ANNUAL PROGRESS REPORT

FISH RESEARCH PROJECT
OREGON

Monitoring of Hospital Pond (2004):

Willamette Basin Oregon Chub Investigations, Monitoring & Management

Contract Number: W66QKZ23304328 (FY04)

Project Period: 1 October 2003- 30 September 2004

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This project was financed with funds administered by the U.S. Army Corps of Engineers.

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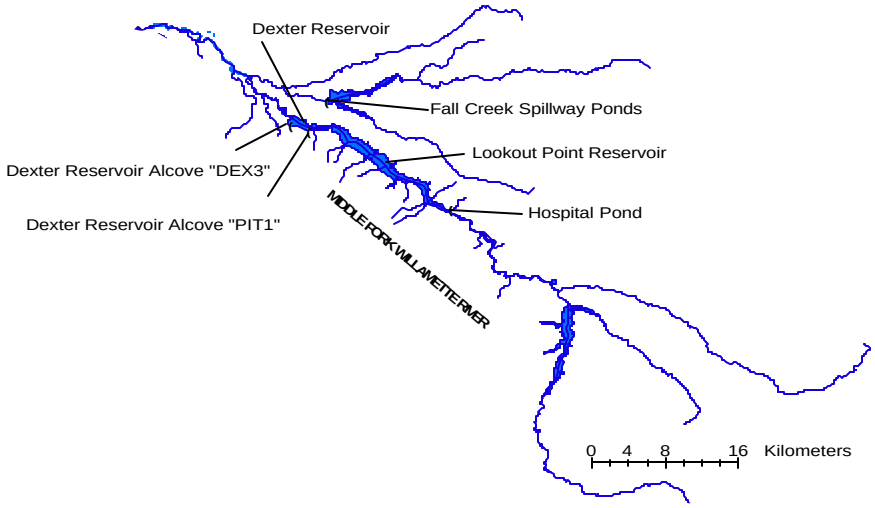
INTRODUCTION

The Oregon chub *Oregonichthys crameri,* endemic to the Willamette Valley of western Oregon, was listed as endangered in 1993 under the federal Endangered Species Act (Rhew 1993). This species was formerly distributed throughout the Willamette Valley (Markle et al. 1991) in off-channel habitats such as beaver ponds, oxbows, stable backwater sloughs, and flooded marshes. These habitats are characterized by little to no water flow, silty and organic substrate, and abundant aquatic vegetation and cover for hiding and spawning. In the past 100 years, these habitats have been drastically reduced because of changes in seasonal flows resulting from the construction of dams throughout the basin, channelization, revetments, diking, and drainage of wetlands. This loss of habitat, combined with the introduction of non-native species to the Willamette Valley such as largemouth bass *Micropterus salmoides* and bluegill *Lepomis macrochirus,* have been implicated in the decline and the restricted distribution of Oregon chub (U.S. Fish and Wildlife Service 1998).

Oregon Department of Fish and Wildlife (ODFW) monitored the effects of water storage and flow management operations at Lookout Point Reservoir from 2000-2003 and found that changes in reservoir elevation directly affected water levels, water temperatures, and the suitability and availability of Oregon chub spawning habitat in Hospital Pond (Scheerer and McDonald 2000; 2001; 2003; Scheerer and Terwilliger 2002; 2003; 2004). Seasonal changes in reservoir and pond elevations were found to affect Oregon chub spawning success and juvenile survival. We found that the filling of the reservoir and flooding of the pond terrace were necessary to increase pond temperatures (>15^{o}C) that allow for successful Oregon chub spawning in Hospital Pond (Scheerer and McDonald 2000).

In 2000, following the listing of Willamette spring chinook and winter steelhead under the federal Endangered Species Act (NOAA 1999), flow management in the Willamette River was modified. New minimum conservation flows at Salem were recommended during April through June of each year (Mamoyac et al. 2000). Management of tributary flows was also altered to balance the demand for water for recreation in the Willamette subbasins with flow levels at Salem. Because Lookout Point has some of the lowest recreational use and the highest storage volume of the Willamette reservoirs, the demand to draft this reservoir to provide spring flows increased. Under the new management regime, Lookout Point Reservoir was not projected to fill, of if it filled it was not projected to remain full through the chub spawning season (mid-May through mid-July), in most years. In 2000, the Corps initiated a study to determine the feasibility of modifying Hospital Pond to provide managers the ability to independently regulate pond elevation. ODFW was contracted to collect life history and population data to assess the effects of these modifications on Oregon chub abundance and recruitment.

Hospital Pond is a long (~300 m), narrow (6-10 m), deep (2-5 m), spring-fed pond that was created during the construction of the North Shore Road near Lookout Point Reservoir (Figure 1). A culvert connects the pond to Lookout Point reservoir at reservoir elevations exceeding 916 ft (full pool elevation is 926 ft). Prior to 2001, the availability of suitable Oregon chub spawning habitat in Hospital Pond was dependent on the flooding of the vegetated terrace. Pond elevation was determined solely by Lookout Point Reservoir elevation. When the reservoir elevation exceeded 922 feet, the vegetated terrace was flooded. This occurred over a 9-10 week period from early-May to mid-July. Hatch date analyses showed that successful spawning of Oregon chub occurred only when the reservoir elevation exceeded 922 ft and the vegetated terrace was flooded (Scheerer et al. 1998, Scheerer and McDonald 2000). After the reservoir level dropped in mid-July, the water temperature in the pond dropped, and no successful spawning was documented. In 2001, the Willamette basin experienced drought conditions and Lookout Point reservoir did not fill. These conditions negatively impacted the recruitment of Oregon chub in Hospital Pond. Successful spawning was limited in 2001, resulting in a weak



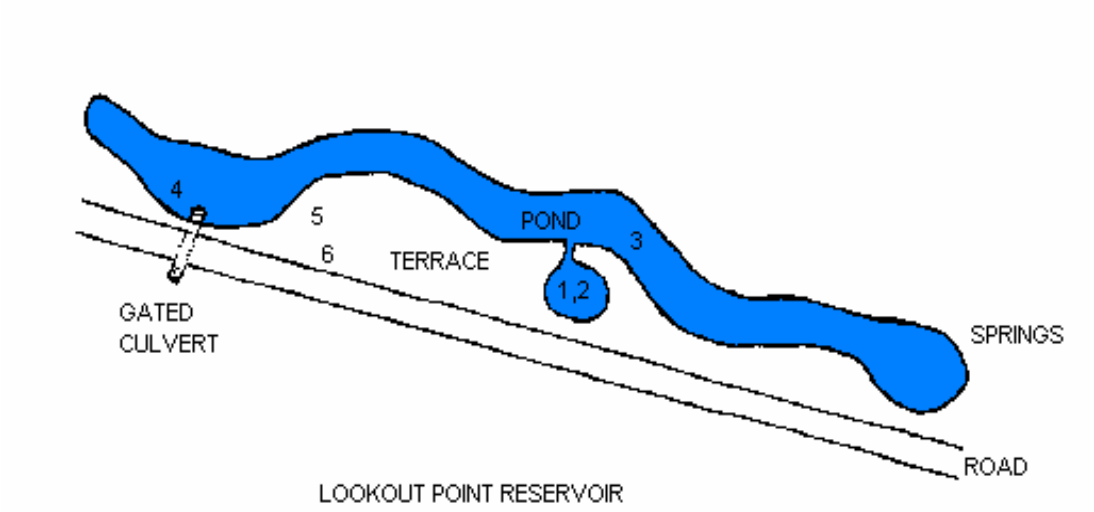


Figure 1. Map (top) showing the locations of chub sites in the Middle Fork Willamette River drainage. Diagram of Hospital Pond (bottom) showing locations of temperature monitors placed in the alcove (1-surface, 2-substrate), the pond (3-surface, 4-substrate), the terrace (5-substrate), and in a tree located on the terrace (6-air temperature). The springs that feed the pond are located at the east end and the gated culvert is located at the west end. The terrace is located between the pond and the North Shore Road. Lookout Point Reservoir is located south of the road.

2001 year-class. The Oregon chub population abundance declined 46 percent from 2,980 adult chub in 2000 to 1,600 chub in 2003.

Pond modifications were conducted in 2001-2003. In the spring of 2001, the Corps installed a gate on the culvert exiting Hospital Pond. However, leakages around the culvert and through the road fill prevented managers from being able to increase pond elevations enough to flood the pond terrace. In the spring of 2002, the Corps sealed the western end of the pond with bentonite clay and reconstructed the gate on the culvert. In 2002, we were able to maintain the pond elevation above the elevation of the vegetated terrace (922 ft.), only when the reservoir elevation exceeded 917 ft. When the reservoir dropped below 917 ft, the pond elevation stabilized at 920 ft. In 2003, the Corps excavated a shallow alcove in the terrace to provide potential spawning habitat that was available for Oregon chub at the pond elevations less than 920 ft. In 2003, the newly excavated alcove was flooded from mid-May through October. However, we found that water temperatures in the alcove exceeded 15^{o}C only when the water depth in the alcove was relatively shallow (<1.5 feet). When the alcove depth was deeper than 1.5 feet, water temperatures dropped, presumably due to the greater exchange of cold spring water in the pond with water in the alcove.

This report contains the results of research conducted in 2004 at Hospital Pond, including monitoring of air and water temperature profiles, monitoring of reservoir and pond level elevations, and the collection and analysis of Oregon chub aging and hatch date data. These data will be useful to the Corps for planning near-term and long range water storage and flow management and to protect Oregon chub and their habitat in Hospital Pond. This report also contains results of monitoring naturally occurring and reintroduced Oregon chub populations on Corps properties in the Willamette Valley.

METHODS

Temperature Monitoring

Temperature recorders (Hobo®) were placed at five locations in Hospital Pond (Figure 1). One recorder was placed on the substrate near the culvert at the southwestern end of the pond, a second recorder was attached to a cable that was anchored to a post and was floated in the pond approximately 0.1 m below the surface near the center of the pond, a third recorder was placed on the substrate of the alcove, a fourth recorder was floated approximately 0.1 m below the surface in the alcove, and a fifth recorder was placed on the shallow vegetated terrace on the south side of the pond. Air temperature was monitored with a recorder placed on the branch of a tree (approximately 1.5 m above the ground) growing on the edge of the shallow vegetated terrace of the pond. This recorder was covered with moss and remained in the shade throughout the day. Recorders were set to record at five hour intervals. The maximum temperature recorded each day was used to determine whether the threshold temperature of approximately 15-16^{0}C, necessary for Oregon chub to spawn, was exceeded (Scheerer and McDonald 2000).

Monitoring Pond and Reservoir Elevations

Staff gages were installed on the gate structure of the culvert and in the alcove. The staff gage in the culvert was sunk 0.6 meters into the substrate to match the gage on the gate structure. Water elevations were recorded from April through September. The elevations of culvert and the bottom of the alcove are approximately 916 feet and 916.6 feet, respectively.

Adult Aging

In April 2004, we collected a random sample of 50 adult Oregon chub from Hospital Pond using baited minnow traps. The fish were collected to determine the age structure of the population. The fish were sacrificed and placed in 95% ethanol. Samples were taken back to the lab to be processed. Total lengths were measured to the nearest millimeter. The right lapillus was removed from each fish using a fine tip probe under a dissecting scope. Each otolith was soaked in a 10% bleach solution for several minutes to remove tissue, rinsed twice with distilled water, rinsed a third time with 95% ethanol, and allowed to air dry (Secor et al. 1992). Otoliths were embedded into molds (plugs) of Spurr® epoxide resin (Spurr 1969). Plugs were mounted on glass slides for thin sectioning using a low speed Isomet® diamond blade saw. Two transverse cuts were made into the plug to produce a thin section (0.5 mm) that included the otolith core. Thin sections were mounted on glass slides in Crystal Bond, ground using 1500 grit wet/dry sandpaper, and polished using Buehler Gamma Micropolish alumina solution (0.05 μ) and a Buehler Microcloth polishing cloth. Adult otoliths were aged using transmitted light at 250X under a compound scope (Hoff et al. 1997). Adult otoliths were read twice by one reader. If there was a discrepancy, a third reading was made. In these cases, the age determined in the majority of reads was assigned to the fish.

Hatch Date Distribution

In late-September 2004, we collected 50 juvenile Oregon chub from Hospital Pond to determine their hatch date distribution and to relate the onset and duration of spawning with pond temperatures. Otoliths (right lapilli) were removed using a fine tip probe under a dissecting scope. Otoliths were mounted dorsoventrally in Crystal Bond® on glass slides and polished in the sagittal plane to the core. Otoliths were flipped and polished on both sides to improve resolution of growth increments. Otoliths from juvenile chub were ground and polished in the same manner as otoliths from adult chub. Otoliths were aged with transmitted light at 500X using a microcomputer equipped with Optimas® imaging software. Each translucent-opaque band represented a daily growth increment (DGI) (Campana and Neilson 1985). DGI were counted from the core out to and including the posterior edge of the otolith. Increments that disappeared when adjusting the fine focus were not counted as DGI. Hatch dates were estimated by subtracting the number of daily increments from the collection date. Otoliths from juvenile fish were read three times by one reader. A final age was assigned that was the median of the three counts. Hatch dates were combined into one-week (7-day) categories. Spawning dates were estimated to be seven days prior to the hatch date. Data for incubation time are not available for Oregon chub. We used available data, approximately seven days from spawning to hatching, for redside shiner *Richardsonius balteatus* (Weisel and Newman 1951).

Population Estimates

Population estimates were obtained for naturally occurring Oregon chub populations at Hospital Pond and the Dexter Reservoir alcoves and for introduced Oregon chub populations in the Fall Creek Spillway Ponds and Foster Pullout Pond. Minnow traps (23 cm x 46 cm with 64 mm mesh) were used to capture chub. Traps were baited with a half slice of bread and set for 3-4 hours. We marked fish with a partial caudal fin clip and returned them to the water. Population abundance was estimated using single-sample mark-recapture procedures (Ricker 1975). Confidence intervals were calculated using a Poisson approximation (Ricker 1975). Fish smaller than ~35 mm in length were not captured by the minnow traps, and were not included in the estimates. Excluded from estimates were age 0 fish (Scheerer and McDonald 2000).

RESULTS

Temperature Monitoring

Water temperatures in Hospital Pond varied substantially depending on the location of the temperature monitor (Figure 2). From April 12 through September 22, changes in water temperature measured near the surface of the pond (mean 15.7°C; range 9.2-20.7°C), near the surface of the alcove (mean 16.7°C; range 9.8-22.2°C), and on the substrate in the alcove (mean 13.7°C; range 10.2-19.0°C) closely paralleled changes in air temperature (mean 20.6°C; range 11.2-31.1°C). Water temperatures were substantially cooler on the bottom of the pond during this period (mean 10.5°C; range 9.8-11.3°C). Cold dense spring water enters the pond at the eastern end, flows through the pond, and exits the pond through the culvert at the southwestern end. A warmer surface stratum covers the cold stratum and extends ~0.1 m down from the surface. Both the pond and alcove were covered with a dense blanket of floating aquatic vegetation, *Azolla mexicana*, from early-June through mid-August. This vegetation likely acted to increase the pond and alcove temperatures by trapping heat and increasing heat absorption (greenhouse effect). In 2004, reservoir levels never exceeded 922 ft and the temperature monitor placed on the shallow vegetated terrace was not covered with water.

Pond and Reservoir Elevations

We closed the gate on the pond's outflow culvert on April 12, 2004. Within two weeks, the pond elevation increased 2.4 feet to 918.4 feet (Figure 3). Because the elevation of the bottom of the alcove (916.6 feet) is 0.6 feet above the lip of the culvert (916.0 feet), the depth of the water in the alcove was 1.6 feet at this time. From late-April through late-July, the pond elevation fluctuated between 917.9 and 918.4 feet (alcove depth 1.1-1.6 feet). By late-July, the pond elevation began to drop. In mid-August pond elevation was 917.5 feet (alcove depth 0.7 feet) and on September 21 pond elevation was 917.1 feet (alcove depth 0.3 feet). As the pond elevation dropped, the alcove's surface and substrate temperatures converged. We opened the gate on the culvert in late-October. The maximum reservoir elevation in 2004 was 905.2 feet, well below the elevation of the Hospital Pond culvert.

Adult Age and Growth

Ages of adult Oregon chub in 2004 ranged from 1-5 years (Figure 4). The fish collected for aging ranged in size from 44-78 mm (total length). There was substantial overlap in the ranges of total lengths across the younger three age categories (Table 1). The 2004 aging sample was dominated by the 2002 year class (age 2). A strong year-class also occurred in 1999 (Figure 4). In both years, conditions were favorable for Oregon chub in Hospital Pond (flooded terrace and elevated temperatures). The 2001 Oregon chub year-class was weak, evidence of minimal recruitment during the drought in 2001. There is an apparent discrepancy in the 2002 age structure. The 2000 year class comprises 26% of 2001 age composition, 4% of the 2002 age composition, and 21% of the 2003 age composition. We would have expected the proportion of 2 year old fish in the 2002 aging sample to be larger. Comparison of the length frequency distributions for fish that we measured in 2002 while conducting the population estimate with fish sacrificed for aging indicates that smaller (younger) fish were under represented in the aging sample (Figure 5). In 2002, fish smaller than 65 mm accounted for 36%

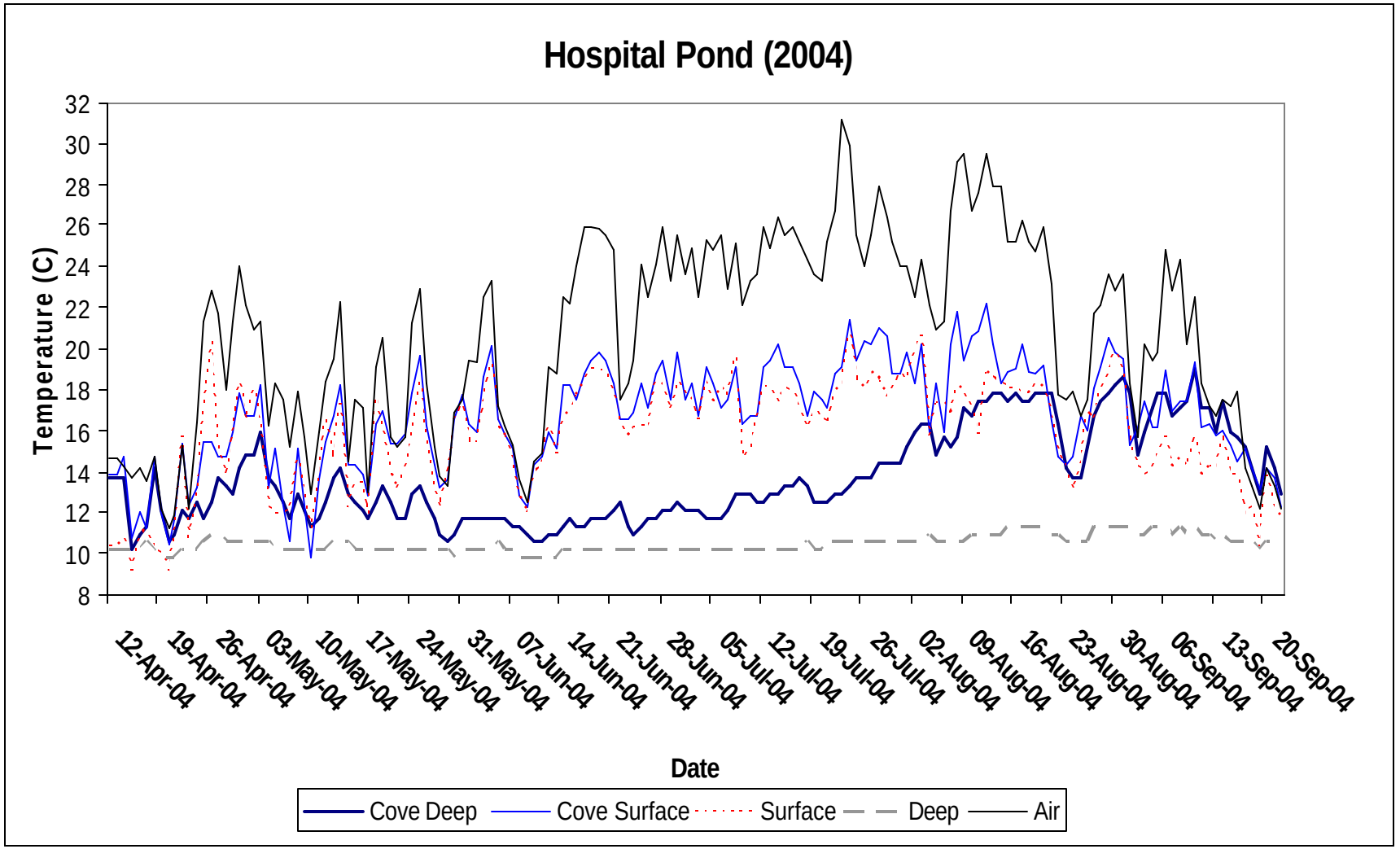


Figure 2. Water and air temperatures recorded at Hospital Pond from April 12 through September 22, 2004.

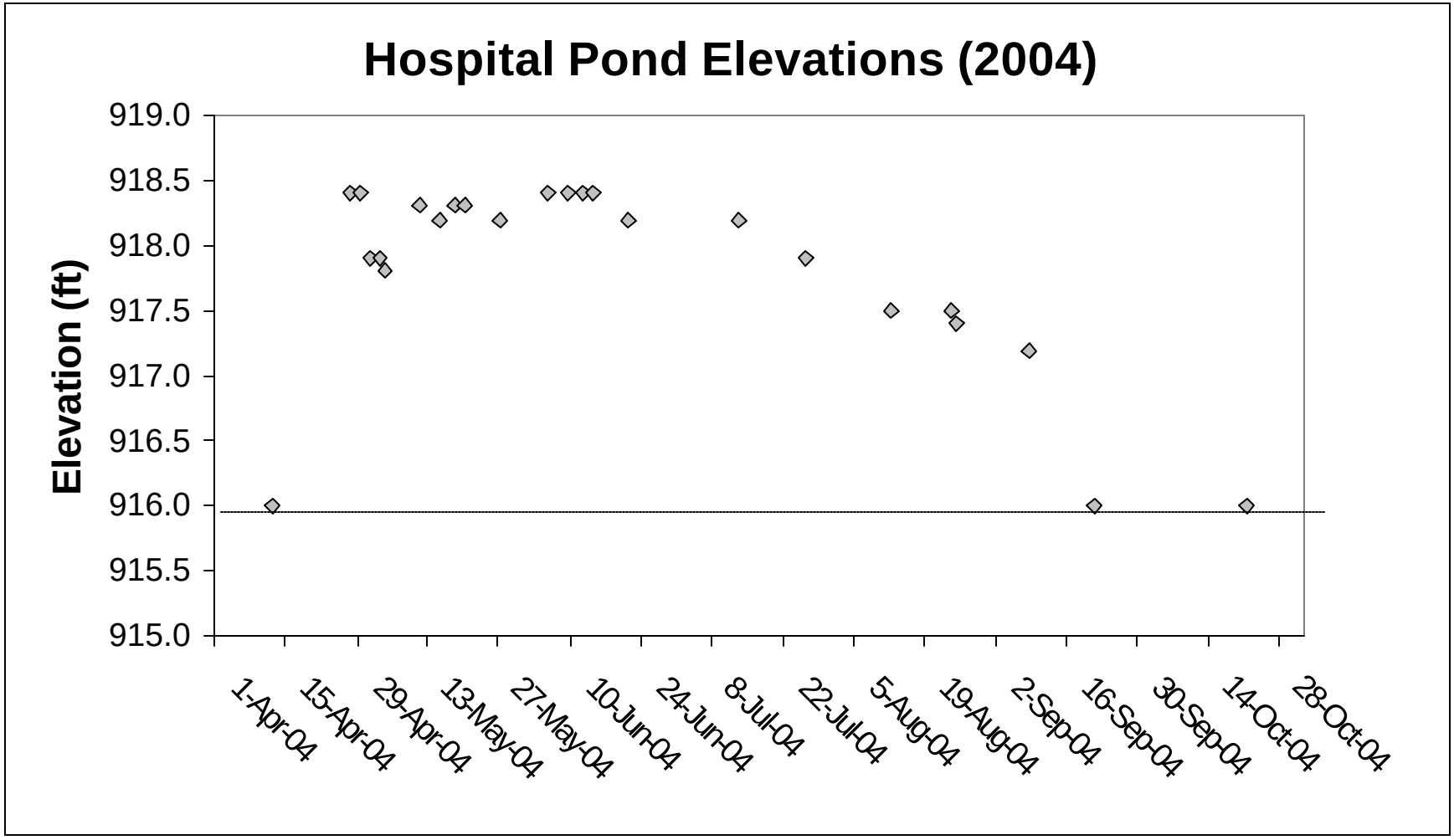


Figure 3. Water elevations in Hospital Pond from April 1 through October 31, 2004. The elevation of the pond's culvert is represented by a dotted horizontal line.

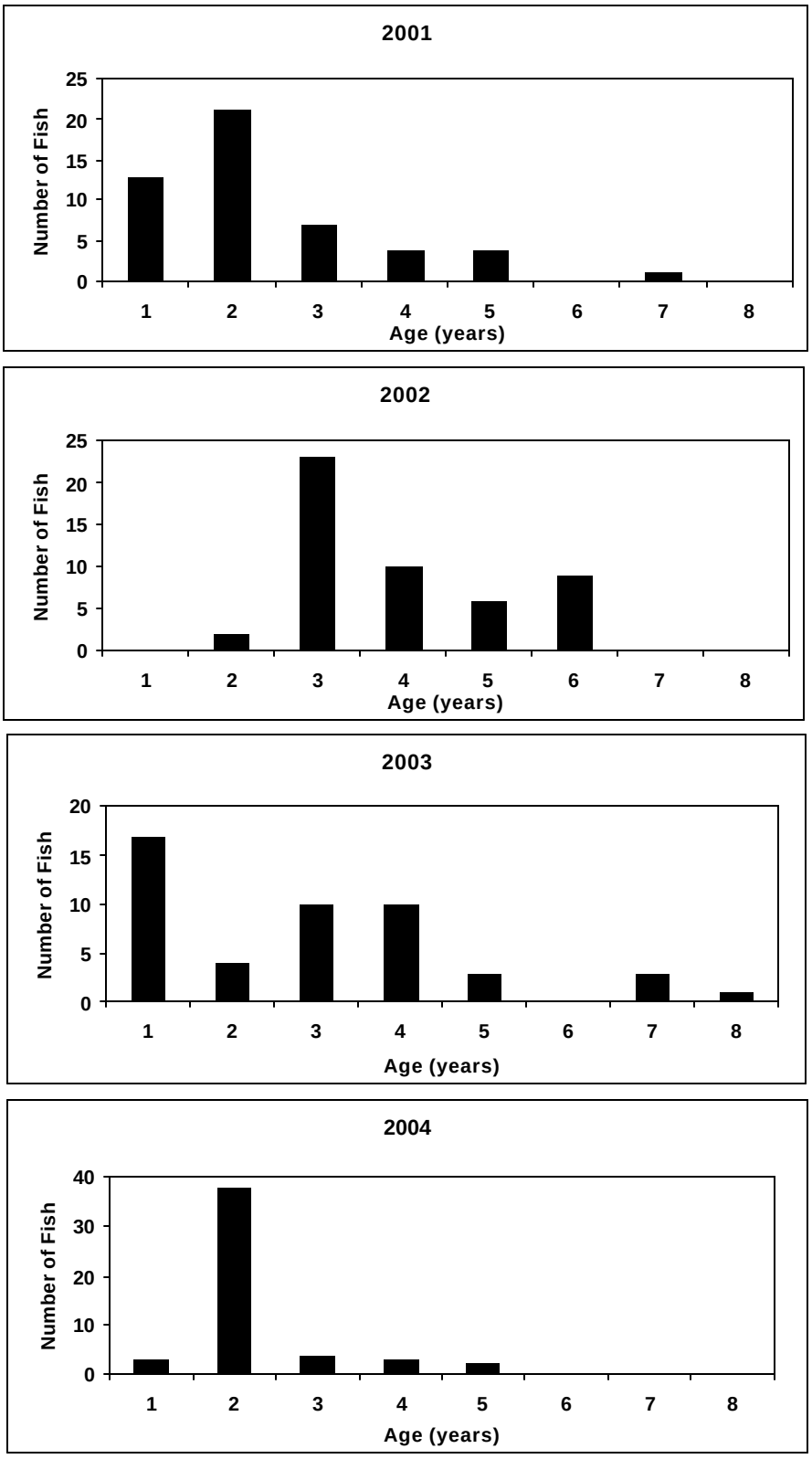


Figure 4. Age structure of the Oregon chub population in Hospital Pond from 2001-2004.

Table 1. Mean lengths at capture and ranges of lengths for Oregon chub aged 1-8 years from Hospital Pond in 2001 through 2004.

	Age (years)							
	1	2	3	4	5	6	7	8
2001								
Mean total length (mm)	55	63	65	72	72	-	85	-
Range of values	(52-59)	(56-68)	(60-69)	(71-74)	(65-78)	-	(85-85)	-
Number of fish	13	21	7	4	4	0	1	0
Percentage of sample	26	42	14	8	8	0	2	0
2002								
Mean total length (mm)	-	57	67	69	73	77	-	-
Range of values	-	(55-59)	(57-74)	(65-75)	(65-82)	(71-82)	-	-
Number of fish	0	2	23	10	6	9	0	0
Percentage of sample	0	4	46	20	12	18	0	0
2003								
Mean total length (mm)	43	48	62	69	73	-	74	79
Range of values	(39-48)	(42-52)	(58-66)	(64-72)	(69-78)	-	(70-79)	(79-79)
Number of fish	17	4	10	10	3	0	3	1
Percentage of sample	35	8	21	21	6	0	6	2
2004								
Mean total length (mm)	46	53	62	70	78	-	-	-
Range of values	(44-48)	(44-59)	(55-68)	(68-72)	(77-78)	-	-	-
Number of fish	3	39	4	3	2	0	0	0
Percentage of sample	6	78	8	6	4	0	0	0

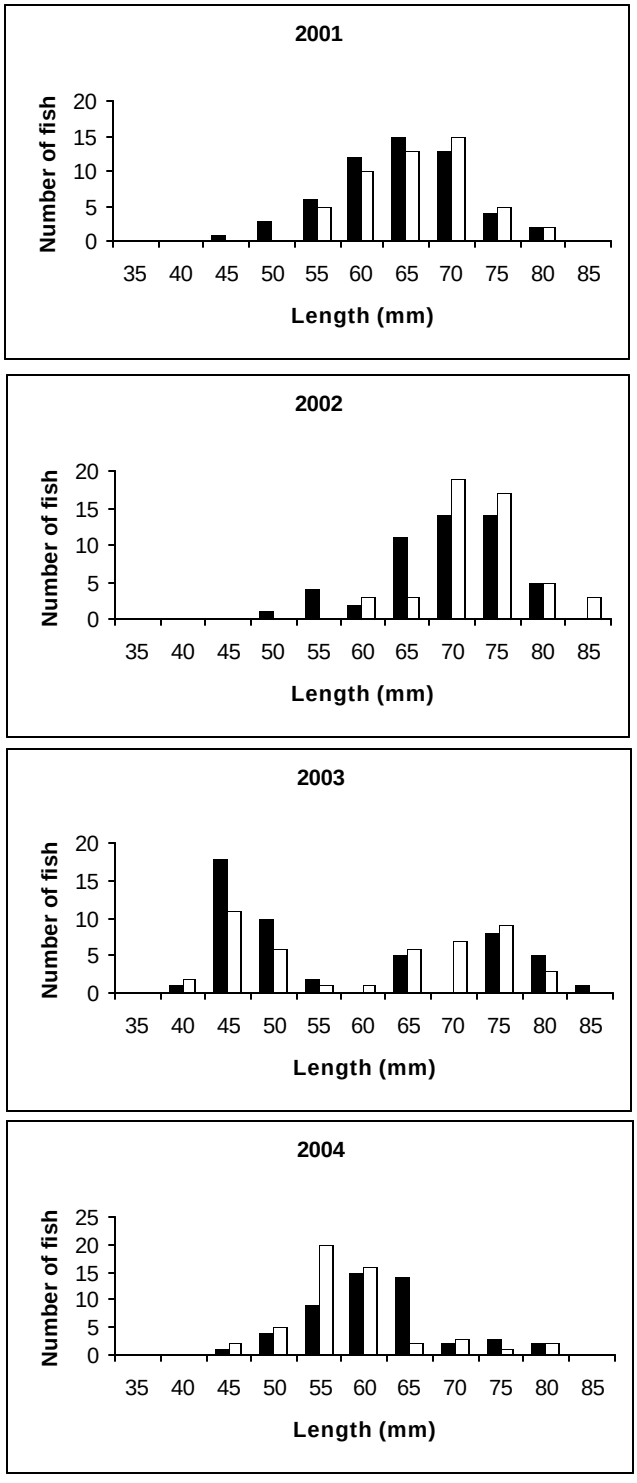


Figure 5. Length frequency histograms for Oregon chub collected in Hospital Pond from 2001-2004. Solid bars represent fish measured during population estimates. Open bars represent fish sacrificed for aging. Samples were collected in April of each year, less than one week apart.

of the sample we measured, but only 6% of the fish aged. In addition, the 2002 aging sample was more difficult to age. The proportion of the sample where the first reading (aging) and the second reading did not agree was 36% in 2002, compared to 12% in 2001 and 2003 and 14% in 2004.

In 2003 and 2004, the mean lengths-at-age for age 1 and age 2 fish were substantially lower than in 2001 and 2002. Growth of the 2001 brood was likely slowed by the relatively cold pond temperatures. Growth of the abundant 2002 brood may have been limited by density dependent factors such as competition for space and/or limited food resources.

Hatch Date Distribution

Approximate hatch dates, determined for 44 juvenile chub (15-37 mm) collected in 2004, extended from May 3 through August 8, and peaked in mid-July (Figure 6). Six of the largest chub collected for hatch date analysis were found to be age 1 fish (37-41 mm). The 2004 hatch date distribution was broad and had less of a pronounced peak than in previous years (Figure 7). The hatch date distribution extended 1-3 weeks later in 2004 than in most of the previous years. Maximum daily temperatures in the alcove exceeded 15^0C for most of the time period when hatching occurred. Water depths in the alcove ranged between 1.8 and 1.2 feet from late-April through late-July then dropped to 0.9 feet by mid-August. These water depths were several feet shallower than those recorded in 2003. In 2003 and 2004, water temperatures that were suitable for chub spawning (>15^0C) occurred earlier and extended later in the year, likely a direct result of the habitat enhancement projects.

From mid-August through September, juvenile chub were abundant and appeared to be concentrated in the alcove and in the pond near the opening to the alcove. Prior to mid-August, we were unable to observe juvenile fish because the western half of the pond was covered with the thick blanket of *Azolla mexicana*. To permit observations of juvenile fish, we skimmed the floating vegetation off of the pond on August 12th. In early-June, adult chub were abundant in the alcove. These observations suggest substantial use of the alcove by both adult and juvenile fish. Unfortunately, we were not able to observe spawning activity in the alcove because of the dense floating vegetation covering the surface.

Population Estimates

In 2004, there were five populations of Oregon chub located at sites on U.S. Army Corps of Engineers properties. Naturally occurring populations were found at Hospital Pond and in two Dexter Reservoir alcoves, located in the Middle Fork Willamette River drainage. Introduced populations were found in the Fall Creek Spillway Ponds in the Middle Fork Willamette drainage, and in Foster Pullout Pond in the Santiam drainage. Population abundance estimates for these locations are presented in Table 2.

The 2004 population estimate for Hospital Pond was 4,940 adult chub (95% CI: 4,230-5,950), a substantial increase over previous estimates. This population declined in abundance in from 2000 to 2003. The abundant 2002 year-class was responsible for the large increase in chub abundance in 2004.

The 2004 estimate for the Dexter Reservoir alcove “The Pit” was 70 adult chub (95% CI: 30-120). This population has fluctuated substantially since 1992 and has declined steadily since 1999. The 2004 estimate for the western alcove of Dexter Reservoir near the RV park was 790 adult chub (95% CI: 460-1,330). This population increased steadily from 1999 through 2002, then declined in 2003 and 2004. Nonnative fish have access to the Dexter Reservoir alcoves from Dexter Reservoir and were collected from both alcoves in 2004.

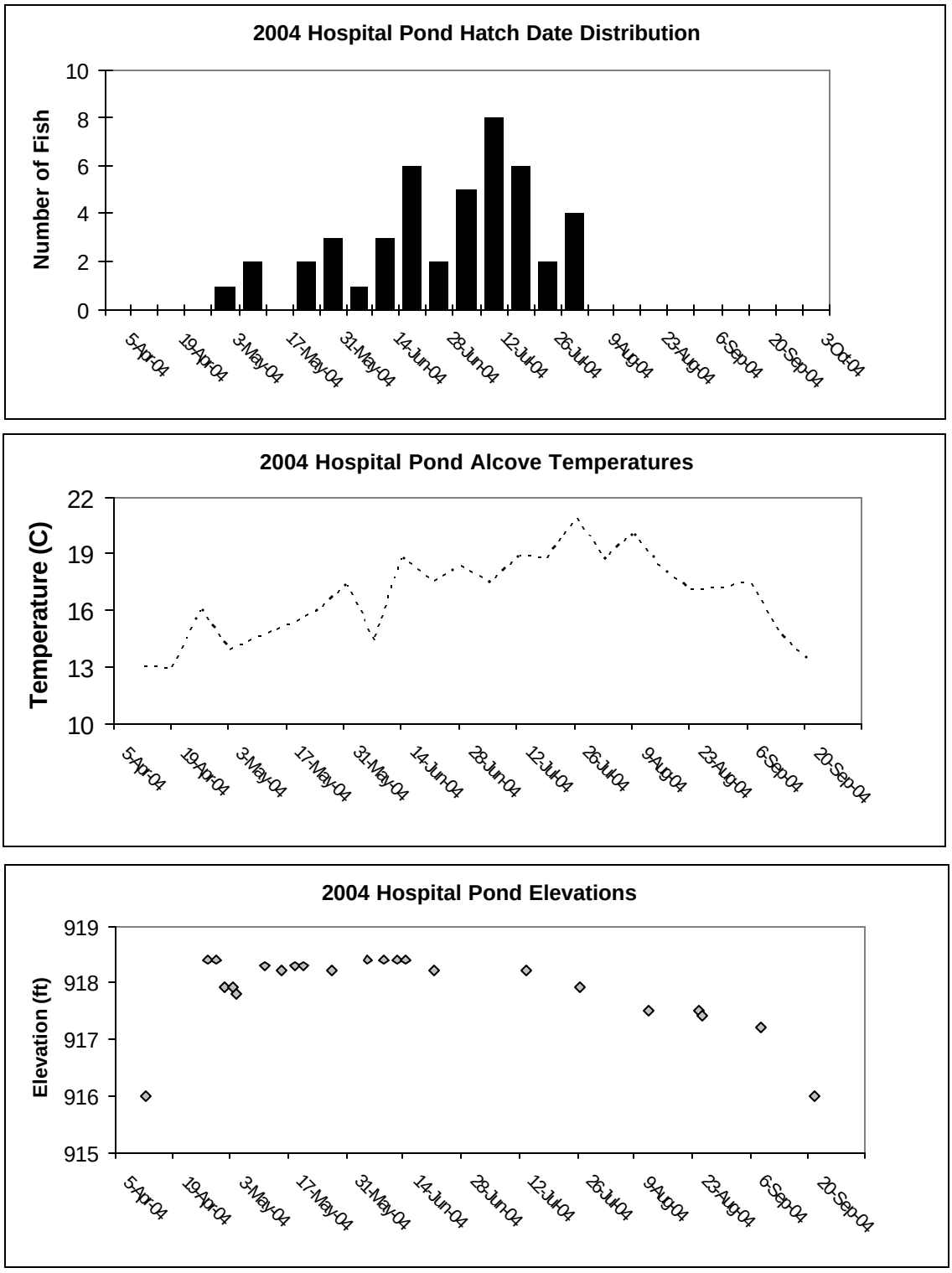


Figure 6. Oregon chub hatch date distribution, maximum daily temperatures, and water elevations in Hospital Pond in 2004. The elevation of the pond culvert is 916 feet (lower figure).

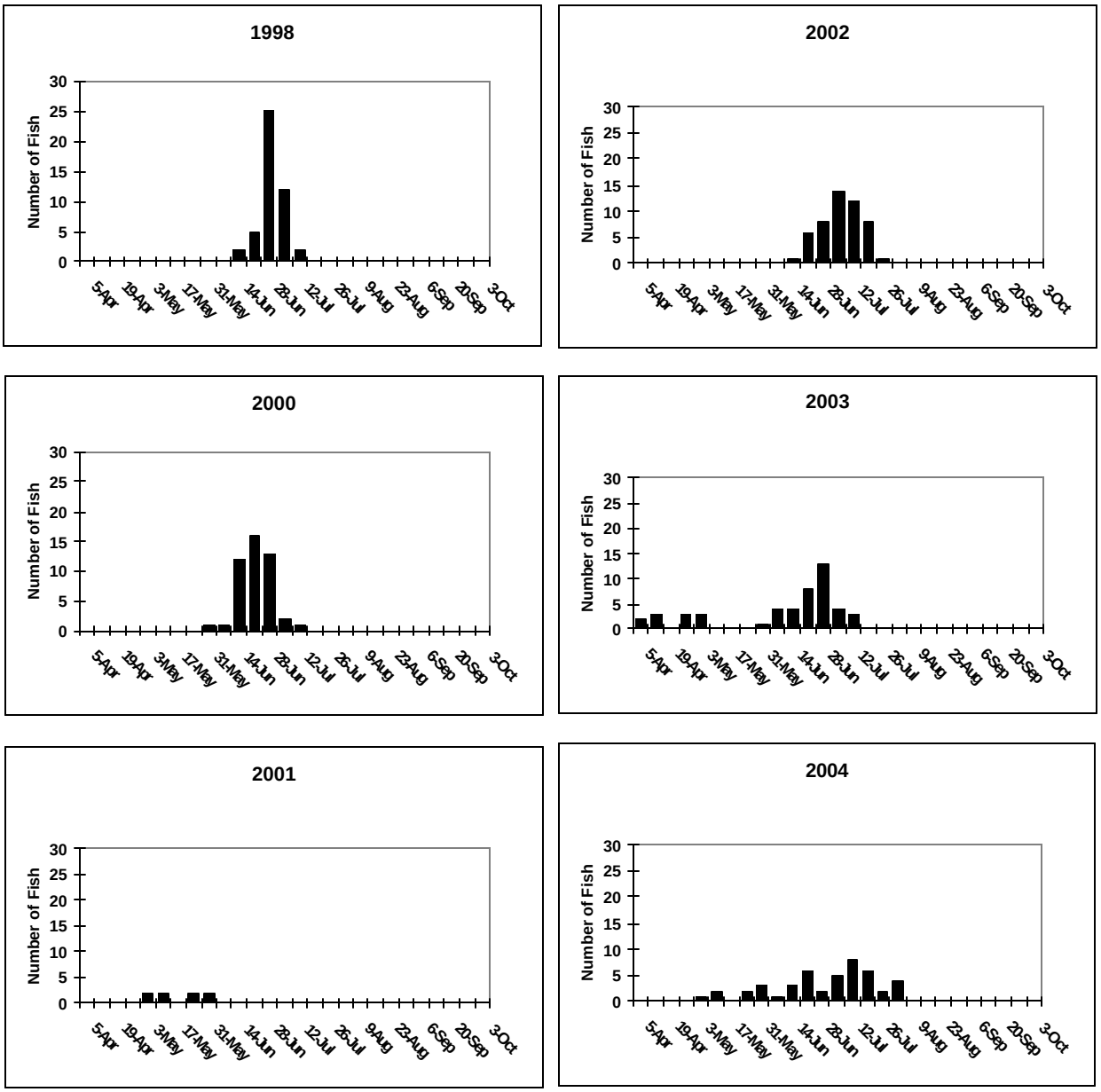


Figure 7. Oregon chub hatch date distributions at Hospital Pond in 1998 and 2000-2004.

Table 2. Estimates of the population abundance of Oregon chub at locations on U.S. Army Corps of Engineers properties in the Willamette Valley, Oregon from 1992-2004.

Location	Year	Estimate	95% Confidence Limits	
			lower	upper
Hospital Pond	1993	690	470	1,300
	1995	780	510	1,390
	1997	3,160	2,480	4,370
	1998	3,030	2,050	5,780
	1999	3,020	2,330	4,290
	2000	2,980	2,050	5,410
	2001	2,700	1,830	5,140
	2002	2,130	1,680	2,910
	2003	1,600	1,060	3,240
	2004	4,940	4,230	5,950
Dexter Reservoir Alcove (The Pit)	1992	780	560	1,100
	1995	140	80	400
	1996	40	20	200
	1997	920	760	1,170
	1998	450	380	540
	1999	1,130	910	1,480
	2000	1,440	1,030	2,440
	2001	800	600	1,200
	2002	460	280	1,330
	2003	390	290	590
	2004	70	30	120

Table 2. (continued).

Location	Year	Estimate	95% Confidence Limits lower	upper
Dexter Reservoir Alcove (RV Park)	1997	1,330	990	2,060
	1998	830	590	1,410
	1999	50	20	100
	2000	880	580	1,770
	2001	1,950	1,690	2,310
	2002	2,270	1,840	2,980
	2003	870	520	2,500
	2004	790	460	1,330
Fall Creek Spillway Ponds[a]	1997	480	400	590
	1998	1,400	960	2,660
	1999	6,300	5,460	7,450
	2000	5,030	4,060	6,620
	2001	7,770	6,480	9,690
	2002	6,370	5,320	7,930
	2003	5,620	4,380	7, 480
	2004	5,850	4,770	7,170
Foster Pullout Pond[a]	2000	80	40	320
	2001	210	130	700
	2002	320	200	780
	2003	640	370	1,480
	2004	570	370	1,240

[a] Introduced populations of Oregon chub.

In 1996, Oregon chub were introduced into the Fall Creek Spillway Ponds, beaver ponds located in the spillway overflow channel below Fall Creek Dam. A total of 500 Oregon chub were transferred from Shady Dell Pond (n=150) and East Fork Minnow Creek Pond (n=350) to these ponds. The population abundance increased rapidly. In 2004, the chub population totaled 5,850 adults (95% CI: 4,770-7,170) and was the second largest chub population in the Willamette Valley (Scheerer et al. 2004).

Foster Pullout Pond is a spring-fed beaver pond located on the north shore of Foster Reservoir in the South Santiam River drainage. Five hundred Oregon chub were introduced into this pond from Geren Island in the North Santiam drainage between 1999 and 2004. In 2004, the chub population estimate was 570 fish (95% CI: 370-1,240).

Hospital Impoundment Pond is a habitat enhancement project which is located in Lookout Point Reservoir (Middle Fork Willamette drainage) adjacent to Hospital Pond. It was constructed by the U.S. Forest Service and the U.S. Army Corps of Engineers in 1994. This pond was excavated in a former railroad grade in the drawdown zone of the reservoir. The outflow from Hospital Pond was diverted into the pond. The fish community in this pond varies each year, depending on which species enter the pond from Lookout Point Reservoir or Hospital Pond. Non-native fish, which originate from the reservoir, were collected in 1995 and 1997-2004. Only a few Oregon chub were collected in 1995 (n=6), 1997 (n=1), and 1999 (n=1) (Scheerer et al. 2004). The pond appears to provide few benefits for Oregon chub.

DISCUSSION & RECOMMENDATIONS

Hospital Pond

Previous investigations at Hospital Pond established links between water elevations of Lookout Point Reservoir, water levels and water temperatures in Hospital Pond, and Oregon chub spawning and recruitment (Scheerer and McDonald 2001, Scheerer and Terwilliger 2002; 2003; 2004). In 2001-2003, ODFW and the Corps initiated projects designed to regulate pond elevations independently of Lookout Point Reservoir elevations. A gate was installed on the culvert, the pond was sealed with bentonite clay, and a shallow alcove was excavated on the pond terrace.

In 2003 and 2004, neither the reservoir nor the pond elevations exceeded 922 ft and the terrace did not flood. However, the newly excavated alcove flooded from mid-May through October 2003 and mid-April through October 2004. In 2003, pond elevations initially increased to 921.5 feet (alcove depth 4.7 feet) and stabilized between 919.6 and 920.2 feet (alcove depth 2.8-3.4 feet). However, water temperatures in the alcove rarely exceeded 15^{o}C. The brief periods when alcove temperatures exceeded 15^{o}C occurred when the pond elevation was less than 918 feet (alcove depth 1.4 feet). The 2003 year-class was not abundant. Poor recruitment may have resulted from our inability to maintain warm temperatures in the alcove in 2003, or from density dependent mechanisms, i.e. competition with the abundant 2002 year-class.

In 2004, for unknown reasons, when the gate on the culvert was closed the maximum pond elevation reached only 918.4 feet (alcove depth 1.8 feet) and ranged from 917.9 to 918.4 feet through July (alcove depth 1.3-1.8 feet). Water temperatures exceeding 15^{o}C were common in the alcove in the summer of 2004. The shallower water depth in the alcove, combined with the blanket of *Azolla mexicana* covering the alcove during most of the spring and summer, were likely responsible for the higher temperatures. Adult chub were abundant in the alcove in mid- to late-May, before observations were hindered by the dense blanket of *Azolla mexicana*.

In 2005, we will continue monitoring the chub population at Hospital Pond to determine whether the current pond modifications and management are sufficient to maintain a stable or increasing trend in population abundance. Until we can document a strong year-class during a water year when the reservoir does not fill, we will not know for certain whether our pond modifications have been successful. In the ideal year, water will be abundant in the spring and early summer months, Lookout Point Reservoir and Hospital Pond will fill, and Oregon chub will successfully spawn on the pond terrace. The strong 2002 year-class resulted from these conditions. Under current flow management, these conditions will occur less frequently. We propose continuing to close the gate on the culvert in early-April and maintaining pond elevations that are conducive of warm alcove temperatures throughout the summer (1-1.5 foot alcove depth). Increasing the area of the alcove at these elevations might also be beneficial to the chub population.

Dexter Reservoir Alcoves

Results from current and past ODFW surveys showed that in those years when nonnative fish were collected in the Dexter Reservoir alcoves, chub populations declined substantially or remained depressed (Scheerer et al. 2004). Dexter Reservoir is a re-regulating project designed to minimize fluctuations in downstream water levels, and the reservoir is operated with daily water level fluctuations of up to 5 ft (1.5 m). In 2003 and 2004, when reservoir levels were near the minimum management elevation of 690 feet, the Dexter alcove "The Pit" was found to be reduced drastically in both depth and surface area (Figure 8). We recommend the installation of water control structures and/or screens to prevent movement of nonnative fish from Dexter Reservoir into the Dexter Reservoir alcoves. Water control structures could be designed to maintain minimum water levels in the alcoves, thus minimizing daily fluctuations in pond levels that result from reservoir operation. Alternately, portions of the alcoves could be excavated to increase water depth. Minimizing daily fluctuations, especially during the chub spawning season, should improve recruitment by reducing mortality of eggs that are spawned on vegetation and then exposed to the air to desiccate when reservoir levels drop.

ACKNOWLEDGEMENTS

We acknowledge the assistance and advice of Greg Taylor, Doug Garletts, Chrissy Murphy, and George Shaffer of the U. S. Army Corps of Engineers, Lowell.

Figure 8. Low water levels observed in the Dexter alcove “The Pit” on September 15, 2004. Note the limited wetted areas between the mud flats and the rip rap. The culvert is in the background. Dexter Reservoir elevation was 690.2 feet on this date.

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