of North Dakota fish from 1998 to 2003 have ranged anywhere from 0 to 10% and in 2004 were as high as 42% when the total number of South Dakota stocked salmon available to spawn was limited to $\leq$ age 2 males and age 5 females.

The appearance of a drop in the contribution of North Dakota salmon to the South Dakota spawn is likely due to the increased abundance of SD salmon present. In addition, South Dakota juvenile salmon

are stocked in Whitlocks Bay and imprint on the area which likely explains the increased percentage of South Dakota salmon captured in the Whitlocks Bay area.

**Results of 2006 Disease Testing**

A subsample of the Lake Oahe salmon population has been tested for fish health inspections since the early 1980's. Additional testing of 2006 adult Lake Oahe Chinook salmon revealed the presence of aquareovirus. Aquareovirus is not a regulated viral pathogen and is not tested for in routine fish health inspections. In this case cytopathic effects of unknown etiology was observed on the cell lines that were being used to screen for the regulated viral pathogens. The Bozeman lab ran polymerase chain reaction (PCR) against the 3 regulated viruses: infectious hematopoietic necrosis virus (IHNV), infectious pancreatic necrosis virus (IPNV), and viral hemorrhagic septicemia virus (VHSV) and the results were negative. Samples were sent to the lab in Seattle and the viral agent was identified as aquareovirus (personal communication with Rick Cordes).

The viral isolate from Lake Oahe Chinook salmon was identified as Group A aquareovirus. Aquareovirus is a genogroup within the family reoviridae. Many of the aquareoviruse's appear benign (i.e., chum salmon reovirus) but a few are known to cause disease. This virus is apparently very common, but this was the first time it was documented in Lake Oahe Chinook.

A review of annual fish health records for Lake Oahe Chinook salmon found a report from 1994 (FHC #95-08 and 95-14) that indicated kidney/spleen and ovarian fluid was screened for a reovirus on EPC and CHSE-214 cell lines and results were negative. This was done because of the finding of a reovirus in Lake Sakakawea Chinook salmon in 1994. It was speculated that this was the same virus originally detected in North Dakota Chinook.

## Tri-State Chinook Salmon Egg Take and Inter-State Assistance

With few outside sources for disease free Chinook salmon eggs and large scale annual fluctuations in the number and quality of salmon eggs collected in Lake Oahe, Lake Sakakawea, and Fort Peck reservoir, tri-state cooperation is a necessity. This cooperation has come in the form of many things (i.e., sharing of CWT machines, research results, manpower, etc.) with the most obvious form of cooperation being the transfer of Chinook salmon eggs or fry/fingerlings among states when needed. A complete summary of South Dakota, North Dakota, and Montana Chinook salmon total egg take and inter-state egg, fry and fingerling transfers can be found in Appendix N. It is hoped that tri-state cooperation will continue and expand as the popularity of salmon fisheries on the prairie mainstem Missouri River reservoirs expands.

Past stocking records of Chinook salmon for Lake Oahe are presented in Appendix A, B, D and E and a summary of past salmon returns and egg collection efforts can be found in Appendix C. A cost breakdown was not completed in 2006 because the station was not operated (Table 5).

Table 5. Costs of taking Chinook salmon eggs at Whitlocks Bay Spawning Station, 2006.

| | |
|---|---|
| Manpower/per diem/travel | NC |
| Utilities | NC |
| Miscellaneous-pump removal, hardware, etc | NC |
| Total Costs | NC |
| Number of eggs taken | NC |
| Cost/1,000 eggs collected | $ NC |

NC=Costs of operation were not completed because Whitlocks Bay Spawning Station was not operated in 2006 due to record low lake elevations and expected low salmon returns.

## Visitation and Tours

The Whitlocks Bay Spawning Station did not operate during the fall of 2005 and 2006. A limited number of visitors observed spawning operations in each of these years. A presentation and tour was given June of 2005 to the Lewis and Clark motorcycle rally. One school group did tour the facility during spawning operations in 2006.

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Haskell, D. G. 1959. Trout growth in hatcheries. New York Fish and Game Journal 5:204-237.

Lott, J., G. Marrone, D. Stout 1997. Influences of size-and-date at stocking, imprinting attempts and growth on initial survival, homing ability, maturation patterns and angler harvest of Chinook salmon in Lake Oahe, SD. South Dakota Department of Game, Fish and Parks, Wildlife Division, Report 97-20, Pierre.

Marrone, G., M. and D. A. Stout 1995. 1995 Whitlocks Bay Spawning Station Annual Report. South Dakota Department of Game, Fish and Parks, Wildlife Division , Report, Pierre.

Appendix A. Numbers of coldwater fish stocked in Lake Oahe by species, 1982--2006.

| Year | Brown Trout | Chinook Salmon | Lake Trout | Rainbow Trout | Lake Herring |
|---|---|---|---|---|---|
| 1982 | ----- | 292,150 | 2,745 | 101,470 | ----- |
| 1983 | ----- | 790,150 | 7,779 | 131,395 | ----- |
| 1984 | 18,000 | 784,550 | 8,560 | 279,395 | 470,000 |
| 1985 | 69,000 | 845,542 | 4,750 | 85,635 | ----- |
| 1986 | 52,900 | 811,665 | ----- | 146,229 | ----- |
| 1987 | 93,700 | 1,005,054 | ----- | 50,000 | ----- |
| 1988 | 77,167 | 1,061,535 | ----- | 41,270 | 200 |
| 1989 | 50,000 | 217,037 | ----- | 19,150 | ----- |
| 1990 | 50,500 | 66,385 | ----- | 32,370 | 9,388,500 |
| 1991 | ----- | 249,478 | ----- | 18,410 | 10,995,500 |
| 1992 | ----- | 219,000 | ----- | 27,190 | 11,416,000 |
| 1993 | ----- | 275,055 | ----- | 74,707 | ----- |
| 1994 | ----- | 298,759 | ----- | 81,365 | ----- |
| 1995 | ----- | 363,787 | ----- | 96,002 | ----- |
| 1996 | ----- | 418,478 | ----- | 145,659 | ----- |
| 1997 | ----- | 396,660 | ----- | 118,958 | ----- |
| 1998 | ----- | 234,101 | ----- | 131,245 | ----- |
| 1999 | ----- | 104,976 | ----- | 213,506 | ----- |
| 2000 | ----- | 49,494 | ----- | 101,021 | ----- |
| 2001 | ----- | ----- | ----- | ----- | ----- |
| 2002 | ----- | ----- | ----- | ----- | ----- |
| 2003 | ----- | 17,259 | ----- | ----- | ----- |
| 2004 | ----- | 173,079 | ----- | ----- | ----- |
| 2005 | | 119,363 | | | |
| 2006 | | 185,194 | | | |
| Total | 411,267 | 8,915,371 | 23,834 | 1,894,977 | 32,270,200 |
| Average | 58,752 | 387,625 | 5,959 | 99,736 | 6,454,040 |

Appendix B. Pounds of coldwater fish stocked in Lake Oahe by species, 1982 – 2006.

| Year | Brown trout (lbs.) | Chinook salmon (lbs.) | Lake trout (lbs.) | Rainbow trout (lbs.) | Steelhead trout (lbs.) | Total (lbs.) |
|---|---|---|---|---|---|---|
| **1982** | ----- | 2,169 | 1,373 | 1,988 | 40 | 5,570 |
| **1983** | ----- | 8,889 | 1,903 | 1,532 | ----- | 12,324 |
| **1984** | 1,385 | 11,266 | 2,094 | 12,541 | ----- | 27,286 |
| **1985** | 4,182 | 11,882 | 1,041 | 1,691 | 430 | 19,226 |
| **1986** | 5,290 | 11,132 | ----- | 7,901 | 6,256 | 30,579 |
| **1987** | 4,462 | 15,754 | ----- | ----- | 12,500 | 32,716 |
| **1988** | 5,599 | 14,820 | ----- | ----- | 8,351 | 28,770 |
| **1989** | 3,378 | 9,299 | ----- | ----- | 2,217 | 14,894 |
| **1990** | 3,389 | 2,346 | ----- | 8,093 | ----- | 13,828 |
| **1991** | ----- | 8,473 | ----- | 3,610 | ----- | 12,083 |
| **1992** | ----- | 5,022 | ----- | 3,153 | ----- | 8,175 |
| **1993** | ----- | 7,348 | ----- | 5,257 | ----- | 12,605 |
| **1994** | ----- | 8,169 | ----- | 6,732 | ----- | 14,901 |
| **1995** | ----- | 9,922 | ----- | 9,973 | ----- | 19,895 |
| **1996** | ----- | 10,893 | ----- | 10,022 | ----- | 20,915 |
| **1997** | ----- | 5,053 | ----- | 9,492 | ----- | 14,545 |
| **1998** | ----- | 9,428 | ----- | 8,942 | ----- | 18,370 |
| **1999** | ----- | 7,608 | ----- | 14,647 | ----- | 22,255 |
| **2000** | ----- | 6,203 | ----- | 6,937 | ----- | 13,140 |
| **2001** | ----- | ----- | ----- | ----- | ----- | ----- |
| **2002** | ----- | ----- | ----- | ----- | ----- | ----- |
| **2003** | ----- | 1,121 | ----- | ----- | ----- | 1,121 |
| **2004** | ----- | 3,882 | ----- | ----- | ----- | 3,882 |
| **2005** | ----- | 3,291 | ----- | ----- | ----- | 3,291 |
| **2006** | ----- | 6,565 | ----- | ----- | ----- | 6,565 |
| **Total** | 27,685 | 180,535 | 6,411 | 112,511 | 29,794 | 356,936 |
| **Average** | 3,955 | 7,849 | 1,603 | 7,032 | 4,966 | 15,519 |

Totals and averages were calculated from years when fish were stocked.

Appendix C. Summary of salmon returns and egg collections at Whitlocks Bay Station, 1984–2006.

| Year | Total salmon returned | Number of females spawned | Number of good eggs | Average number of eggs/female | Percent egg eye-up |
|---|---|---|---|---|---|
| 1984 | 175 | 29 | 81,340 | 2,800 | ----- |
| 1985 | 435 | 119 | 364,900 | 3,066 | ----- |
| 1986 | 484 | 61 | 186,746 | 3,061 | ----- |
| 1987 | 1,034 | 187 | 871,137 | 4,659 | ----- |
| 1988 | 1,320 | 270 | 667,796 | 2,473 | ----- |
| 1989 | 1,256[a] | 227 | 418,160 | 1,842 | 37 |
| 1990 | 1,107 | 409 | 787,708 | 1,926 | 40 |
| 1991 | 1,343 | 193 | 453,864 | 2,352 | 60 |
| 1992 | 690[b] | 319 | 992,630 | 3,112 | 40 |
| 1993 | 1,354 | 449 | 1,744,100 | 3,884 | 53 |
| 1994 | 2,749 | 408 | 1,542,180 | 3,780 | 44 |
| 1995 | 3,664 | 527 | 1,969,162 | 3,737 | 48 |
| 1996 | 1,133 | 355 | 1,054,841 | 2,971 | 74 |
| 1997 | 673[c] | 193 | 558,945 | 2,896 | 53 |
| 1998 | 422[d] | 211 | 498,100 | 2,361 | 48 |
| 1999 | 328[e] | 124 | 316,862 | 2,555 | 70 |
| 2000 | 283 | 74 | 155,700 | 2,100 | 49 |
| 2001 | 468 | 67 | 153,264 | 2,286 | 31 |
| 2002 | 727 | 189[f] | 724,380[f] | 3,833[f] | 57[f] |
| 2003 | 459 | 284 | 1,168,978 | 4,116 | 48 |
| 2004 | 170[g] | 18 | 33,120 | 1,840 | -- |
| 2005 | 372[g] | 116 | 377,301 | 3,252 | 30 |
| 2006 | 993[g] | 338 | 1,015,447 | 3,004 | 25 |
| Total | 20,104 | 5,149 | 16,136,661 | 67,906 | -- |
| Average | 1,005 | 234 | 701,594 | 2,952 | 47 |

For codes to superscript letters a-f see appendix C in Hanten (2005)
[g]all of the fish collected were electrofished from Cow/Spring, Sutton and Whitlocks Bay

Appendix D. Chinook salmon stocked in Lake Oahe, South Dakota by number, size and mark, 2000 – 2006.

| Date | Number | Strain | Hatchery | No./lb. | Mark | Fin clips | Location |
|---|---|---|---|---|---|---|---|
| 07/19/00 | 7,458 | O | MN | 16.46 | None | None | WB |
| 09/20/00 | 15,000 | O | MN | 8.46 | CW | AD | WB |
| 09/26/00 | 19,494 | O | MN | 8.58 | None | None | WB |
| 09/26/00 | 15,000 | O | MN | 8.61 | CW | AD | WB |
| 2001 | 0 | - | - | - | - | - | - |
| 2002 | 0 | - | - | - | - | - | - |
| 06/02/03 | 5,688 | O | MN | 34.76 | CW | AD | WB |
| 06/02/03 | 4,403 | O | MN | 33.64 | CW | AD | WB |
| 10/27/03 | 4,368 | O | MN | 8.43 | CW | AD | WB |
| 05/11/04 | 14,295 | O | MN | 22.67 | CW | None | WB |
| 05/11/04 | 13,528 | O | MN | 23.93 | CW | None | WB |
| 05/26/04 | 66,254 | O | MN | 84.4 | CW | AD | WB |
| 05/26/04 | 23,002 | O | MN | 26.3 | None | None | WB |
| 6/01/04 | 56,000 | O | CS | 54.8 | None | None | WB |
| 4/5/05 | 9,389 | O | MN | 86.7 | None | None | WB |
| 4/5/05 | 66,968 | O | MN | 87.5 | CW | AD | WB |
| 5/31/05 | 14,900 | O | MN | 37.6 | None | None | WB |
| 5/31/05 | 19,740 | O | MN | 27.76 | CW | AD | WB |
| 10/27/05 | 8,366 | O | MN | 6.38 | CW | AD | WB |
| 4/20/06 | 44,008 | O | CS | 65.9 | None | None | WB |
| 4/22/06 | 56,025 | O | CS | 61.4 | None | None | WB |
| 5/24/06 | 13,976 | O | MN | 19.58 | CW | AD | WB |
| 5/24/06 | 13,976 | O | MN | 21.45 | CW | AD | WB |
| 5/31/06 | 12,108 | O | CS | 34.5 | None | None | WB |
| 5/31/06 | 26,144 | O | MN | 26.87 | None | None | WB |
| 5/31/06 | 9,540 | O | CS | 37.7 | None | None | WB |
| 10/31/06 | 9,417 | O | MN | 4.63 | CW | AD | WB |

CW = coded-wire tagged and adipose fin clipped; AD = adipose fin clipped fish; BD = Blue Dog, State Fish Hatchery; MN = McNenny State Fish Hatchery; CS = Cleghorn Springs State Fish Hatchery

Appendix E. South Dakota Chinook salmon coded-wire-tag data 1993 –2006.

| Year stocked | Brood year | Description | Number tagged | Corrected Number Tagged | Number stocked | Data1 | Data2 |
|---|---|---|---|---|---|---|---|
| 1993 | 1992 | WWB (34/lb.) | 22,959 | 21,237 | ---------- | 22 | 1,2,3 |
| 1993 | 1992 | WWB (51/lb.) | 18,430 | 14,744 | ---------- | 22 | 4,5,6,7 |
| 1994 | 1993 | WWB (29.6/lb.) | 47,973 | 39,722 | 210,656 | 23 | 1,2,3,4,5,6 |
| 1995 | 1994 | WWB (27.9/lb.) | 48,469 | 47,500 | 212,999 | 24 | 1,2,3,4,5,6 |
| 1996 | 1995 | WWB (32.5/lb.) | 46,394 | 39,899 | 237,217 | 25 | 1,2,3,4,5,6 |
| 1997 | 1996 | WWB (38.9/lb.) | 50,428 | 40,595 | 243,278 | 26 | 1,2,3,4,5,6 |
| 1998 | 1997 | WWB (34.5/lb.) | 28,822 | 23,663 | 126,144 | 27 | 1 |
| 1998 | 1997 | WWB (9.41/lb.) | 19,315 | 19,315 | 47,696 | 27 | 2 |
| 1999 | 1998 | WWB (43.13/lb.) | 14,519 | 14,374 | 54,772 | 28 | 1 |
| 1999 | 1998 | WWB (40.24/lb.) | 15,745 | 15,288 | 54,772 | 28 | 2 |
| 1999 | 1998 | WWB (8/lb.) | 9,686 | 9,550 | 50,204 | 28 | 3 |
| 1999 | 1998 | WWB (8.12/lb.) | 9,685 | 9,520 | 50,204 | 28 | 4 |
| 2000 | 1999 | WWB (8.61/lb.) | 14,850 | 14,702 | 24,597 | 29 | 1 |
| 2000 | 1999 | WWB (8.46/lb.) | 14,835 | 14,672 | 24,582 | 29 | 2 |
| 2001 | -------- | ---------- | None | | None | -------- | -------- |
| 2002 | -------- | ---------- | None | | None | -------- | -------- |
| 2003 | 2002 | WWB (33.64/lb.) | 4,403 | 3,853 | 4,403 | 25, 28 | 8,6 |
| 2003 | 2002 | WWB (34.76/lb.) | 5,688 | 2,230 | 5,688 | 22 | 6,8 |
| 2003 | 2002 | WWB (8/lb.) | 4,368 | 1,096 | 4,368 | 22 | 9 |
| 2004 | 2003 | WWB (23.93/lb.) | 13,528 | 11,093 | 13,528 | 29 | 3 |
| 2004 | 2003 | WWB (22.67/lb.) | 14,295 | 11,908 | 14,295 | 29 | 4 |
| 2004 | 2003 | WWB (84.4/lb.) | 6,303 | 6,303 | 66,254 | 26 | 11 |
| 2005 | 2004 | WWB (6.4/lb.) | 6,387 | 3,634 | 6,387 | 30 | 1 |
| 2005 | 2004 | WWB (27.1/lb.) | 9,959 | 9,949 | 9,959 | 30 | 2 |
| 2005 | 2004 | WWB (28.5/lb.) | 9,777 | 7,088 | 9,777 | 30 | 3 |
| 2005 | 2004 | WWB (86.7/lb.) | 9,389 | 9,201 | 76,357 | 30 | 4 |
| 2006 | 2005 | WWB (4.6/lb.) | 9,540 | 8,204 | 9,540 | 31 | 1 |
| 2006 | 2005 | WWB (19.58/lb.) | 13,976 | 13,836 | 13,976 | 31 | 2 |
| 2006 | 2005 | WWB (21.45/lb.) | 13,976 | 13,836 | 13,976 | 31 | 3 |

Stocking in gray experienced substantial mortality due to beaching behavior.

Appendix F North Dakota Chinook salmon coded-wire-tag data 1996 –2006.

| Year stocked | Brood year | Description | Number tagged | Corrected No. Tagged | Number stocked | Data1 | Data2 |
|---|---|---|---|---|---|---|---|
| 1996 | 1995 | Cage reared (49/lb.) | 13,000 | 12,350 | 120,000 | 30 | 4 |
| 1996 | 1995 | Cage reared (44/lb.) | 13,000 | 12,480 | 79,000 | 30 | 5 |
| 1996 | 1995 | GDNFH (39/lb.) | 13,000 | 12,220 | 170,000 | 30 | 10 |
| 1996 | 1995 | GDNFH (44/lb.) | 13,000 | 11,310 | 120,011 | 30 | 12 |
| 1997 | 1996 | Cage reared (82/lb.) | 52,900 | 48,139 | 38,059 | 31 | 1 |
| 1998 | 1997 | Small Cage reared (51/lb.) | 18,327 | 16,311 | 70,000 | 1 | 2 |
| 1998 | 1997 | Large Cage reared (28/lb.) | 18,327 | 14,570 | 69,500 | 1 | 5 |
| 1998 | 1997 | GDNFH (41/lb.) | 18,327 | 16,403 | 86,482 | 1 | 3 |
| 1999 | 1998 | GDNFH (96/lb.) | 15,900 | 14,151 | 131,325 | 60 | 1 |
| 1999 | 1998 | GDNFH (65/lb.) | 15,900 | 12,720 | 92,002 | 60 | 2 |
| 2000 | 1999 | GDNFH (60/lb.) | 15,000 | 14,400 | 250,000 | 60 | 3 |
| 2000 | 1999 | GDNFH (90/lb.) | 15,000 | 14,250 | 250,000 | 60 | 4 |
| 2001 | 2000 | GDNFH (62/lb.) | 11,386 | 11,352 | 255,276 | 1 | 72 |
| 2001 | 2000 | GDNFH (62/lb.) | 602 | 600 | | 45 | 58 |
| 2001 | 2000 | GDNFH (62/lb.) | 2,012 | 2,006 | | 24 | 14 |
| 2001 | 2000 | GDNFH (106/lb.) | 11,248 | 10,911 | 205,300 | 1 | 71 |
| 2001 | 2000 | GDNFH (106/lb.) | 3,752 | 3,639 | | 30 | 08 |
| 2002 | 2001 | Cage-Rodeo (25/lb.) | 14,000 | 11,200 | 110,007 | 2 | 2 |
| 2002 | 2001 | Cage-Rodeo (50/lb.) | 14,000 | 13,790 | 98,283 | 2 | 1 |
| 2002 | 2001 | GDNFH-Rodeo (50/lb.) | 14,000 | 13,230 | 250,554 | 2 | 3 |
| 2003 | 2002 | GDNFH-Rodeo (27/lb.) | 15,000 | 14,490 | 97,500 | 2 | 12 |
| 2003 | 2002 | GDNFH-Rodeo (45/lb.) | 15,000 | 14,025 | 202,965 | 2 | 11 |
| 2004 | 2003 | GDNFH-Rodeo (31/lb.) | 14,000 | 12,320 | 78,000 | 2 | 18,19 |
| 2004 | 2003 | GDNFH-Rodeo (48/lb.) | 14,000 | 11,900 | 242,818 | 2 | 13 |
| 2005 | 2004 | GDNFH-Gov (25.5/lb.) | 32,767 | 26,181 | 200,000 | 2 | 28 |
| 2006 | 2005 | GDNFH-Gov (7/lb.) | 18,394 | 14,440 | 44,585 | 2 | 31 |
| 2006 | 2005 | GDNFH-Gov (30/lb.) | 18,076 | 16,919 | 200,000 | 2 | 32 |
| 2006 | 2005 | GDNFH-Tailrace (27/lb.) | 18,035 | 17,314 | 50,000 | 2 | 30 |

Appendix G. Number of coded-wire-tagged Chinook salmon stocked along with treatment and evaluation in Lake Oahe, 1990 –2006.

| Date Stocked | Location | Size (number/lb.) | Corrected No. Stocked | Treatment | Purpose |
|---|---|---|---|---|---|
| 06/08/90 | Whitlocks Bay | 53.0 | 29,019 | Held at Whitlocks station 25 days | Evaluate stock size and identify |
| 11/01/90 | Whitlocks Bay | 8.0 | 7,704 | Held at Whitlocks station 15 days. | Known age fish. Evaluate fall |
| 04/24/91 | Whitlocks Bay | 2.9 | 9,232 | None – direct stock | Stock and identify known age fish. |
| 03/08/91 | Oahe Tailwaters | 3.0 | 5,254 | None | Evaluate stock size and identify Known age and hatchery source. Evaluate Oahe Tailwater stocking. |
| 05/15/91 | Whitlocks Bay | 45.0 | 17,850 | Held at Whitlocks station 14 days. | Compare adults return rate from |
| 05/16/91 | Whitlocks Bay | 46.2 | 19,242 | None – direct stock. | Smolts held and stocked from Whitlocks station. |
| 05/27/92 | Whitlocks Bay | 29.5 | 30,193 | None – direct stock. | Identify known age fish. |
| 05/27/92 | Whitlocks Bay | 60.3 | 2,623 | None – direct stock | Determine stocking success and Survival of “runts”. |
| 05/25/93 | Whitlocks Bay | 33.9 | 22,959 | None – direct stock | Identify known age fish. Compare |
| 05/25/93 | Whitlocks Bay | 50.6 | 18,430 | None – direct stock | Stocking sizes of 34/lb. with 51/lb. |
| 05/23/94 | Whitlocks Bay | 29.6 | 47,973 | None – direct stock | Identify known age fish. |
| 05/30/95 | Whitlocks Bay | 27.9 | 48,469 | None – direct stock | Identify known age fish. |
| 05/28/96 | Whitlocks Bay | 32.5 | 46,397 | None – direct stock | Identify known age fish. |
| 05/27/97 | Whitlocks Bay | 38.9 | 50,428 | None – direct stock | Identify known age fish. |

Appendix G. (continued).

| Date stocked | Location | Size (No./lb.) | Code | Corrected No. stocked | Treatment | Purpose |
|---|---|---|---|---|---|---|
| 06/02/98 | Whitlocks Bay | 34.5 | | 28,822 | None – direct stock | Identify known age fish. |
| 09/23/98 | Whitlocks Bay | 9.4 | | 18,461 | None – direct stock | |
| 06/02/99 | Whitlocks Bay | 40.2 | 28-2 | 15,745 | Inside circular tank rearing density <10 kg/m$^3$ | Determine how rearing density |
| 06/02/99 | Whitlocks Bay | 43.1 | 28-1 | 14,519 | Inside circular tank rearing density >20 kg/m$^3$ | and water flows influence |
| 09/29/99 | Whitlocks Bay | 8.0 | 28-3 | 9,686 | Reared in covered raceway at low flow (200gpm) | Post-stocking salmonid survival |
| 09/29/99 | Whitlocks Bay | 8.1 | 28-4 | 9,685 | Reared in covered raceway at high flow (>300gpm) | |
| 09/26/00 | Whitlocks Bay | 8.46 | 29-2 | 14,835 | Reared in covered raceway at low flow (>100gpm) | Determine how water flows influence |
| 09/26/00 | Whitlocks Bay | 8.61 | 29-1 | 14,850 | Reared in covered raceway at high flow (>250gpm) | Post-stocking salmonid survival |
| 2001 | ---------- | ---- | ---- | ------ | Suspended | Studies were suspended until FCS |
| 2002 | ---------- | ---- | ---- | ------ | Suspended | stockings continue due to a prey shortage |
| 06/02/03 | Whitlocks Bay | 33.64 | 22-6,8 | 3,853 | Inside circular tank rearing density <10 kg/m$^3$ | Replicate 1999 |
| 06/02/03 | Whitlocks Bay | 33.6 | 25-8, 28-6 | 2,230 | Inside circular tank rearing density >20 kg/m$^3$ | Replicate 1999 |
| 10/27/03 | Whitlocks Bay | 8.43 | 22-9 | 1,096 | Growth/survival data | |
| 05/11/04 | Whitlocks Bay | 22.67 | 29-4 | 11,908 | Inside circular tank rearing density <10 kg/m$^3$ | Replicate 1999 |
| 05/11/04 | Whitlocks Bay | 23.93 | 29-3 | 11,093 | Inside circular tank rearing density >20 kg/m$^3$ | Replicate 1999 |
| 05/26/04 | Whitlocks Bay | 84.4 | 26-11 | 6,303 | Rationed feed | Hold back fish experiment-determine Maturation, no tag retention |
| 04/05/05 | Whitlocks Bay | 86.7 | 30-4 | 9,201 | Growth/survival data | |
| 05/31/05 | Whitlocks Bay | 28.5 | 30-3 | 7,088 | Rear without covers | Determine how use of cover influence |
| 05/31/05 | Whitlocks Bay | 27.1 | 30-2 | 9,949 | Rear under covers to provide refuge areas | Post-stocking salmonid survival |
| 10/27/05 | Whitlocks Bay | 6.4 | 30-1 | 3,634 | Growth/survival data | |

Appendix G. (continued).

| Date stocked | Location | Size (No./lb.) | Code | Corrected No. stocked | Treatment | Purpose |
|---|---|---|---|---|---|---|
| 010/31/06 | Whitlocks Bay | 4.6 | 31-1 | 8,204 | Increased fall stock size | Evaluate survival and return to creel and static |
| 05/24/06 | Whitlocks Bay | 21.45 | 31-2 | 13,836 | Reared without covers | Determine how use of cover influence |
| 05/24/06 | Whitlocks Bay | 19.58 | 31-3 | 13,836 | Reared under covers to provide refuge areas | Post-stocking salmonid survival |

Stocking highlighted in gray experienced substantial mortality due to beaching behavior.

Appendix H. Percent of coded-wire tags returned by anglers and recovered at Whitlocks Bay Spawning Station in Lake Oahe, 1989-2006.

| Year stocked | Brood year | Description | Total Number Stocked | % Tag retention | Corrected #tagged fish | Total No. tagged fish return (fisherman) | Total No. tagged fish return (station) | % of tagged FCS returned to | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Fisherman | Station | Total | Data 1 | Data 2 |
| 1990 | 1989 | WBS/Fall Stock (8/lb.) | ---------- | 74.80% | 10,300 | 93 | 108 | 0.90 | 1.05 | 1.95 | 17 | 19 |
| 1990 | 1989 | WBS/(53/lb.) | ---------- | 100% | 29,019 | 114 | 106 | 0.39 | 0.37 | 0.76 | 19 | 26,27 |
| 1991 | 1989 | WBS (2.9/lb.) | ---------- | 76.99% | 11,990 | 177 | 381 | 1.48 | 3.18 | 4.65 | 19 | 24 |
| 1991 | 1990 | WWB Direct Stock (45/lb.) | ---------- | 100% | 19,242 | 107 | 106 | 0.56 | 0.55 | 1.11 | 20 | 28,29,30 |
| 1991 | 1990 | WBS Stock | ---------- | 100% | 17,850 | 82 | 114 | 0.46 | 0.64 | 1.10 | 20 | 31,32,33,34 |
| 1992 | 1991 | WWB (30/lb.) | ---------- | 89.50% | 30,193 | 186 | 199 | 0.62 | 0.66 | 1.28 | 21 | 1,2 |
| 1992 | 1991 | WWB (runts; 60.5/lb.) | ---------- | 86.00% | 2,623 | 2 | 15 | 0.08 | 0.57 | 0.65 | 21 | 3 |
| 1993 | 1992 | WWB (34/lb.; Direct stock) | ---------- | 92.50% | 22,959 | 169 | 220 | 0.74 | 0.96 | 1.69 | 22 | 1,2,3 |
| 1993 | 1992 | WWB (51/lb.) | ---------- | 80.00% | 18,430 | 104 | 108 | 0.56 | 0.59 | 1.15 | 22 | 4,5,6,7 |
| 1994 | 1993 | WWB (29.6/lb.) | 210,656 | 82.80% | 47,973 | 269 | 379 | 0.56 | 0.79 | 1.35 | 23 | 1,2,3,4,5,6 |
| 1995 | 1994 | WWB (27.9/lb.) | 212,999 | 98.00% | 48,469 | 65 | 87 | 0.13 | 0.18 | 0.31 | 24 | 1,2,3,4,5,6 |
| 1996 | 1995 | WWB (32.5/lb.) | 237,217 | 86.00% | 46,394 | 10 | 18 | 0.02 | 0.04 | 0.06 | 25 | 1,2,3,4,5,6 |
| 1997 | 1996 | WWB (38.9/lb.) | 243,278 | 80.50% | 50,428 | 23 | 96 | 0.05 | 0.19 | 0.24 | 26 | 1,2,3,4,5,6 |
| 1998 | 1997 | WWB (34.5/lb.) | 126,144 | 82.10% | 28,822 | 7 | 14 | 0.02 | 0.05 | 0.07 | 27 | 1 |
| 1998 | 1997 | WWB (9.41/lb.) | 47,696 | | 19,315 | 4 | 28 | 0.02 | 0.14 | 0.17 | 27 | 2 |
| 1999 | 1998 | WWB (43.13/lb.) | 54,772 | 99.00% | 14,519 | - | 3 | 0.00 | 0.02 | 0.02 | 28 | 1 |
| 1999 | 1998 | WWB (40.24/lb.) | 54,772 | 97.10% | 15,745 | 2 | 26 | 0.01 | 0.17 | 0.18 | 28 | 2 |
| 1999 | 1998 | WWB (8/lb.) | 50,204 | 98.60% | 9,686 | 2 | 59 | 0.02 | 0.61 | 0.63 | 28 | 3 |
| 1999 | 1998 | WWB (8.12/lb.) | 50,204 | 98.30% | 9,685 | 2 | 55 | 0.02 | 0.57 | 0.59 | 28 | 4 |
| 2000 | 1999 | WWB (8.61/lb.) | 24,597 | 99.00% | 14,850 | 4 | 180 | 0.03 | 1.21 | 1.24 | 29 | 1 |
| 2000 | 1999 | WWB (8.46/lb.) | 24,582 | 98.90% | 14,835 | - | 116 | 0.00 | 0.78 | 0.78 | 29 | 2 |
| 2001 | 2000 | None | | | | | | | | | | |
| 2002 | 2001 | None | | | | | | | | | | |
| 2003 | 2002 | WWB (33.7/lb.) | 5,688 | 39.20% | 2,230 | 1 | 5 | 0.04 | 0.22 | 0.27 | 25, 28 | 8, 6 |
| 2003 | 2002 | WWB (33.6/lb.) | 4,403 | 87.50% | 3,853 | 1 | 15 | 0.03 | 0.39 | 0.42 | 22 | 6, 8 |
| 2003 | 2002 | WWB (8.4/lb.) | 4,368 | 25.10% | 1,096 | | 22 | 0.00 | 2.01 | 2.01 | 22 | 9 |
| 2004 | 2003 | WWB (33.7/lb.) | 13,528 | 82.00% | 11,093 | | | 0.00 | 0.00 | 0.00 | 29 | 3 |
| 2004 | 2003 | WWB (33.6/lb.) | 14,295 | 83.30% | 11,908 | | 1 | 0.00 | 0.01 | 0.01 | 29 | 4 |
| 2004 | 2003 | WWB (84.4/lb.) | 6,303 | Not available | 6,303 | | | 0.00 | 0.00 | 0.00 | 26 | 11 |
| 2005 | 2004 | WWB (6.4/lb) | 6,387 | 56.9% | 3,634 | | | | | | 30 | 1 |
| 2005 | 2004 | WWB (27.1/lb) | 9,959 | 99.9% | 9,949 | | | | | | 30 | 2 |
| 2005 | 2004 | WWB (28.5/lb) | 9,777 | 72.5% | 7,088 | | | | | | 30 | 3 |
| 2005 | 2004 | WWB (86.7/lb) | 9,389 | 98% | 9,201 | | | | | | 30 | 4 |
| 2006 | 2005 | WWB (4.6/lb) | 9,540 | 86% | 8,204 | | | | | | 31 | 1 |
| 2006 | 2005 | WWB (21.45/lb | 13,976 | 99% | 13,836 | | | | | | 31 | 2 |
| 2006 | 2005 | WWB (19.58/lb) | 13,976 | 99% | 13,836 | | | | | | 31 | 3 |

Portions in gray are still being created

Stocking highlighted in yellow experienced substantial mortality due to beaching behavior.

Appendix I. Estimated contribution of North Dakota Chinook salmon to South Dakota spawning operations on Lake Oahe during 2005 and 2006.

Estimated contribution of North Dakota Chinook salmon to South Dakota spawning operations on Lake Oahe during 2005.

| ID code | State | Year Stocked | Brood year | Stocking size /lb. | ND FCS Corrected No. CWT | No. fish captured | % CWT returned | Total No. stocked | Est. No. of ND FCS fall of 05 |
|---|---|---|---|---|---|---|---|---|---|
| 2-1 | ND | 2002 | 2001 | 50 | 13,790 | 3 | 0.02175 | 98,283 | 21 |
| 2-3 | ND | 2002 | 2001 | 50 | 13,230 | 1 | 0.00756 | 250,554 | 19 |
| 2-11 | ND | 2003 | 2002 | 45 | 14,025 | 2 | 0.01426 | 202,965 | 29 |
| 2-12 | ND | 2003 | 2002 | 27 | 14,490 | 3 | 0.00690 | 97,500 | 7 |
| TOTALS | | | | | 55,535 | 8 | | | 76 |

| Total FCS collected | Est. No. of ND FCS | Estimated % of ND FCS collected during During SD Spawn |
|---|---|---|
| 372 | 76 | 20% |

Note: Data used in calculations from Paul Bailey, North Dakota Fish and Game Department.

Appendix I continued. Estimated contribution of North Dakota Chinook salmon to South Dakota spawning operations on Lake Oahe during 2005 and 2006.

Estimated contribution of North Dakota Chinook salmon to South Dakota spawning operations on Lake Oahe during 2006.

| ID code | State | Year Stocked | Brood year | Stocking size /lb. | ND FCS Corrected No. CWT | No. fish captured | % CWT returned | Total No. stocked | Est. No. of ND FCS fall of 06 |
|---|---|---|---|---|---|---|---|---|---|
| 2-12 | ND | 2003 | 2002 | 27 | 14,490 | 1 | 0.00690 | 202,965 | 14 |
| 2-28 | ND | 2005 | 2004 | 25.5 | 26,181 | 1 | 0.00382 | 200,000 | 8 |
| TOTALS | | | | | 40,671 | 2 | | | 22 |

| Total FCS collected | Est. No. of ND FCS | Estimated % of ND FCS collected during during SD Spawn |
|---|---|---|
| 993 | 22 | 2% |

Note: Data used in calculations from Jason Lee, North Dakota Fish and Game Department.

Appendix J. Summary of South Dakota, North Dakota and Montana Chinook salmon total egg take efforts and egg transfers among states.

| Year | No. of eggs taken in SD | No. of eggs taken in ND | No. of eggs taken in MT | No. of excess eggs given to ND from SD | No. of excess eggs given to MT from SD | No. of excess eggs given to SD from ND | No. of excess eggs given to MT from ND |
|---|---|---|---|---|---|---|---|
| 1980 | | 90,000 | | | | | |
| 1981 | 100,000 | 400,000 | | | | | |
| 1982 | | Unknown | | | | | |
| 1983 | | N/A | | | | | 250,000 |
| 1984 | 81,340 | 395,000 | | | | | |
| 1985 | 364,900 | 379,700 | | | | | |
| 1986 | 186,746 | 479,600 | | | | | 177,413 |
| 1987 | 871,137 | 2,403,000 | | | | | |
| 1988 | 667,796 | 933,234 | | | | | 55,940 |
| 1989 | 418,160 | 739,350 | | | | | |
| 1990 | 787,708 | 1,574,269 | | | | | 101,210 |
| 1991 | 453,864 | 654,280 | | | | | |
| 1992 | 992,630 | 1,087,500 | | | 112,000 | | |
| 1993 | 1,744,100 | 392,000 | | 677,200 | | | |
| 1994 | 1,542,180 | 381,700 | | 502,500 | 50,000 | | 37,000 |
| 1995 | 1,969,162 | 547,650 | | 849,000 | 240,000 | | |
| 1996 | 1,054,841 | 1,570,130 | 390,000 | 228,000 | | | |
| 1997 | 558,945 | 1,126,406 | | | | 50,000 | |
| 1998 | 498,100 | 749,116 | 6,000 | | 49,561 | | |
| 1999 | 316,862 | 3,038,219 | 141,000 | | 193,000 [a] | | 250,000 |
| 2000 | 155,700 | 2,203,638 | | | 54,925 | | 344,393 |
| 2001 | 153,264 | 2,400,322 | | | 43,150 | | 600,000 |
| 2002 | 1,192,372 | 2,005,380 | 64,000 | | 350,800 [b] | | |
| 2003 | 1,162,372 | 644,242 | 231,645 | 311,200 | 186,366 | | |
| 2004 | 33,120 | 1,756,000 | | | | 407,846 | 200,000[c] |
| 2005 | 377,301 | 1,683,600 | | | | | |
| 2006 | 1,015,447 | 702,112 | 124,140 | | | | 350,000 |
| **Total** | 16,698,047 | 28,336,448 | 956,785 | 2,567,900 | 1,279,802 | 808,518 | 2,148,714 |
| **Average** | 695,752 | 1,133,458 | 95,679 | 513,580 | 142,200 | 269,506 | 195,338 |

[a] Includes 100,000 eggs from collected from Cleghorn Springs Hatchery brood stock; [b] Includes 200,000 fingerling raised for MT; [c]Fingerlings raised in SD hatchery for MT, eggs from

Appendix K. The number of good female Lake Oahe Chinook salmon spawned from 1984-2006 in relation to 11.1 -13.9°C (52-57°F) water temperatures.

Appendix L. Chinook salmon carcass contract results for 2005 and 2006.

## 2005 Salmon Carcass Contract

| Date | Number of Salmon Received | Pounds of Fish Received | Bid Price/lb. | | Total |
|---|---|---|---|---|---|
| Oct. 6, 2005 | 28 | 206 | **$0.10** | **$** | **20.60** |
| Oct. 12, 2005 | 118 | 822 | **$0.10** | **$** | **82.20** |
| Oct.17, 2005 | 104 | 691 | **$0.10** | **$** | **69.10** |
| Oct. 26, 2005 | 122 | 816 | **$0.10** | **$** | **81.60** |
| **Total:** | 372 | 2,535 | | **$** | **253.50** |
| **2005 cost for salmon carcasses:** | | | | **$** | **253.50** |

.10 cents a pound up to 7,000 lbs and .05 cents per pound over 7,000 lbs

## 2006 Salmon Carcass Contract

| Date | Number of Salmon Received | Pounds of Fish Received | Bid Price/lb. | | Total |
|---|---|---|---|---|---|
| Oct. 4, 2006 | 118 | 928 | **$0.20** | **$** | **185.60** |
| Oct. 10, 2006 | 251 | 1,721 | **$0.20** | **$** | **344.20** |
| Oct.18, 2006 | 321 | 1912 | **$0.20** | **$** | **382.40** |
| Oct. 25, 2006 | 303 | 2067 | **$0.20** | **$** | **413.40** |
| **Total:** | 993 | 6,628 | | **$** | **1,325.60** |
| **2006 cost for salmon carcasses:** | | | | **$** | **1,325.60** |

.20 cents a pound up to 7,000 lbs and .10 cents per pound over 7,000 lbs

# Appendix M. Length at selected number per pound values for rainbow trout and Chinook salmon.

**Length at selected number per pound values for rainbow trout**

**Note**: These values come from condition factor averaged from
Thousands of hatchery fish measured and weighed and are to be considered with
A grain of salt for wild fish.

| Condition Factor (C) | Number per lb. | Individual Weight lb. | Length (inches) |
|---|---|---|---|
| 0.0004 | 2500.00 | 0.0004 | 1.0 |
| 0.0004 | 740.74 | 0.0014 | 1.5 |
| 0.0004 | 312.50 | 0.0032 | 2.0 |
| 0.0004 | 160.00 | 0.0063 | 2.5 |
| 0.0004 | 92.59 | 0.0108 | 3.0 |
| 0.0004 | 58.31 | 0.0172 | 3.5 |
| 0.0004 | 39.06 | 0.0256 | 4.0 |
| 0.0004 | 27.43 | 0.0365 | 4.5 |
| 0.0004 | 20.00 | 0.0500 | 5.0 |
| 0.0004 | 15.03 | 0.0666 | 5.5 |
| 0.0004 | 11.57 | 0.0864 | 6.0 |
| 0.0004 | 9.10 | 0.1099 | 6.5 |
| 0.0004 | 7.29 | 0.1372 | 7.0 |
| 0.0004 | 5.93 | 0.1688 | 7.5 |
| 0.0004 | 4.88 | 0.2048 | 8.0 |
| 0.0004 | 4.07 | 0.2457 | 8.5 |
| 0.0004 | 3.43 | 0.2916 | 9.0 |
| 0.0004 | 2.92 | 0.3430 | 9.5 |
| 0.0004 | 2.50 | 0.4000 | 10.0 |

**C is based On English Measurements (Pounds and Inches)**

Excel equation to calculate length from a known number/pound.

=10^((LOG(1000/**#/LB**.)-LOG(**Cond Factor***1000))/3)

**To calculate length in inches enter number/lb here** 10

**and condition factor (C) here** 0.0004

**Length in Inches =** 6.30

Excel equation to calculate individual fish weight from a known Length

=**Cond. Factor***(**Length**^3)

**To calculate number/lb enter length (inches) here** 6.30

**and condition factor (C) here** 0.0004

**Weight per fish =** 0.1000

**Number per Pound =** 9.9981

**Length at selected Number per Pound values for Chinook Salmon**

**Note**: These values come from condition factor averaged from
thousand of hatchery fish measured and weighed and are to be considered with
a grain of salt for wild fish.

| Condition Factor | Number per lb. | Individual weight lb. | Length (inches) |
|---|---|---|---|
| 0.0003 | 3333.33 | 0.0003 | 1.0 |
| 0.0003 | 987.65 | 0.0010 | 1.5 |
| 0.0003 | 416.67 | 0.0024 | 2.0 |
| 0.0003 | 213.33 | 0.0047 | 2.5 |
| 0.0003 | 123.46 | 0.0081 | 3.0 |
| 0.0003 | 77.75 | 0.0129 | 3.5 |
| 0.0003 | 52.08 | 0.0192 | 4.0 |
| 0.0003 | 36.58 | 0.0273 | 4.5 |
| 0.0003 | 26.67 | 0.0375 | 5.0 |
| 0.0003 | 20.04 | 0.0499 | 5.5 |
| 0.0003 | 15.43 | 0.0648 | 6.0 |
| 0.0003 | 12.14 | 0.0824 | 6.5 |
| 0.0003 | 9.72 | 0.1029 | 7.0 |
| 0.0003 | 7.90 | 0.1266 | 7.5 |
| 0.0003 | 6.51 | 0.1536 | 8.0 |
| 0.0003 | 5.43 | 0.1842 | 8.5 |
| 0.0003 | 4.57 | 0.2187 | 9.0 |
| 0.0003 | 3.89 | 0.2572 | 9.5 |
| 0.0003 | 3.33 | 0.3000 | 10.0 |

**Guide to selecting Condition Factor (C)**
**For various Fish Species**

| Condition Factor (C) | Species |
|---|---|
| 0.000150 | Muskellune and Tiger Muskie |
| 0.000200 | Northern Pike |
| 0.000250 | Lake Trout |
| 0.000300 | Chinook Salmon, Walleye, Channel Catfish |
| 0.000350 | Cutthroat, Coho |
| 0.000400 | Rainbow, brook and brown trout |
| 0.000450 | Large Mouth bass |

**Haskell, David G. 1959. Trout growth in hatcheries. New York Fish And Game Journal, Vol. 5, no. 2, pp. 204 - 237.**