

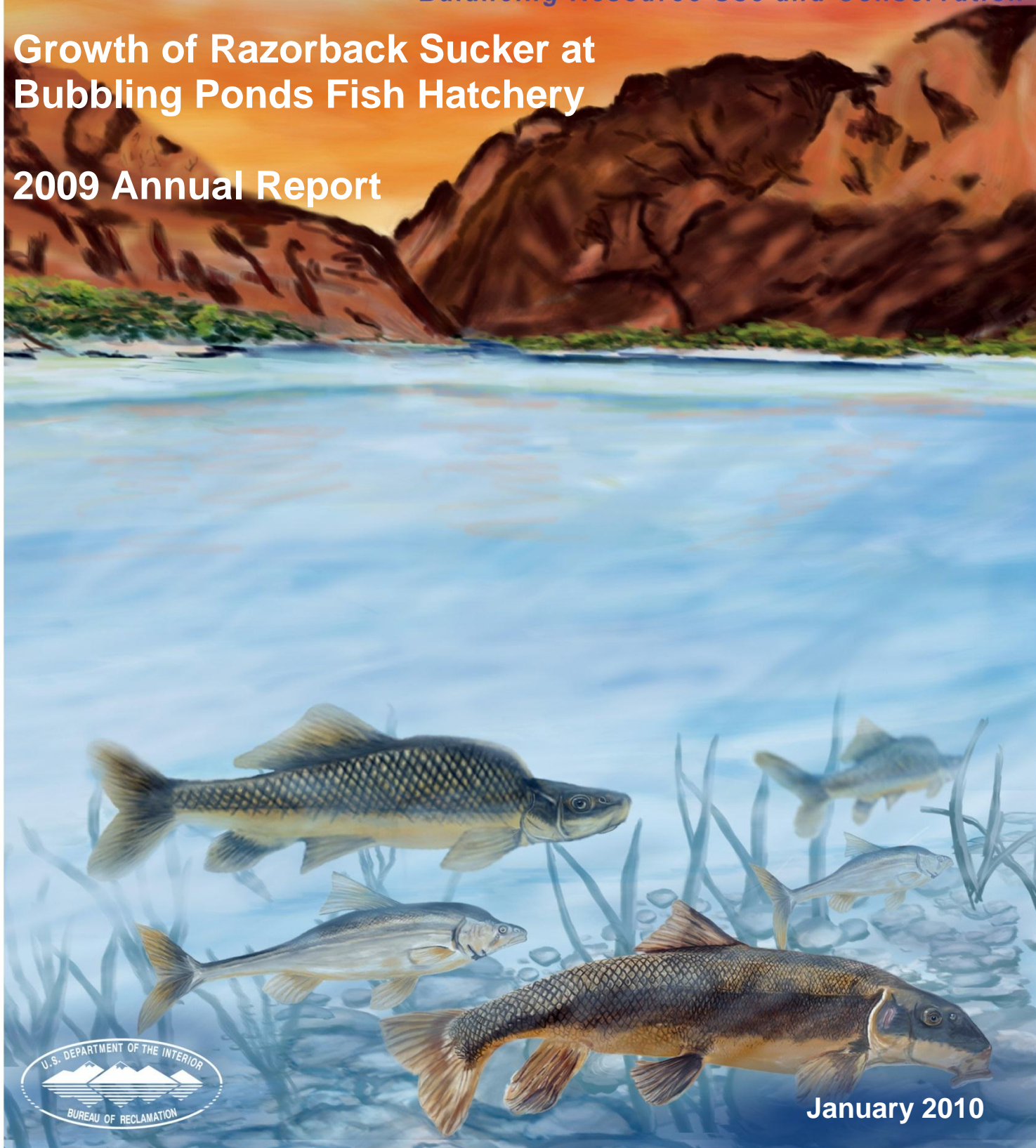
Lower Colorado River Multi-Species Conservation Program



Balancing Resource Use and Conservation

Growth of Razorback Sucker at Bubbling Ponds Fish Hatchery

2009 Annual Report



January 2010

Lower Colorado River Multi-Species Conservation Program Steering Committee Members

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U.S. Fish and Wildlife Service
National Park Service
Bureau of Land Management
Bureau of Indian Affairs
Western Area Power Administration

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Arizona Department of Water Resources
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Arizona Game and Fish Department
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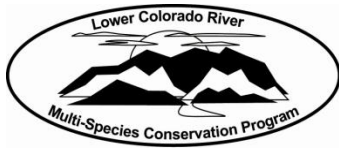
Colorado River Commission of Nevada
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Ducks Unlimited
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Multi-Species Conservation Program
Bureau of Reclamation
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Abstract – Survival of razorback suckers in the wild is largely associated with size at stocking. Research is needed to understand the factors that affect razorback sucker growth and identify ways to improve growth rates at fish production facilities. In 2009, 141 PIT tagged razorback suckers were recaptured from pond 3 upper at Bubbling Ponds Hatchery. Of the tagged fish, 26 fish had been in the pond for a year (May 08 – May 09), and 115 had been in the pond for 7 months (Oct. 08 – May 09). Razorback suckers that had been in the pond for the entire year grew an average of 96 mm (0.263 mm/day, or 7.89 mm/month) and razorback suckers that had been in the pond for 7 months (Oct – May) grew an average of 59 mm (0.28 mm/day, or 8.43 mm/month). These growth rates were similar to those observed for razorback suckers confined in 8-foot diameter tanks during a 3-month study in 2008 (0.21 – 0.3mm day), but are lower than most growth rates reported from the literature from natural or semi-natural pond environments. No significant differences in growth rate were observed among fish that had been in the pond only during the winter period compared to fish that had been in the pond the entire year indicating that water temperatures at Bubbling Ponds are high enough to allow fish to feed effectively year-round. No significant differences in growth rate were observed between large and small fish within the 150 – 298 mm TL size range.

There are currently 610 tagged fish that remain in 3 separate ponds at Bubbling Ponds Fish Hatchery. As those fish are harvested in 2010, additional information will be obtained on how sorting affects growth rates as well as how growth rates change as fish get larger. This information will allow for valid assessments of the effects that specific rearing practices have on razorback sucker growth rates at Bubbling Ponds Hatchery.

Introduction

Conservation efforts for razorback sucker (*Xyrauchen texanus*) currently depend on captive rearing and stocking programs. Low survival of stocked razorback suckers (Brooks 1986, Marsh and Brooks 1989, Marsh and Pacey 2005) has caused target sizes for stocked fish to steadily increase in efforts to reduce predation mortality (Marsh et al. 2005, Schooley and Marsh 2007). Rearing fish to larger sizes at hatcheries comes with increased costs and creates the need to evaluate husbandry and rearing practices that may affect fish growth. Reported growth rates for razorback vary widely (Ward et al. 2007). Because growth in fish is extremely variable and is impacted by many physiological and environmental factors it is often difficult to interpret the effects of rearing practices on growth. The best measures of growth are usually determined from lengths of individual fish rather than from groups of fish (Anderson and Nuemann 1996) because individual growth rates allow calculations of estimates of confidence intervals and variance (Busacker et al. 1990). We evaluated growth rates of individual razorback suckers in ponds at Bubbling Ponds Fish Hatchery using Passive Integrated Transponder (PIT) tags to obtain precise growth information for individual fish so that valid comparisons of growth rates as related to rearing practices can be made.

Methods

On May 14, 2008, 141 razorback suckers were tagged with 12 mm PIT tags (134.2 kHz) and placed in Pond 3 (approximately 1,100,000 gallons) at Bubbling Ponds Fish Hatchery. Fifty-three of these tags were recovered two months later when a large *Ichthyophthirius multifiliis* (Ich) outbreak killed many fish in the pond. On October 15, 2008 an additional 145 PIT tagged fish were also placed into pond 3 to increase the

likelihood that sufficient numbers of fish would still be alive at the end of the study to give good growth information. Fish were fed a fixed ration of commercial razorback diet (Silvercup®, 4mm pellet) twice daily (2 % percent body weight per day according to standard rearing practices at Bubbling Ponds Hatchery). An average of 225 gallons per minute of water at 20°C flowed through the pond during the study period. On May 14, 2009 pond 3 was harvested and a total of 141 PIT tagged fish were recovered. Of the tagged fish, 26 fish had been in the pond since May of 2008 and 115 had been in the pond since October 15, 2008 (Table 1). Growth of fish that had been in the pond the entire year were compared to growth of fish that had only been in the pond during the winter months (Oct. – May) using analysis of variance (ANOVA). These tagged fish were offspring of captive razorback sucker broodstock held at Dexter National Fish Hatchery, NM (2007 year class). Numbers of fish in Pond 3 after the Ich outbreak and for the majority of the period of growth were between 3, 000 and 4,000 fish. A Hobotemp® temperature logger was also installed in pond 3, one meter below the water surface near the outflow and recorded water temperature every 3 hours to allow analysis of the effects of water temperature on growth rate (Figure 4).

Results

Razorback suckers that had been in the pond for the entire year grew an average of 96 mm (0.263 mm/day, or 7.89 mm/month) and razorback suckers that had been in the pond for 7 months (Oct. - May) grew on average 59 mm (0.28 mm/day, or 8.43 mm/month) (Figure 1). Fish density in pond 3 during the majority of the growth period was 0.0032 – 0.0036 fish/gallon. No significant differences in growth rate (mm/day) were observed among fish that had been in the pond for 7 versus 12 months ($p>0.05$,

ANOVA) (Figure 1). The initial size of fish tagged in May, 2008 averaged 193 mm TL (Range = 150 – 230 mm) and the initial size of razorback suckers tagged in October of 2008 averaged 206 mm TL (Range = 159 – 298 mm) (Table 1). Although the fish tagged in October were slightly larger than those tagged in May (Figure 2), growth rates were not different. No significant differences in growth rate were observed between fish smaller than 210 mm TL and fish larger than 210 mm TL when all recaptured fish were combined (Figure 3).

Discussion

The growth rate of razorback suckers was not different for fish that had been in the pond for the entire year (0.26 mm/day) compared to fish that had been in the pond during only the winter period (0.28 mm/day) (Oct. – May) (Figure 1). Water temperature is typically one of the most important variables affecting growth rates of fish.

Differences in water temperature by season currently do not fluctuate more than 10°C at Bubbling Ponds because of the continuous supply of water flowing through each pond (approx 225 gallons/min). These high water flows appear to keep pond temperatures within the thermal preference for razorback suckers (12 - 28 °C, Bulkley and Pimentel 1983) throughout the entire year with temperatures rarely dropping below 16° C (Figure 4).

Growth rates observed in pond 3 (0.23 – 0.29 mm/day) are similar to those that were observed in 8-foot diameter circular tanks during the 3-month study to evaluate effects of chemical treatments on growth (0.21 – 0.3 mm/day) (Ward 2008) but are low compared to those reported in other studies of razorback sucker growth (0.2 – 1.8 mm/day) (Ward et al. 2007). I calculated a growth rate for a separate lot of fish (Lot

5WBF3P) using the mean size of 50 fish sampled in 2007 by Mike Childs and the final lengths prior to stocking in 2009. This calculated growth rate for razorback suckers originally captured from Lake Mohave as larvae was similar but slightly higher (0.32 mm/day) (Table 2). These initial data suggest that under typical hatchery operations (maximizing number of fish produced) the growth rate of razorback suckers is relatively consistent at Bubbling Ponds hatchery (0.2-0.3 mm/day), and to achieve growth rates substantially higher than this will likely require large changes in rearing practices such as greatly reduced densities.

There are currently 610 tagged fish that remain in 3 separate ponds at Bubbling Ponds Fish Hatchery (Table 3). As those fish are harvested in 2010, additional information on razorback sucker growth will be obtained. The tagged fish that are currently in ponds 7 and 8 should give information on growth of smaller razorback suckers as well as indicate the effects that sorting may have on growth rates. The tagged fish that are currently in pond 3 are all larger individuals (300+ mm) and should give data on growth rates of larger fish under current rearing conditions at bubbling Ponds Hatchery. This information will allow for valid assessments of the effects altered rearing practices may have on growth rates of razorback suckers at Bubbling Ponds Hatchery.

Acknowledgements

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research and for their technical assistance. We also thank the LCRMSCP fish group from Boulder City, NV for their assistance with harvesting ponds and tagging fish.

Table 1. Number and sizes of razorback suckers used in studies to evaluate growth in Pond 3 at Bubbling Ponds Fish Hatchery in 2009. All fish are Lot Code 7DTF1P.

# of fish tagged	# of fish Recovered	Days in pond	Initial TL, mm		Final TL, mm	
			Mean	(Range)	Mean	(Range)
141	26	359	193	(150 – 230)	288	(243-352)
145	115	210	206	(159 – 298)	264	(205 – 353)

Table 2. Calculated growth rate for '05 Razorback suckers stocked in Oct 2009, based on initial measurements taken by Mike Childs from samples of fish in 2007. These calculations are based only on calculated means from groups of fish.

Lot Code	Initial Measure Date	Initial size TL (mm) Mean	Final Measure Date	Days in Pond	Final Size TL (mm) Mean	Growth rate mm/day
RBS5WBF3P	2/27/07 N= 50	110.5	10/20/09 N= 2000 +	952	420.5	0.32

Table 3. Number and sizes of tagged razorback suckers that still remain in ponds at Bubbling Ponds Fish Hatchery that will be recaptured in 2010 as part of future growth assessments.

Pond Number	# of fish tagged	Tagging Date	Lot Code	Initial TL, mm	
				Mean	(Range)
3	210	May 14, 2009	7DTF1P	289	(208-396)
7	200	March 11, 2009	8DTF1P	122	(71 – 151)
8	200	March 11, 2009	8DTF1P	160	(115 – 260)

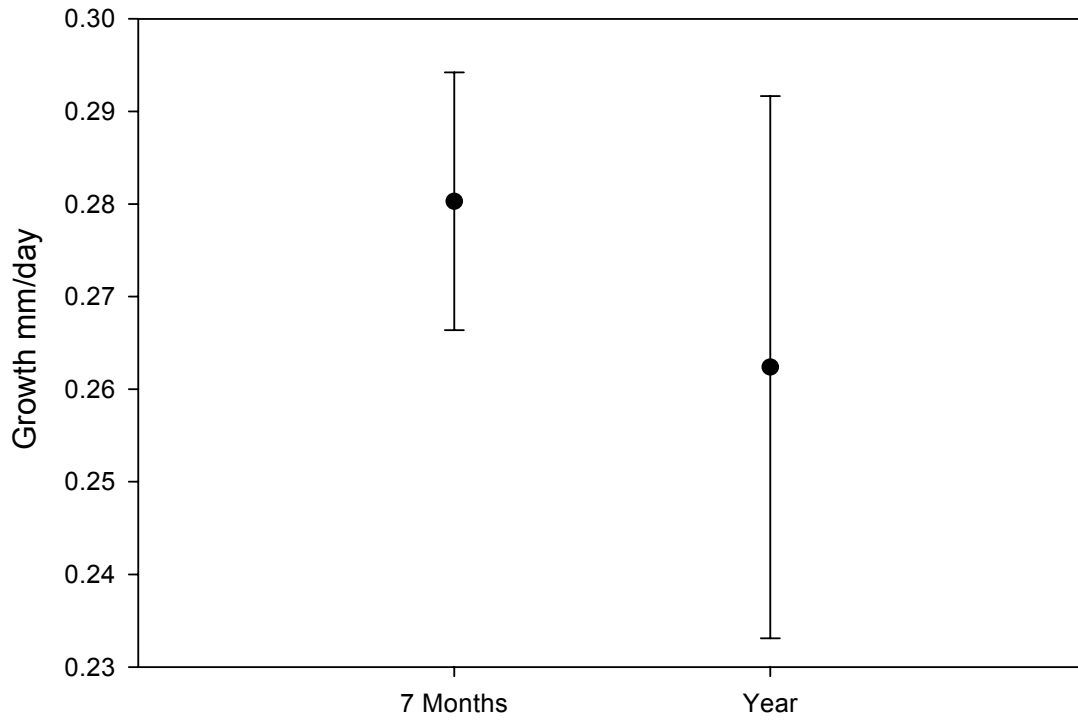


Figure 1. Average growth (mm/day) of razorback suckers in pond 3 for two groups of PIT tagged fish. Error bars represent 95% confidence intervals. The first group of fish (n= 115) was in the pond for 7 months (October to May 2009) and the second group of tagged fish (n=26) were in pond 3 for the entire year (May 2008 to May 2009).

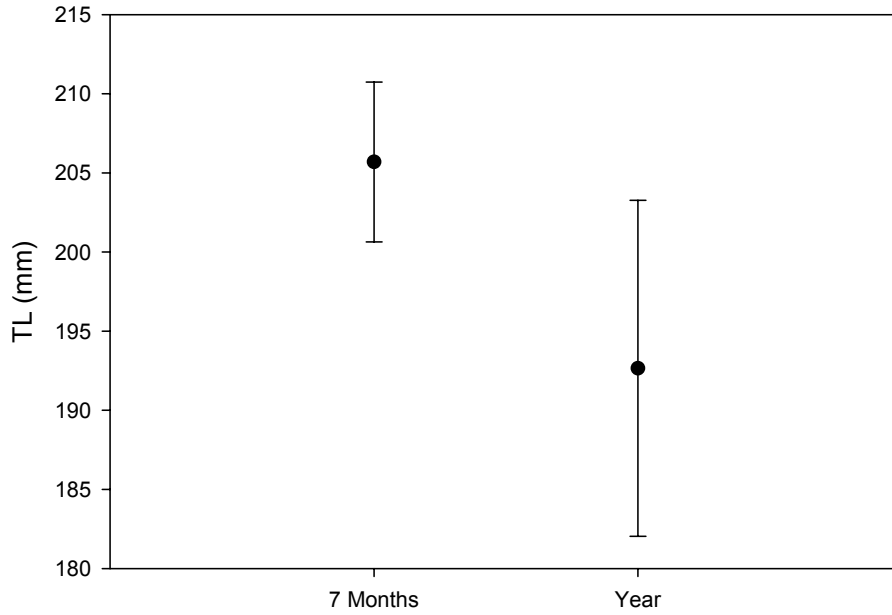


Figure 2. Average size (mm TL) of fish at initial tagging. Error bars represent 95% confidence intervals.

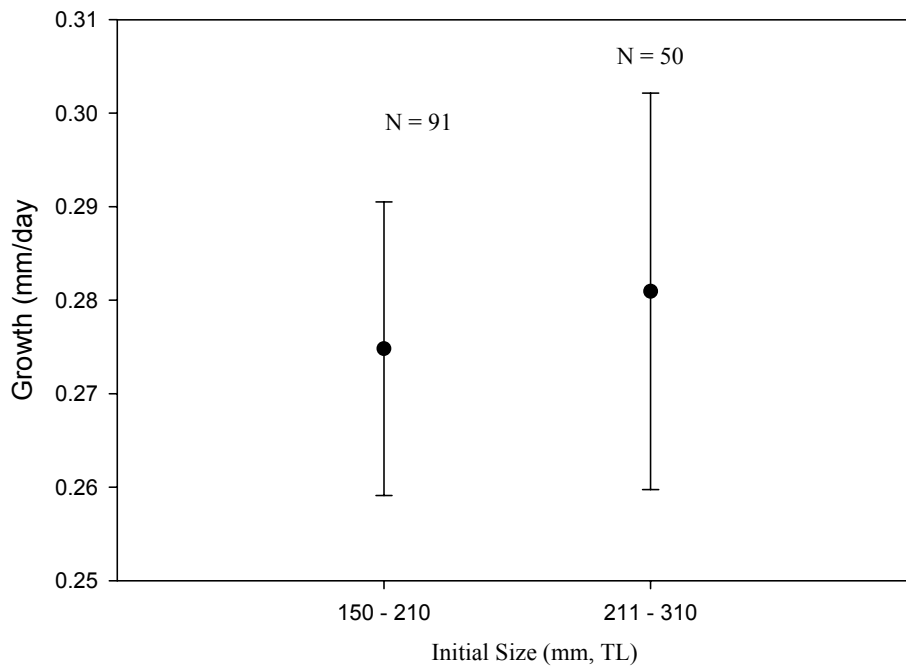


Figure 3. Growth rate of small versus large razorback suckers. Error bars represent 95% confidence intervals. All recaptured fish included.

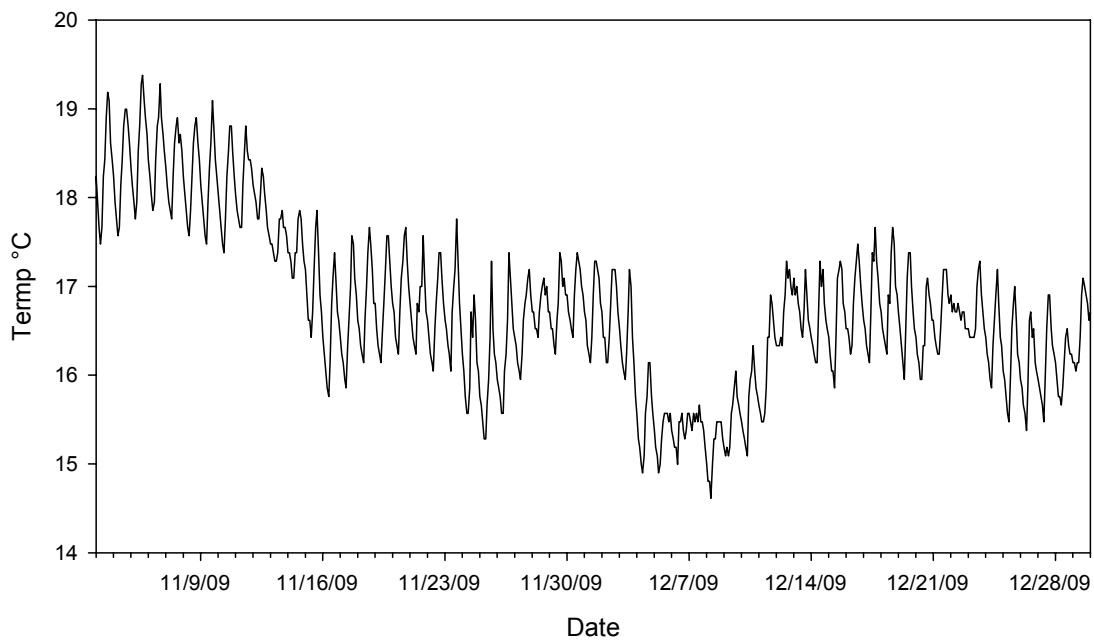
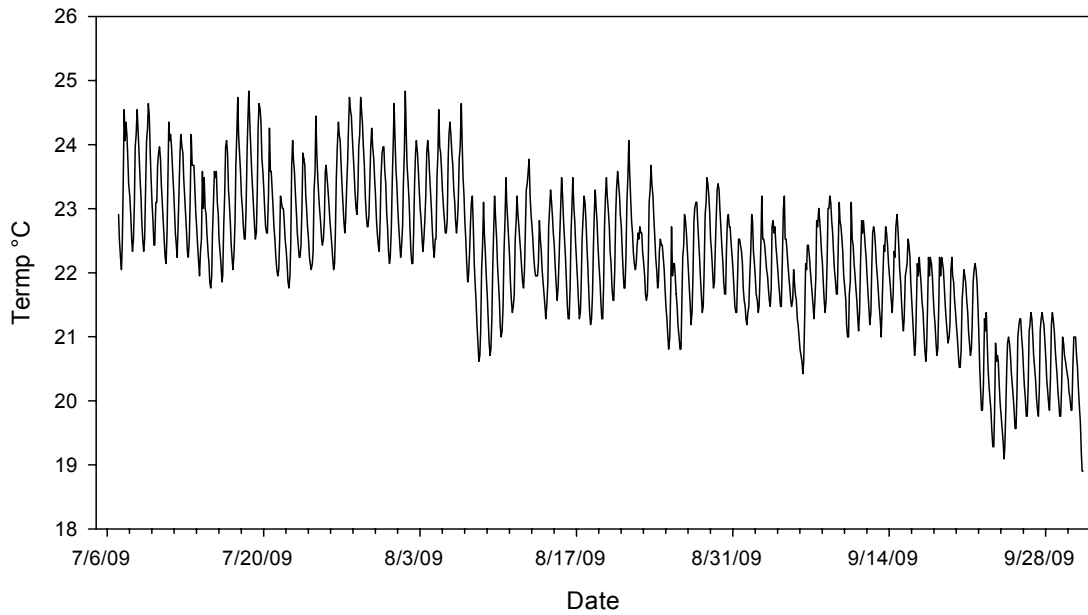


Figure 4. Temperatures ($^{\circ}\text{C}$) in rearing pond at Bubbling Ponds Hatchery from July to Sept 2009 (top graph) and from Nov to Dec 2009 (Lower graph). Temperatures recorded with a Hobotemp[®] remote data logger every 3 hours.

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