



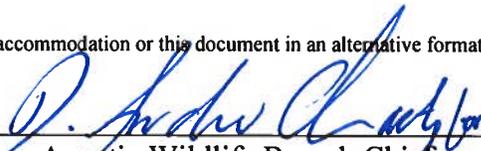
Deadhorse Ranch State Park Lagoons Fisheries Management Plan 2019 – 2029

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Approved [] by Chris Cantrell


Aquatic Wildlife Branch Chief

Date: 6/18/19

Location

Deadhorse Ranch State Park is located in Region III, Game Management Unit 6B, in the City of Cottonwood in Yavapai County at an elevation of 3,300. The Arizona State Park is located approximately 90 miles north of Phoenix, and 20 miles southeast of the town of Sedona, UTM Zone 12-WGS 84 407715, 3846128 (Figure 1).



Figure 1. Location map for DHRSP.

Management Prescription

Fishery management at Deadhorse Ranch State Park (DHRSP) involves three lagoons: an upper lagoon (3.29 acres), middle lagoon (5.32 acres) and lower lagoon (9.98 acres). The Arizona Game and Fish Department (Department) has developed concepts under two Strategic Vision Documents (AGFD 2019a, AGFD 2019b). Using these concepts, management at DHRSP will focus on a cold water Intensive Use Rainbow Trout *Oncorhynchus mykiss* fishery in the winter months, a warm water Intensive Use Channel Catfish *Ictalurus punctatus* fishery during the summer months, a AZ Hawg Water Largemouth Bass *Micropterus salmoides* fishery in the middle lagoon, and a high quality Largemouth Bass fishery in the upper and lower lagoons. Management strategies to meet objectives are identified in Table 1.

Objective 1: Maintain an Intensive Use Rainbow Trout fishery during months when water quality allow.

Objective 2: Maintain an Intensive Use Channel Catfish fishery during months when water quality won't allow Rainbow Trout stocking.

Objective 3: Maintain an AZ Hawg Water Largemouth Bass Fishery in the middle lagoon.

Objective 4: Maintain a High Quality Largemouth Bass fishery in the upper and lower lagoons.

Objective 5: Maintain a level of at least 80% of the anglers interviewed during creel census rate the fishing as fair, good, or excellent.

Table 1. DHRSP Objectives and Adaptive Management Strategies:

<i>Objective 1: Maintain a Rainbow Trout fishery to meet or exceed Intensive Use standards as listed in the Coldwater Sportfisheries Strategic Vision Document during months where water quality allows.</i>			
Parameters	Objective Guideline	Trigger point to address unmet Objectives	Strategies if Objectives are Unmet
Angler Catch Rates	Rainbow Trout CPUE ¹ of no less than .5 fish per hour for anglers targeting Rainbow Trout.	Catch rates drop below 0.5 fish/hour during assessment of catch rates on a 5 year rotational basis through creel surveys.	<ul style="list-style-type: none"> • Implement changes in daily bag limit. • Increase the average size of trout stocked. • Increase frequency of stocking.
<i>Objective 2: Maintain the Channel Catfish population to meet or exceed Intensive Use Concept standards as listed in the Warmwater Sportfisheries Strategic Vision Document during months where water quality won't allow Rainbow Trout stocking.</i>			

Angler Catch Rates	Channel Catfish CPUE of no less .5 fish per hour during stocking season for anglers targeting Channel Catfish.	Catch rates drop below 0.5 fish/hour during assessment of catch rates on a 5 year rotational basis through creel surveys.	<ul style="list-style-type: none"> • Implement changes in daily bag limit. • Increase number of catfish stocked to meet demand. • Increase frequency of stocking. • Increase the amount of artificial habitat.
<i>Objective 3: Maintain the Largemouth Bass population in the middle lagoon to meet or exceed AZ Hawg Bass standards as listed in the Warmwater Sportfisheries Strategic Vision Document.</i>			
Size Distribution	PSD ² between 50-80, PSD-P between 30-60, PSD-M between 10-25.	Three consecutive sampling events showing the population below management guidelines.	<ul style="list-style-type: none"> • Stock additional prey species of appropriate size. • Stock Florida Bass that weigh 10-15 pounds each. • Remove Bass under 300mm during sampling efforts.
Body Condition	Maintain relative weights in the Largemouth Bass population in all size classes within management guidelines of 95 to 105 based on data collected in biannual surveys.	Three consecutive sampling events showing the population below management guidelines.	<ul style="list-style-type: none"> • Stock additional prey species of appropriate size. • Remove Bass under 300mm during sampling efforts.
<i>Objective 4: Maintain the Largemouth Bass population in the upper and lower lagoons to meet or exceed High Quality standards as listed in the Warmwater Sportfisheries Strategic Vision Document.</i>			
Size Distribution	PSD ² between 40-70, PSD-P between 10-40.	Three consecutive sampling events showing the population below management guidelines.	<ul style="list-style-type: none"> • Stock additional prey species of appropriate size. • Stock Florida Bass that weigh 10-15 pounds

			<p>each.</p> <ul style="list-style-type: none"> Remove bass under 300mm during sampling efforts.
Body Condition	Maintain relative weights in the Largemouth Bass population in all size classes within management guidelines of 90 to 100 based on data collected in biannual surveys.	Three consecutive sampling events showing the population below management guidelines.	<ul style="list-style-type: none"> Stock additional prey species of appropriate size. Remove bass under 300mm during sampling efforts.
Objective 5: Maintain a level of at least 80% of the anglers during creel census rate the fishing as fair, good, or excellent.			
Angler Satisfaction	A minimum of 80% of anglers rate fishing as fair, good or excellent.	Creel census shows less than 80% of anglers rate fishing as fair, good or excellent.	<ul style="list-style-type: none"> Increase stocking rates. Increase size of trout stocked. Increase or modify efforts for angler education, preferably at the lake.

¹ CPUE=Catch Per Unit Effort (fish per hour) ² PSD=Proportional Size Distribution

Background

DHRSP opened June 1, 1977 featuring a 3.29 acre lagoon for fishing. This park was the first land that Arizona State Parks acquired with associated water rights. In 2002, two new lagoons were created within the park bringing the total water available for angling to just over 20 surface acres. The three lagoons going east from the park entrance will be referred to as the upper, middle and lower lagoons. The upper lagoon is 3.29 acres, the middle lagoon is 5.32 acres and the lower lagoon is 9.98 acres in size. The upper lagoon is independently filled by a diversion and associated ditch from the Verde River known as the Hicky Ditch. The middle and lower lagoons are gravity filled from upper to lower lagoons, but movement of fish between the lagoons is prevented by steel grating on each of the inflow/outflow pipes. This grating was installed as part of the construction of the lower two lagoons specifically to prevent movement of fishes and larger aquatic animals. A percolation pad is used for outlet water from the lower lagoon. This pad is adjacent to the pond just east and south of the lower pond's outlet. Water drained onto this pad is allowed to naturally percolate into the sandy substrate; no water from the lagoons is released directly into the Verde River or its tributaries.

During flood events, all water in the ditch supplying the Park can be shut off diverting all water back into the Verde River. During past high water events, the diversion has been destroyed or made unusable making it impossible for water to flow into the Hicky Ditch and reach the park. Water entering the upper lagoon comes down an approximate two-foot concrete drop from the canal to the lagoon due to the above features; the lagoons are a closed system from the Verde River.

Productivity/Water Quality

Water quality issues have been rare at DHRSP. Temperatures experience typical season fluctuations with high temperatures in the mid 80's °F and lower temperatures in the mid 40's °F. Monitoring of pH shows the lagoons fluctuate from 6.0 to 10.0 based on time of year, the amount of Verde River water flowing in, and the amount of vegetation present. The specific conductivity typically ranges from 450 to 525 µmhos. However, several years ago low dissolved oxygen may have been the cause of a Channel Catfish die off in the lower lagoon.

The overabundance of submerged aquatic vegetation during summer and fall may impact the available dissolved oxygen that fish require. When aquatic vegetation and associated algal blooms decomposes, much of the available dissolved oxygen is used in the decomposition process, thus reducing the oxygen content in the water and adversely affecting fish and other aquatic life. Water quality measurements will be taken periodically to monitor water quality parameters.

Forage/Prey

All three lagoons have a large prey base of Bluegill Sunfish *Lepomis macrochirus* with a smaller population of Green Sunfish *Lepomis cyanellus* that supports a self-sustaining Largemouth Bass population. Monitoring of the sunfish populations as a constituent of the prey base occurs as part of the biannual electrofishing surveys conducted at DHRSP (Table 2-5.). These populations are evaluated on their body condition through all size classes and overall length frequencies. For body condition, established management guidelines require that relative weights for a balanced population should be within the range of 90 to 100.

Non-imperiled native fish species such as Sonora Sucker *Catostomus insignis* and Desert Sucker *Catostomus clarki* are plentiful in the nearby Verde River and may occasionally enter the lagoons through the diversion ditch where they may serve as additional forage species in the lagoons. Stockings of these species may occur also from Department hatcheries when culture techniques are perfected.

The addition of Threadfin Shad *Dorosoma petenense* to the lagoons would add a soft-rayed forage species. Out of state suppliers of shad are being pursued by the Department, although to date Threadfin Shad have not been available. When a supplier is located, new stockings of Threadfin Shad will occur.

Habitat

Shoreline habitat consists of sand and silt with an overabundance of Cattails *Typha sp.* Riparian

species around the lagoons include native Cottonwoods *Populus fremontii*, Willows *Salix* sp., Arizona Ash *Fraxinus velutina* and Net Leaf Hackberry *Celtis reticulata*. Some common native vegetation surrounding DHRSP include Mesquite *Prosopis* sp., Canotia Tree *Canotia holacantha*, Creosote Bush *Larrea divaricata* and Catclaw Acacia *Aracia greggii*. Exotics found at DHRSP include Tree of Heaven *Ailanthus altissima* and Russian Olive *Eleagnus angustifolia*. Submergent aquatic vegetation consists of Spiny Nead *Najas marina* and Milfoil *Myriophyllum* sp.. This assemblage of habitat provides adequate cover for juvenile fish, ambush habitat for larger adult fish and plenty of spawning habitats to support the current fish assemblage. However, the overabundance of emergent and submergent aquatic vegetation has created problems for angler access. The upper and lower lagoons were grown over with cattails and shore access was limited until recently when many of the cattails were removed. Shore access is best at the upper and middle lagoons, the lower lagoon is the largest, but some sections of it are not accessible from shore due to cattails.

Because of the aquatic vegetation problem, White Amur *Ctenopharyngodon idella* were introduced as an alternative to tools currently being used such as manual removal and chemical herbicides which are not keeping up or proving effective in reducing aquatic vegetation to acceptable levels. Park staff and volunteers have worked hundreds of hours annually towards cutting and clearing cattails in order to provide shore access to anglers. Regional Aquatic Wildlife personal have spent many hours spraying herbicides and spreading herbicide pellets to increase shoreline access. DHRSP fishing lagoons remain heavily impacted by aquatic vegetation which in turn impacts angler success and may result in a decrease of angler satisfaction. The long-term goal of stocking White Amur into the lagoons is to reduce the impacts of aquatic vegetation on angler access and thereby reaching a balance between the needs of the fish population and the needs of anglers.

Some artificial fish habitat structures and rock piles were installed when the lagoons were being built. Regional Aquatic Wildlife staff will work with Aquatic Habitat staff in Phoenix Headquarters to map existing structures and install new structures if necessary.

Species

The species composition at DHRSP consists of Bluegill Sunfish, Green Sunfish, Black Crappie *Pomoxis nigromaculatus*, Channel Catfish, Yellow Bullhead *Ameiurus natalis*, Rainbow Trout, and Largemouth Bass. While Black Crappie, and Yellow Bullhead are present in low numbers, Largemouth Bass, Channel Catfish, Rainbow Trout and Bluegill Sunfish are the most sought after species by anglers at DHRSP.

Rainbow Trout:

During the winter months of November through March the lake is typically stocked with approximately 30,000 catchable Rainbow Trout. Fifty-four percent of anglers at DHRSP target Rainbow Trout making it by far the most highly targeted species (Figure 3). Catch rates of 1.38 trout per hour in the winter far exceed the 0.5 CPUE target (Table 6). During the 2008-2009 DHRSP creek survey it was estimated that 27469 trout were harvest from the Lagoons (Table 7). This is 71% of the 38,600 trout stocked.

Channel Catfish:

Historically, during the summer months approximately 1,000 pounds of catchable Channel Catfish (approximately 500 fish) are stocked in both June and September, respectively. When available, an additional 1,000 pounds of Channel Catfish may also be stocked in both May and August. The CPUE (0.49) is lowest in the fall before the trout stockings have resumed. This is largely due to the relatively low number of catfish stocked. Anywhere from 1,000 to 2,500 catfish are stocked per year as opposed to the 30,000 trout that are stocked annually. Catfish are the second most targeted species with 17% of all anglers targeting only catfish (Figure 3).

Largemouth Bass:

The Largemouth Bass population at DHRSP continues to improve. Anderson (1980) reported that Largemouth Bass populations that are in balance with their prey base will express Proportional Size Distribution (PSD) values in the range of 40 -70, PSD-Preferred values in the range of 10 - 40 and PSD-Memorable values in the range of 0 - 10. The 2012-2017 data for the middle and lower lagoons shows that the PSD, PSD-Preferred and PSD-Memorable values fall within the range of a healthy population periodically (Table 4). However, Anderson suggested the following values for a system with big bass: PSD values in the range of 50 - 80, PSD-Preferred values in the range of 30 - 60 and PSD-Memorable values in the range of 10 - 25. While the population is within the big bass guidelines for PSD and PSD-Preferred periodically it falls short in the PSD-Memorable category. It might be possible to increase and maintain the population within these guidelines by reducing or eliminating harvest of Largemouth Bass over 18 or 20 inches in an effort to protect the larger individuals or by reducing the number of bass under 12 inches (300mm). On their own over the last six years the numbers in the middle lagoon are trending toward meeting these goals.

Anderson (1980) recommended that Largemouth Bass in a balanced population should have a relative weight (W_r) that falls within a range of 95 to 105. Largemouth Bass require a prey source that is roughly 15 percent of the bass's total length to express a W_r around 100. Largemouth Bass with a W_r less than 95 are feeding on prey that are less than 15 percent of the bass's total length while bass with a W_r greater than 105 are feeding on a prey source that is greater than 15 percent of that fishes total length (Davies 1987). Table 5 shows that the stock relative weights of the Largemouth Bass population are mostly within the 95 to 105 range in the middle lagoon. The lower lagoon saw a slight decrease in 2017 suggesting that there may be a shortage of adequate prey of the appropriate size in the lower lagoon to support the Largemouth Bass population. While the numbers have been good in the middle lagoon, Table 5 shows a slight dip in 2017 for quality, preferred, and memorable fish. This may also be a sign of decreased prey availability.

Genetic testing has not been done on the Largemouth Bass populations at DHRSP. Testing should be pursued at the very least for the middle lagoon. This testing could determine if stockings of pure Florida bass would aid in reaching management objectives.

Access

There is one developed boat launch ramp at DHRSP. The main ramp is located on the lower lagoon with an adjacent boat dock. The middle and upper lagoons have no public boat trailer access but fisherman commonly use canoes and Jon boats to access these lagoons. Overnight camping is available at the park campgrounds.

To increase and improve shoreline access the park installed several fishing platforms in the lower lagoon. The platforms are currently in good working condition but some are overgrown with cattails limiting access to the lagoon. DHRSP does annual maintenance to have cattails removed from the shorelines of all three lagoons to improve angler access.

Catch

Data from the 2008-2009 roving creel survey at DHRSP (Table 6) revealed an overall CPUE of 0.96, nearly double the target of 0.5 fish per hour set in the 2003 DHRSP fisheries management plan. Fifty percent of the anglers catch 1 or more fish. If an angler is willing to fish for four hours they should be able to catch a limit of fish. Current catch rate goals established for this fishery are 0.5 fish an hour. Recent creel data is lacking for DHRSP. A creel survey will be scheduled in the near future and then this survey will be conducted on a 5 year rotational basis.

The statewide survey of 2013 Arizona anglers estimated the annual angler use days to be 66,700 (Fisheries Branch 2015). The 13 month creel study in 2008-2009 estimated the total number of angler use days to be 36,835.

Satisfaction

During creel surveys and interactions with anglers, creel staff will ask a standardized question regarding an angler's satisfaction with the fishery on a scale of 1-5. Satisfaction of 80% is the goal of the fishery. Data from the 2008-2009 roving creel survey at DHRSP revealed on a scale of 1-5, 1 being extremely dissatisfied and a 5 being extremely satisfied, anglers averaged a 4.4. Eighty-four percent of the people interviewed were either satisfied or extremely satisfied with their fishing experience (Figure 4). Only 4% were dissatisfied or extremely dissatisfied.

In this survey, if an angler's species preference was more than one species, they were recorded as targeting anything that bites. Fifty-four percent (54%) of the anglers preferred to catch Rainbow Trout and 22% were classified as wanting to catch anything. These two categories account for 76% of the anglers. Seventeen percent (17%) of the anglers preferred Channel Catfish, while only 4% of the anglers preferred Largemouth Bass. Sunfish accounted for 3%.

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Tables and Figures

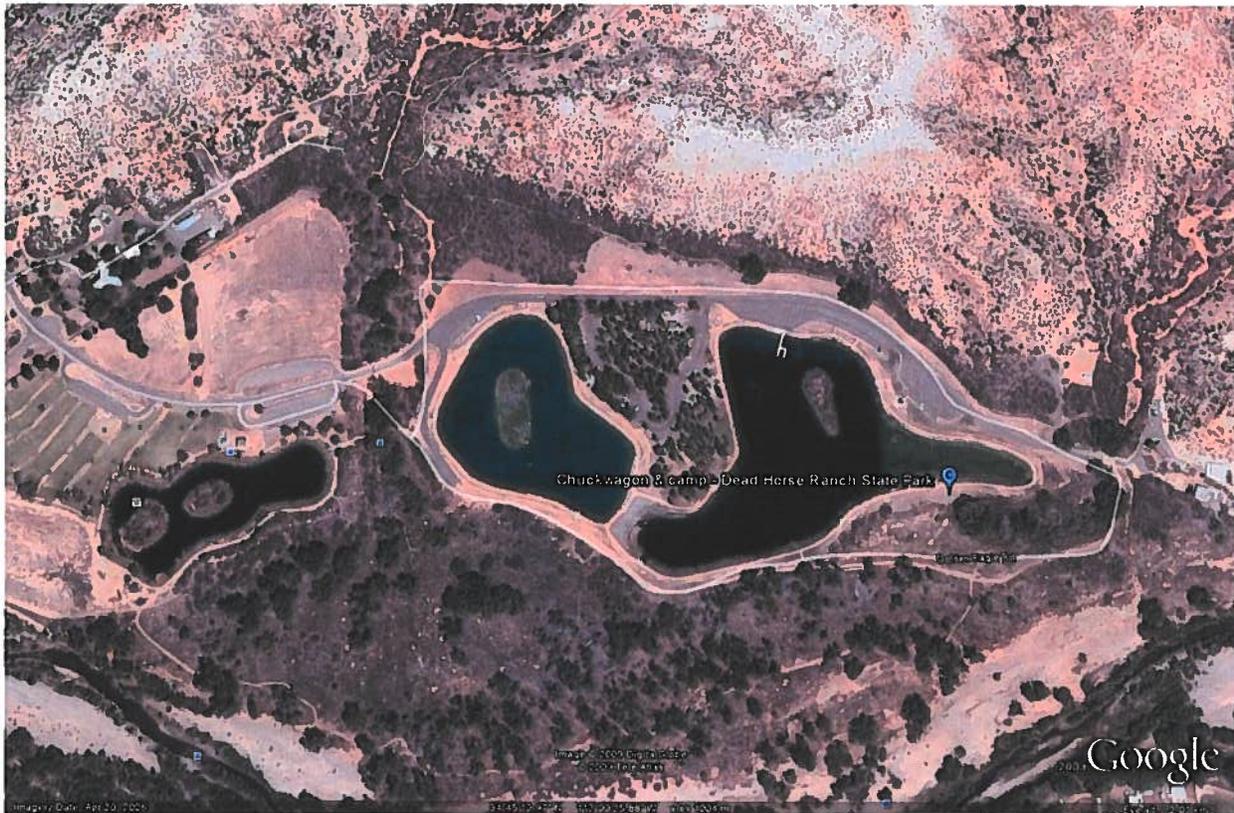


Figure 2. Map of DHRSP showing location of the lagoons.

Table 2. Species composition, total number, percent of total, catch per unit effort (fish/hr), and standard error of fished sampled electrofishing during fall surveys of Dead Horse Ranch State Park.

Middle Lagoon

Species	Year	Number Sampled	Percent of Total %	CPUE	Standard Error
Bluegill Sunfish	2012	81	58	21.6	0.85
	2015	244	79	65	3.4
	2017	290	83	580	23.3
Largemouth Bass	2012	59	42	15.7	20.04
	2015	51	16	13.6	5.62
	2017	48	14	96	6.4

Lower Lagoon

Species	Year	Number Sampled	Percent of Total %	CPUE	Standard Error
Bluegill Sunfish	2012	149	84	39.7	0.78
	2015	75	65	20	6.27
	2017	124	69	248	20.51
Largemouth Bass	2012	23	13	6.12	19.7
	2015	30	26	8	17.6
	2017	27	15	54	1.1

Table 3. Total length (mm) and weight (g) by minimum, maximum, and mean, including standard error, of all species of fish electrofished during fall surveys of Dead Horse Ranch State Park.

Middle Lagoon

Species	Year	Total Length (mm)				Weight (g)			
		Min	Max	Mean	SE	Min	Max	Mean	SE
Bluegill Sunfish	2012	53	155	77	2.06	1	57	7	0.9
	2015	60	159	82	0.7	3	76	9	0.4
	2017	88	140	111	3.74	19	64	44	2.8
Largemouth Bass	2012	60	450	115	12.2	2	1416	82	27.9
	2015	93	540	185	17.1	5	2565	242	68.3
	2017	70	550	116	5.33	3	2832	57	25.1

Lower Lagoon

Species	Year	Total Length (mm)				Weight (g)			
		Min	Max	Mean	SE	Min	Max	Mean	SE
	2012	58	151	70	1.3	4	64	8	0.6

Bluegill Sunfish	2015	50	145	104	2.3	1	45	19	1.1
	2017	88	140	111	3.74	19	64	44	2.8
Largemouth Bass	2012	52	254	73	8.7	2	229	13	9.8
	2015	71	505	193	27.8	5	1970	349	109.5
	2017	70	550	116	5.33	3	2832	57	25.1

Table 4. Proportional Size Distribution (P=preferred, M=memorable, T=trophy) of Largemouth Bass collected during fall electrofishing surveys at Dead Horse Ranch State Park.

Middle Lagoon

Species	Year	PSD	PSD-P	PSD-M	PSD-T
Bluegill Sunfish	2012	8	*	*	*
	2015	1	*	*	*
	2017	*	*	*	*
Largemouth Bass	2012	31	8	*	*
	2015	71	24	6	*
	2017	83	67	8	*

Lower Lagoon

Species	Year	PSD	PSD-P	PSD-M	PSD-T
Bluegill Sunfish	2012	4	*	*	*
	2015	0	*	*	*
	2017	*	*	*	*
Largemouth Bass	2012	0	*	*	*
	2015	67	33	*	*
	2017	38	25	*	*

Table 5. Overall average and structural indices categories (S=stock, Q=quality, P=preferred, M=memorable, T=trophy) of relative weight (W_r), for Largemouth Bass electrofished during fall survey at Dead Horse Ranch State Park's Middle Lagoon in 2017.

Middle Lagoon

Species	Year	W_r	W_r	W_r	W_r	W_r
		Overall	S	Q	P	M
Bluegill Sunfish	2012	74	74	74	*	*
	2015	89	81	89	*	*
	2017	109	116	*	*	*

Table 7. The number of fish caught, fish harvested, and trout harvested by season from DHRSP 2008-2009 Roving Creel/Use Survey. Effort is measured in hours.

Middle Lagoon					
Season	Weekdays / Weekends	# Days	# Fish Caught	# Fish Harvested	# Trout harvested
Summer (June-July)	Weekday	39.0	908.7	308.10	0.000
	Weekend	22.0	891.0	114.40	0
		<i>Summer Subtotal:</i>	<i>1,799.7</i>	<i>422.50</i>	<i>0</i>
Autumn (Aug. to Oct.)	Weekday	57.0	2,114.7	1,185.60	0.000
	Weekend	35.0	2,030.0	469.00	0
		<i>Autumn Subtotal:</i>	<i>4,144.7</i>	<i>1,654.60</i>	<i>0</i>
Winter (Nov. to Jan.)	Weekday	53.5	13,653.2	6,671.50	6671.500
	Weekend	38.5	4,227.3	1,828.80	1732.5
		<i>Winter Subtotal:</i>	<i>17,880.5</i>	<i>8,500.30</i>	<i>8404</i>
Spring (Feb. to April.)	Weekday	47.0	5,306.3	2,585.00	2556.800
	Weekend	32.0	4,860.8	2,534.40	2480.000
		<i>Spring Subtotal:</i>	<i>10,167.1</i>	<i>5,119.40</i>	<i>5036.800</i>
Summer (June-July)	Weekday	37.5	2,928.8	547.50	120.000
	Weekend	23.5	6,770.4	789.60	430.1
		<i>Summer Subtotal:</i>	<i>9,699.2</i>	<i>1,337.10</i>	<i>550.10</i>
		Weekday Total:	24,911.7	11,297.70	9,348.30
		Weekend Total:	18,779.5	5,736.20	4,642.60
		TOTAL:	43,691.2	17,033.90	13,990.90
Lower Lagoon					
Season	Weekdays / Weekends	# Days	# Fish Caught	# Fish Harvested	# Trout harvested
Summer (June-July)	Weekday	39.0	1,860.3	1,033.50	0.00
	Weekend	22.0	519.2	334.40	0.00
		<i>Summer Subtotal:</i>	<i>2,379.5</i>	<i>1,367.90</i>	<i>0.00</i>
Autumn (Aug. to Oct.)	Weekday	57.0	746.7	353.40	0.00
	Weekend	35.0	850.5	98.00	0.00
		<i>Autumn Subtotal:</i>	<i>1,597.2</i>	<i>451.40</i>	<i>0.00</i>
Winter (Nov. to Jan.)	Weekday	53.5	11,721.9	3,841.30	3,841.30
	Weekend	38.5	6,337.1	2,044.40	2,009.70
		<i>Winter Subtotal:</i>	<i>18,059.0</i>	<i>5,885.70</i>	<i>5,851.00</i>
Spring (Feb. to April.)	Weekday	47.0	9,268.4	3,224.20	3,224.20
	Weekend	32.0	12,409.6	4,316.80	4,284.80
		<i>Spring Subtotal:</i>	<i>21,678.0</i>	<i>7,541.00</i>	<i>7,509.00</i>
Summer (June-July)	Weekday	37.5	843.8	292.50	78.80
	Weekend	23.5	1,497.0	561.70	40.00
		<i>Summer Subtotal:</i>	<i>2,340.8</i>	<i>854.20</i>	<i>118.80</i>
		Weekday Total:	24,441.1	8,744.90	7,144.30
		Weekend Total:	21,613.4	7,355.30	6,334.50
		TOTAL:	46,054.5	16,100.20	13,478.80
Both Lagoons					
			# Fish Caught	# Fish Harvested	# Trout harvested
			49,352.8	20,042.6	16,492.6
			40,392.9	13,091.5	10,977.1
			89,745.7	33,134.1	27,469.7

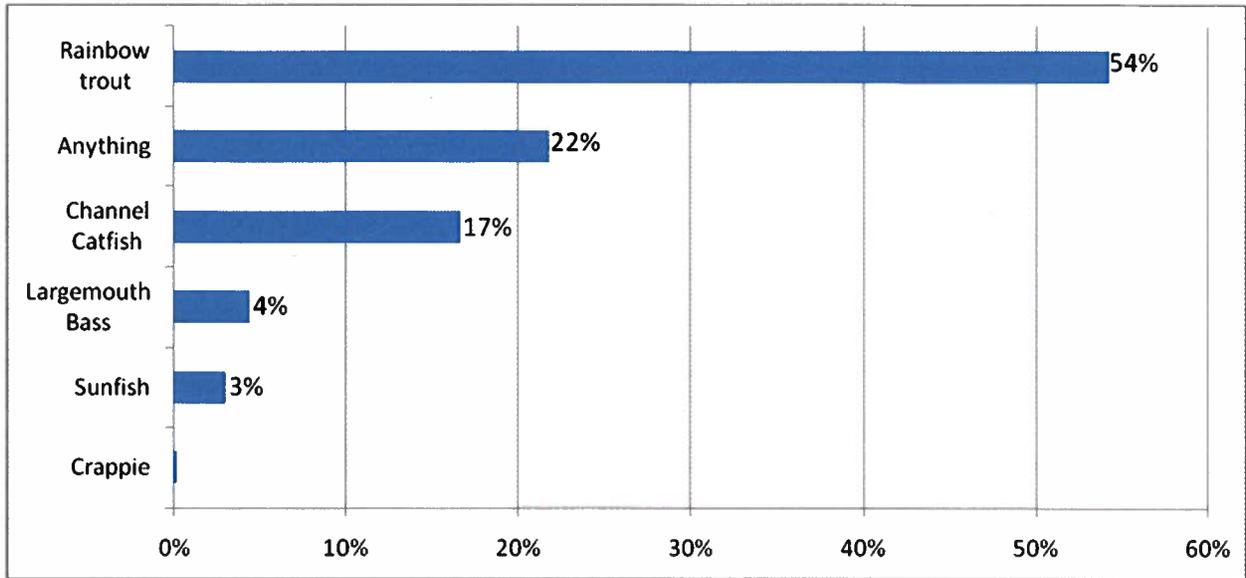


Figure 3. Species preference by anglers from DHRSP 2008-2009 Roving Creel/Use Survey

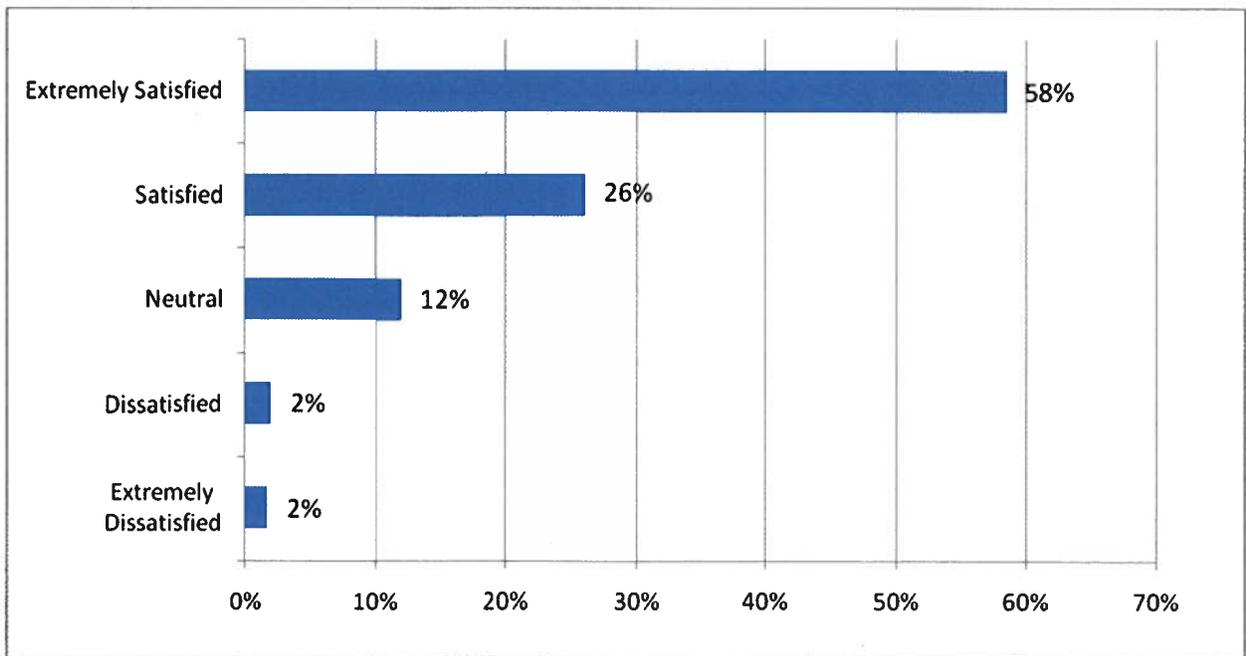


Figure 4. Satisfaction ratings from DHRSP 2008-2009 Roving Creel/Use Survey.