

Distribution, Migratory Behavior, and Habitat Use of Razorback Sucker (*Xyrauchen texanus*) in Lake Mohave, Arizona-Nevada

Open File Report 98-252

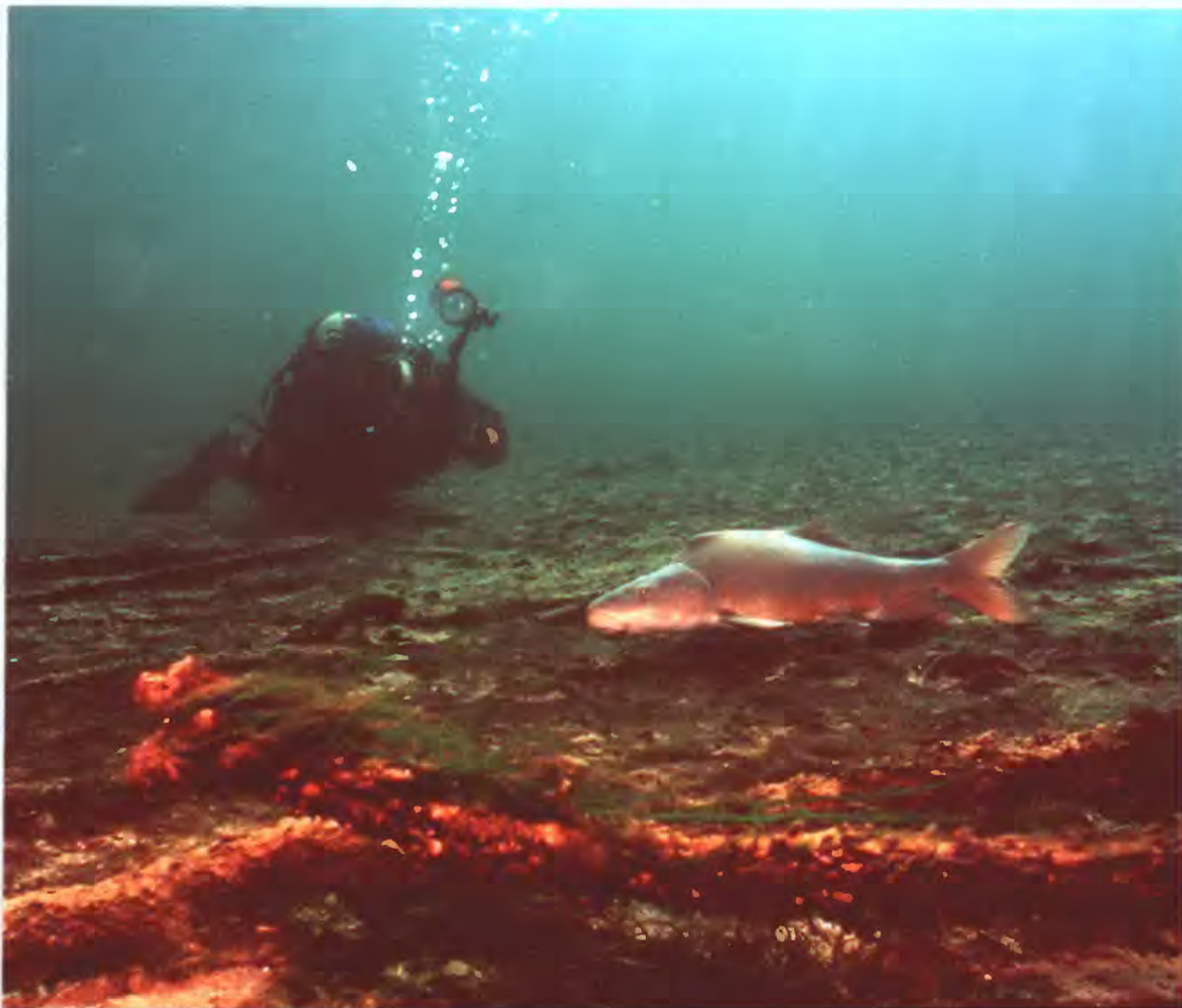


Photo courtesy of Greg Finnegan

U.S. Department of the Interior
U.S. Geological Survey

Prepared in Cooperation with Arizona State University,
Bureau of Reclamation, National Park Service,
Fish and Wildlife Service, and Nevada Division of Wildlife



U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

**Distribution, Migratory Behavior, and Habitat Use of
Razorback Sucker (*Xyrauchen texanus*) in Lake Mohave, Arizona-Nevada**

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EXECUTIVE SUMMARY

Lake Mohave currently supports the vast majority of wild razorback suckers in the Colorado River basin. The first few years following the closure of Davis Dam, ecological conditions allowed the survival of 100's of thousands of young razorback suckers in the new reservoir. This represented the last notable recruitment for the species. Measurable survival has not occurred following the establishment of the reservoir's sport fishery. Unfortunately, juveniles seek and use the same areas inhabited by large predators such as largemouth bass and channel catfish. As juveniles become sexually mature, increased activity may lead to additional losses from hydroelectric entrainment or water diversion.

Ten adult and six juvenile razorback sucker with sonic transmitters were released and tracked in Lake Mohave between November 1994 and July 1997 to determine habitat use and migratory behavior. Individual movements and ranges varied, but adults exhibited both pre- and post spawning migrations. Adults assembled in early December between river kilometer (RK) 26 and RK 90 (Horse Shoe Rapids) with spawning aggregations that often numbered in the hundreds. Tagged adults spawned between mid-January and March at multiple spawning sites.

Post-spawning movements were as prevalent as pre-spawning migrations as adults disbursed toward summer ranges. Six fish (60%) used the area between RK 69 and RK 50 where hypolimnetic water released from Hoover Dam mixes with Lake Mohave waters. Two adults spent summers along the Nevada shoreline in Cottonwood Basin (RK 26 to RK 32) while the two remaining fish used both areas. Adult territorial ranges averaged 39 km (17.8 to 72.4 km) and were normally found between RK 26 (Nine Mile Cove) and RK 69 (Chalk Cliff Lights).

The reservoir's longitudinal thermal gradient did not influence geographical distribution. Fish were typically found within 50 m of shore and at depths between 3.1 and 16.8 m. Although razorback suckers moved vertically in the water column, no correlation was found for depth with time of day. Adults utilized a wide thermal range and may regulate body temperature with depth. Fish inhabited shallower depths in early summer (June) and autumn (October) compared to the warmer months of July and August. Body temperatures of razorback suckers typically ranged between 18 and 22 °C when surface water temperature in the reservoir peaked at 30 °C during the summer.

Adult razorback suckers return annually to select spawning sites along the wave-washed rubble shoreline. However, nine of 10 sonic-tagged fish were found at several spawning areas, regardless of where they were initially captured. After spawning, some individuals appeared to also have fidelity to specific areas of Lake Mohave during the non-spawning season, suggesting they may exhibit a home range.

Hourly movement rates showed females were significantly ($P=.05$) more active during spawning than males. Apparently male razorback suckers congregate and remain on, or close to, spawning sites throughout the spawning season. Females on the other hand joined the males only when ready to spawn and left the site when the spawning act was completed. They appeared to wander between specific spawning groups and may spawn with various males that would contribute to genetic diversity.

Preliminary information on juveniles suggested they are cover oriented and exhibit migratory behavioral quite different than adults. Juveniles traveled substantial distances (>5 km) immediately following release, but with time their movements became less erratic and more closely associated with shore and protective cover. Juveniles typically found refuge in shallow, vegetated coves where they often remained sedentary for days and some for weeks. One young razorback sucker (3-yr) became quite active during the 1995 spawning season, traveling downstream to within 3 km of Davis Dam and then moving upstream to within 8 km of Hoover Dam, a minimum distance of 145 km.

Lake Mohave serves as the largest refugium for adult razorback sucker. It provides additional research opportunities that merit consideration. Further research is recommended on predator/prey relationships between the early life stages of razorback sucker and introduced predators. The migratory behavior of sub- or young adults also needs to be examined to determine if that life stage is more susceptible to entrainment, passage, or stranding. Lastly, we suggest investigations into the influence that reservoir fluctuations have on predatory distribution and densities in shallower habitats used by juvenile razorback suckers. In sight into these interactions may increase stocking survival by introducing fish at times or locations where predators may be inactive or disbursed.

INTRODUCTION

Most research on wild razorback suckers has dealt with adults, and much of the research focused on the relic population in Lake Mohave (Minckley 1983, Langhorst and Marsh 1986, Marsh 1987, Mueller 1989, Bozek et al. 1990, Minckley et al. 1991, Mueller 1995, Marsh 1997) and a small population found in the Green River, Utah (McAda and Wydoski 1980, Tyus 1987, Tyus and Karp 1990, Modde 1996, Modde et al. 1996, Modde and Wick 1997). Less is known about early life stages. Detection, movement, and behavior of larval suckers has been reported Minckley (1983), Langhorst and Marsh (1986), Horn et al. (1994), Mueller et al. (1995), and Muth (1995). Recent information on wild juveniles has been limited to a few, rare collections (Marsh and Minckley 1989a, Minckley et al. 1991, Gutermuth et al. 1994, Modde 1996, Mueller 1996, Modde and Wick 1997, Holden et al. 1997).

Most observations have occurred during the spawning period when razorbacks are most easily found and captured. Razorback suckers in Lake Mohave aggregate along shoreline between January through March to spawn over wave-washed alluvial terraces of sands and gravels. The majority of spawning occurs in the main basin of the reservoir but, occasionally, small spawning aggregations are observed in the upstream riverine portion of the reservoir (Minckley 1983, Mueller 1989). Some studies in the Upper Basin (Tyus 1987, Tyus and Karp 1990) suggested razorbacks exhibited fidelity to a specific spawning site, but these data have been inconclusive.

Less information is available on habitat use during non-spawning periods. Following spawning, Lake Mohave suckers were generally thought to disperse. Many can be found downstream of Hoover Dam (RK 97-103) and large schools have been seen on the surface of the main reservoir (Mike Burrell-NDOW personal communique). It was unknown whether these areas represent important summer habitat or if individual fish have specific home ranges.

Razorbacks are long-lived, many over 35 years of age and believed to be nearing the end of their estimated lifespan (Minckley et al. 1991). Population estimates conducted during the past decade has shown a 60 percent decline in the reservoir's population (Marsh 1995). While adults are still common, juvenile suckers are rarely collected. Information on juvenile razorback suckers is virtually nonexistent because of their scarcity. Nocturnal behavior and use of dense aquatic vegetation was reported for cove-reared fish (Mueller and Marsh 1993). Young suckers hid in aquatic vegetation during the day, but became active at night and less reclusive as they matured (Ryden and Pfeifer 1996). Modde (1996) reported collecting young razorback suckers from a depression wetland suggested that earlier speculations (Tyus and Karp 1990) of floodplain habitats may be important nursery habitat. To our knowledge, only six juvenile suckers have been collected from Lake Mohave in the past 20 years, and these may have been

captive-reared fish from previous stockings (Marsh and Minckley 1989a).

The Native Fish Work Group formed as a coalition of concerned state and federal agencies for the purpose of stocking 50,000, juvenile razorback suckers to replace the old population that was dying out in Lake Mohave (Mueller 1995). Stocked fish are monitored to determine the appropriate sizes needed to ensure adequate survival. Preliminary information suggests that approximately 57% over 20 cm have survived (Marsh 1997). Predation is believed to be a major factor that limits recruitment from natural spawning. Survival is size dependent but other factors, such as time and location of stocking, cove availability, predator densities, and behavioral traits that could also impact survival.

The purpose of this study was to gain a better understanding of the migratory behavior and habitat used by juvenile and adult razorback suckers in a reservoir environment. As adults become rare and more difficult to capture, information regarding their movements and habitat use will become more important in monitoring populations. In addition, understanding habitat use and behavior of juveniles will allow assessment of predation, stocking protocols, and factors that can enhance survival and recovery.

METHODS

Study Specimens

Adults--Adults were trammel netted at Yuma and Tequila coves (Figure 1, RK 34& 39) during November 6-7, 1994. Five males and five females were selected and held at each site for surgery the following morning. The Yuma Cove fish were surgically implanted and released on November 7th and the Tequila Cove fish were implanted and released on November 8th. Adults averaged 609 mm (555-680 mm) in total length and 2.78 kilograms (1.75-4.21 kg). Individual data pertaining to length, weight, PIT tag numbers, sonic transmitter code, release location, and distances moved are summarized in Appendix A.

Juveniles--Twenty five juvenile suckers were taken from grow-out ponds and held in holding facilities at the Bureau of Reclamation laboratories in Boulder City, Nevada. The fish were later transported by truck and by boat on November 22, 1994. Fish averaged 338 mm (315 to 392 mm) and 369 grams (296-598 g). The juveniles were released in groups of four fish at: Red Light Cove (RK 10), Dandy Cove (RK 17), Owl Point (RK 45), Double Neck Cove (RK 71), and Cross Current Rapids (RK 92). Pertinent information is summarized in Appendix A.

Telemetry Equipment

We determined a 30+-cm sucker was capable of carrying a 6 gram, 16 X 55-mm sonic transmitter (Sonotronics model CTT-83-2) (Knowles 1994). Appropriate transmitter size for

juvenile suckers was determined by examining the volume of the abdominal cavity in museum specimens at Arizona State University. Transmitters ranged in size from 8 x 35 mm to 18 x 70 mm with life spans ranging from 45 days to 48 months. While smaller transmitters are less stressful to fish, there is a substantial trade-off between transmitter size and performance with weaker signal strength and shorter the battery life with smaller transmitters.

Transmitters operated on a frequency of 73 kHz and produced a code of pulses broken by pauses (e.g. 249 would be 2 pulses-pause, 4 pulses-pause, 9 pulses-pause, repeat sequence). Battery longevity was estimated to be about 14 months and signals had an average detection range of 1,000 meters. The transmitters also provided body temperature with an accuracy of ± 0.25 °C through a measurable pulse interval.

Surgical Procedures

Surgical procedures were similar to Hart and Summerfelt (1975) and Tyus (1987). Fish were anesthetized in a tub containing approximately 80 L of a 0.1 g/L mixture of tricaine methanesulfate (MS-222). When the fish lost equilibrium, it was positioned belly up in a specially designed surgical cradle. Water was passed over the gills to provide oxygen and to keep the body moist. Anesthetic bath was used during the first half and fresh water was used during the last half of the operation to minimize the effect of anesthesia and speed fish recovery.

Transmitters and passive integrated transponder (PIT) tags were sterilized in 70% isopropyl alcohol and 10% betadine. A 30-40 mm, medio-lateral incision was made slightly anterior and dorsal to the left pelvic fin. The transmitter was inserted toward the posterior of the abdominal cavity so that it rested on the pelvic girdle. The incision was sutured with 4-5 knots using 3-0 Ethilon black monofilament nylon and a FS-1 cutting needle.

The surgical process for individual fish required approximately 7-12 minutes. Anesthesia took effect in about 2-4 minutes and surgery normally required 3-5 minutes. The fish remained docile and incisions caused minimal bleeding. Following surgery, fish required from 1 to 10 minutes to recover from the anesthesia. Fish were released when they regained their motor skills.

External Attachment

Microtransmitters (8 X 35 mm, 45 day) were externally mounted to five juvenile suckers on October 20, 1995. Equipment was sterilized in alcohol and the fishes dorsal keel was swabbed with betadyne. Two sutures were tied approximately 20 mm apart on each transmitter and their knots were glued. Needles were threaded through a plastic backing plate about 1 cm below the dorsal keel. The wound was treated with neosporium and the sutures were tied together with 2 square knots.

External attachment of sonic transmitters required approximately 30 seconds. Three fish were

released with approximately 200 other juveniles in a small protected cove adjacent to Nellis Cove (RK 26). The remaining two fish were transported to a location cove near Sidewinder Cove (RK 14) on the Arizona side and released with another group of fish. The fish averaged 315 mm (303-328 mm) in total length and weighed approximately 350 grams (288-406 mm). Specific information is summarized in Appendix A.

Survey Design

Weekly surveys were conducted by boat using a global positioning system (GPS). A transect grid was developed using 71 GPS way-points or “listening stations” (Figure 1). These way-points were established at 1,600 meter intervals, which standardized our survey design and provided continuity and overlap (1,000 meter range). The pre-established way-points were programmed into the GPS’s navigational program. Surveyors simply navigated between way-points, lowered a directional hydrophone into the water, and listened for transmitter signals.

Signals were detected using a DH-2 hand held, directional hydrophone, a USR-5W ultrasonic receiver, and headphones. The receiver had a digital readout that provided the time interval between signals, which correlated to the fishes body temperature.

Surveys required two days to cover the entire reservoir. Two complete surveys were conducted each week for 18 months. Alternate areas of Lake Mohave were examined during both day and night. When fish were detected, surveyors triangulated the fish as closely as possible without disturbing it. Fish location (latitude and longitude), body temperature, and estimated distance from shore were recorded. A Hydrolab was used to measure vertical water temperature profiles.

Battery life of several transmitters exceeded the 14 month life expectancy. Scheduled surveys continued until mid-April 1996, however, additional information was collected through July 1997 on an intermittent basis.

Data Analysis

Geographical information was provided using digitized shoreline profile maps of Lake Mohave and the geographical information program (GIS) ARC/INFO (TM). Using ASCII files developed for each fish, the program calculated the distances between all locations where that particular fish was found. The output provided movement rates in m/day, total distance traveled, actual maps of movement, and seasonal distribution of fish (Appendices B & D). Rate measurements and distances from shore were transformed into single classification frequency distributions. Each observed datum were summarized by particular classes. Movement rates (m/day) of both males and females were examined for the periods between January 31 and March 15 in 1995 and 1996, to determine if there were differences in movement patterns between sexes (F-test).

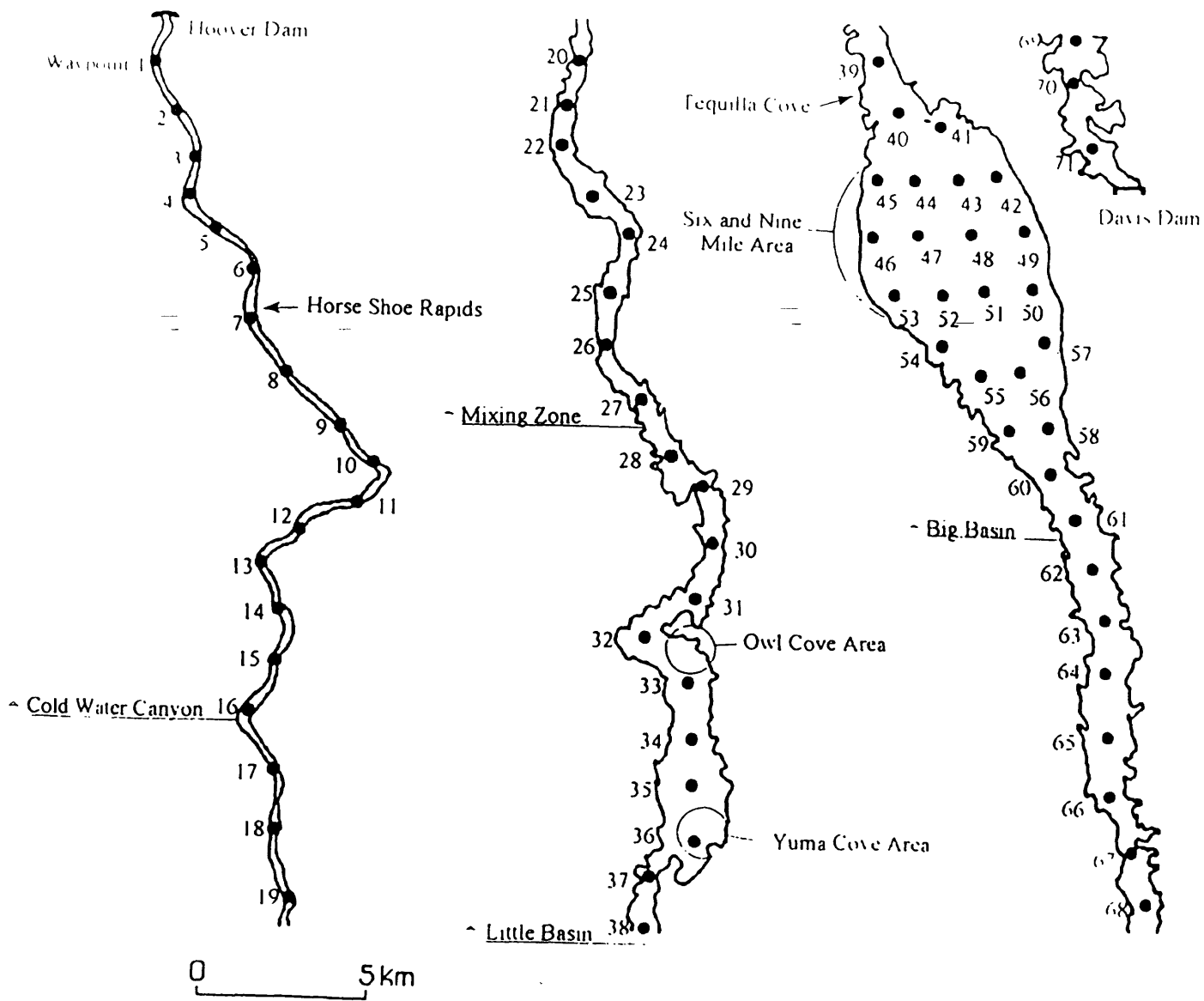


Figure 1. Segmented map of Lake Mohave showing the distribution and location of the 71 GPS waypoints or listening stations.

To determine fidelity to inshore habitats, ARCINFO was used to determine the amount of area in the reservoir at specific distances from shore. Percentiles of available surface habitat were compared to the percentile of fish use within specific zones via chi square test (Sokal and Rolf 1981).

Comparisons of shoreline habitat utilization, movement rates, and area affinity were divided into spawning and non-spawning periods. These periods were defined based on information and observations reported for razorback suckers in Lake Mohave (Minckley 1983, Minckley et al. 1991, Bozek et al. 1990, NFWG unpublished data). The spawning season can vary depending upon weather and flow conditions. Staging of spawning aggregations have been observed as early as November and larval suckers have been collected into April. For the purposes of this analysis, we defined the spawning period as being from November through April and the non-spawning period from May through October.

RESULTS

Data Base

The database is presented in Appendices A-D which details information on all 45 fish (20 adults plus 25 juveniles) used in the telemetry study. We felt analysis could be biased by unhealthy fish, so only movement data from the 10 adults and 1 juvenile that remained active through the initial 14 month period for the analysis. Nearly 2,000 detections of fish movement were recorded, of which 637 represented daily detections of the eleven surviving fish. Hourly tracking information added over 1,000 observations to the database. Over 800 recordings of body temperature in razorback suckers with 147 correlated to depth through vertical water temperature profiles acquired with the Hydrolab (Appendix C). These data represented our most accurate information on depths occupied by fish.

Information was also collected from the 5 juveniles that were externally tagged with 45 day transmitters. Four of the five fish were tracked for the duration of the transmitter life.

Fish Movement

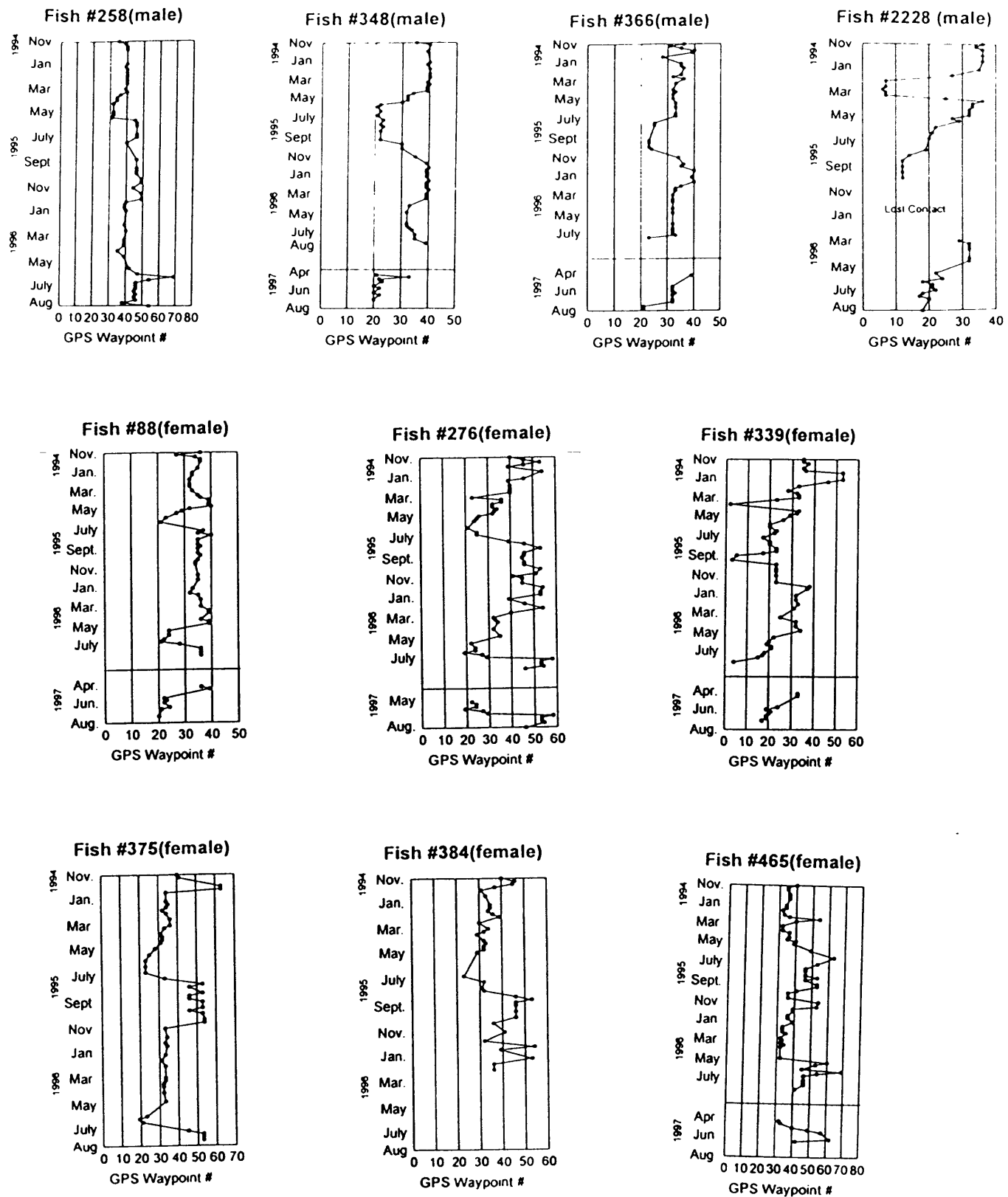
Adults--Fish movements were not only variable but quite distinctive by sex and among individuals (Figures 2-II). Both males and females exhibited the ability to travel substantial distances in a short time span. One fish (#348) traveled more than 17 kilometers in fewer than 24 hours while some fish remained in the same general locations for weeks. Adult daily movement rates averaged 527 m/day (242-788 m/day). Females exhibited a slightly higher rate (\bar{x} =582 m/day) compared to males (\bar{x} =445 m/day)(Table 1). Maps of individual fish movements are summarized in Figures 2-12 and provided in detail in Appendix D.

Table 1. Minimum, maximum, and average distance (m/day) traveled by adult razorback suckers in Lake Mohave between November 1994 and July 1997.

Fish ID	# of Obs	Min. ---(meters / day)---	Max.	Avg.	STD	Total Distance Traveled (m)
Females--Total Record						
88	65	0	6,703	603	1,322	250,427
276	71	21	3,502	606	708	352,544
339	62	9	10,108	767	1,413	417,375
375	54	4	2,368	417	544	249,681
384	36	0	6,886	614	1,133	182,991
465	65	9	6,558	485	851	264,277
Males--Total Record						
2228	51	3	15,607	788	2,280	231,470
366	57	0	1,986	243	509	167,653
348	65	0	17,353	509	2,154	181,680
258	57	0	1,635	242	334	120,942

Spawning Movements --Movements of fish during the peak of spawning, January 31 to March 15 were examined for both 1995 and 1996. We compared the daily average movements (m/day) for each sex. Parametric comparison of male and female movement rates indicated females were significantly (Anova/ $F_{1,8}=6.79$, $P=0.0314$) more active than males. During this 6-week period, females exhibited individual movement rates of 721, 444, 453, 412, 444, 284 m/day, which was slightly lower than their year-round total ($\bar{x}=460$ versus 582 m/day) average. The four males on the other hand averaged 409, 281, 32, and 31 m/day, all below their annual average ($\bar{x}=188$ versus 445 m/day).

Range--Fish were found occupying areas that encompassed known spawning sites and summer habitats (Figure 12). The average linear range of the 10 adults was about 39 km (18 to 72 km). Females ranged further than males, both up and down reservoir. Their range averaged 42 km (29-72 km) compared to 35 km (18-51 km) for males.



Figures 2-11. Movements of individual adult razorback suckers between GPS waypoints in Lake Mohave, November 1994 to July 1997.

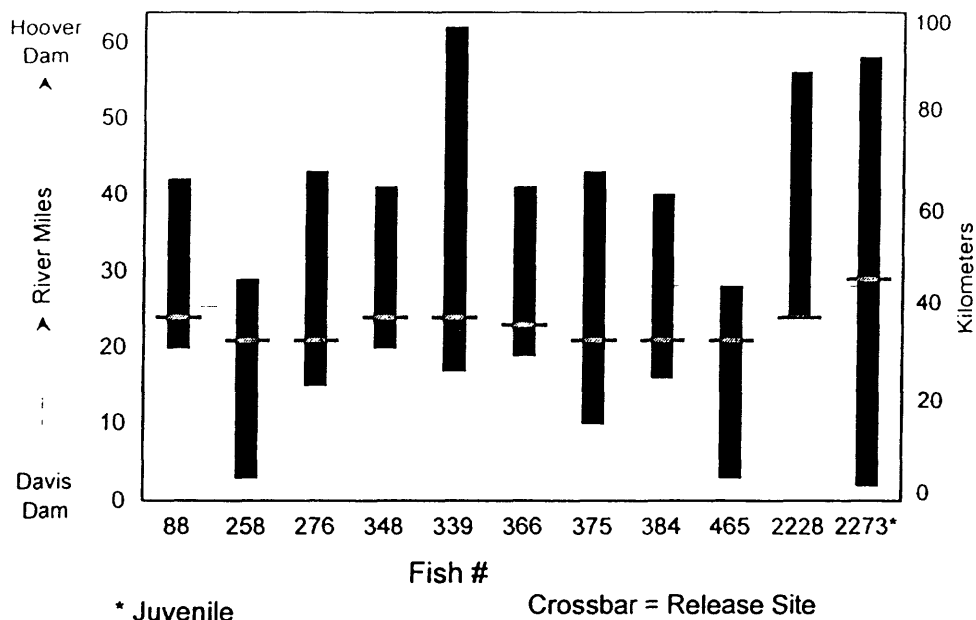


Figure 12. The maximum linear distance (range) traveled by Razorbacks Suckers by River Kilometer within Lake Mohave during November 1994 through July 1997.

Hourly and Monthly Movement Rates Data were examined to determine trends in hourly or seasonal movement by adult razorback suckers. No significant trends were identified. Hourly data suggested fish might be slightly more active during mid-morning (9:00 to 10:00 am) in the summer. A similar analysis was performed for the monthly averages but variability was high. However, months when individual fish movement exceeded 1,000 m/day, occurred immediately after release and following both spawning periods (Table 2).

Table 2. Monthly average movement rates (m/day) for adult razorback suckers in Lake Mohave from November 1994 to July 1997.

Month	Julian Day	Average	STD	Obs #
Nov-1994	34639	1,216	1,658	16
December	34669	488	563	25
January 1995	34700	350	431	32
February	34731	345	525	25
March	34759	1,100	2,703	35
April	34790	309	515	33
May	34820	445	770	24
June	34851	463	593	28
July	34881	679	1,256	27
August	34912	686	2,030	23
September	34943	157	214	24
October	34973	307	541	24
November	35004	333	380	21
December	35034	521	773	21
January 1996	35065	199	261	17
February	35096	262	390	10
March	35125	247	335	30
April	35156	479	1,407	18
May	35186	1,730	2,179	6
June	35217	475	453	40
July	35247	533	641	33
April 1997	35521	2,338	5,017	11
May	35551	510	399	14
June	35582	576	806	17
July	35612	477	685	6

Juveniles The juvenile (#2273) exhibited a very different trend. Shortly after release at Owl Point (RK 47) the juvenile (a 2 yr-old) was found 2 km from the release site in a shallow, vegetated cove. The fish remained relatively stationary for 21 weeks and then slowly moved down toward Arizona Bay (RK 40). In November 1995, its movements increased dramatically, traveling a minimum of 145 km. The fish moved to within 3 km of Davis Dam and then was found within 8 km of Hoover Dam when surveys resumed in 1997 (Appendices B & D).

Movements of the 5 (YOY) juveniles were highly erratic following release when fish swam around and across the reservoir's pelagic zone. Migratory rates for all 5 fish exceeded 1,000 m/day (range 1,193 to 3,750 m/day) during the first 10 days following release (Figure 13). After the second week, fish moved along the shore and were found in protected coves (Table 3). Average movement rates for 5 juvenile razorback suckers in Lake Mohave was between 319 and 1,011 m/day for a 50-day period following stocking.

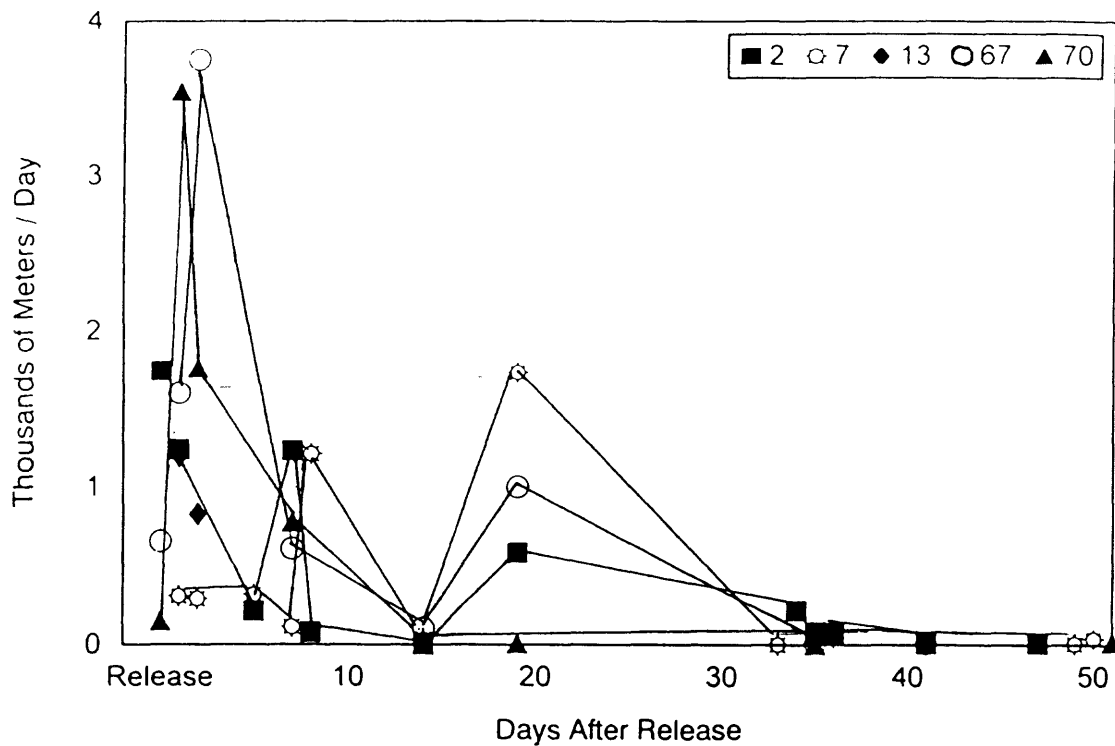


Figure 13. Dispersal rate of young of the year razorback suckers determined by externally attached sonic transmitters.

Table 3. Minimum, maximum, and average distance (m/day) traveled by juvenile (YOY) razorback suckers in Lake Mohave over a 50 day period in 1996.

Fish ID	OBS #	Min, Max. ---(meters / day)---	Avg.	STD	Total Distance Traveled (m)
2	12	4	1,741	457	12,685
7	13	3	1,733	319	12,243
13	2	830	1,193	181	2,023
67	8	11	3,750	969	15,293
70	10	0	3,541	630	9,788

Habitat Use

Temperature Preference--Body temperatures varied according to the location of fish within the reservoir. Water temperatures above Willow Beach had a narrow range (12-16 °C) regardless of season because of the cold hypolimnetic releases from Lake Mead. However, further downstream the lake stratified during the summer, with water temperatures ranging from 15 to nearly 30 °C.

Temperature data were obtained from 570 fish contacts over the first 15 month period following tagging and release. Razorback suckers were found through a wide temperature range (12 to 28 °C) (Figure 14). However during the summer, adults preferred temperatures that averaged between 18 to 22 °C. They seldom were found in water temperatures >25 °C. Hourly tracking indicated that fish moved vertically in the water column but there were no correlations for depth with time of day. Temperature data for juvenile #2273 demonstrated that this fish preferred shallow, warm, protected coves (Appendices B & D)

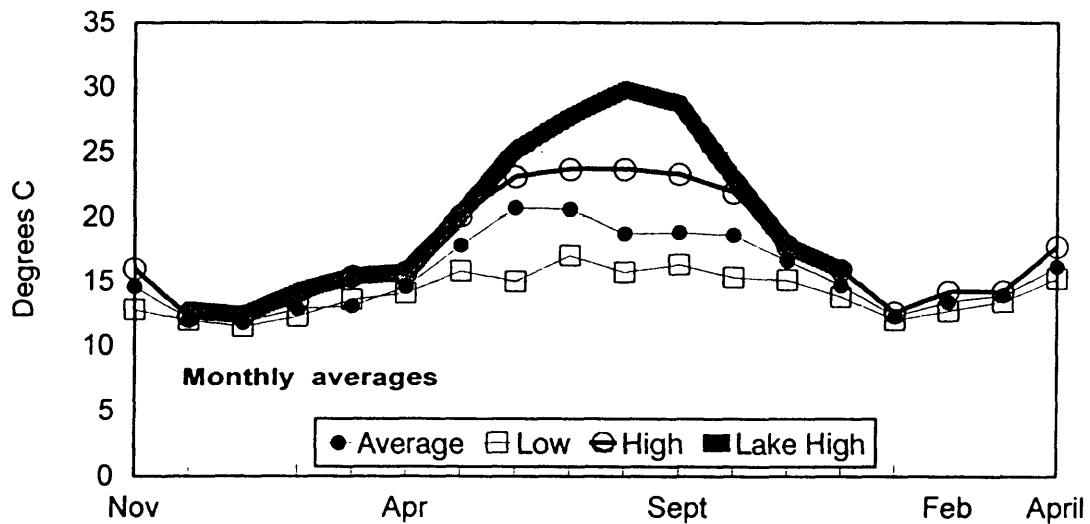


Figure 14. Average, maximum, and minimum body temperature range (monthly average) of adult razorback suckers compared to maximum reservoir temperatures found in Lake Mohave, Arizona-Nevada from December 1994 to February 1996.

Table 4 presents the average depths and ranges for the 10 adult and one juvenile fish. While the depths are highly variable, the seasonal temperatures recorded for these fish were not, averaging between 18.0 and 20.9 °C for the adults.

The thermal characteristics of Lake Mohave varied, with the lower portions of the reservoir being strongly stratified. Accordingly, water temperature at a specific depth also varied depending upon where the measurements were taken. For instance, a fish seeking out a temperature of 18 °C during the summer would find that thermal regime close to the surface at RK 72, while at RK 32 that temperature would be found at a depth nearer to 10 m. We simply did not collect the data required to describe the thermal dynamics of the entire reservoir or attempt to make correlations of depth and temperature by month. Both are highly variable, but it appeared that adults may have had a stronger preference toward water temperature, rather than depth (Table 4).

Shoreline Fidelity--Both juvenile and adult razorback suckers exhibited a significant fidelity for inshore habitats during the entire year ($P < .001$, Chi Square test). Fish were typically found within 50 m of shore. Fidelity was most pronounced during the spawning season when average distance from the shoreline was less than 30 m. Fish tended to move off-shore following spawning (July-November) in concert with warming surface water temperatures.

Depth--We collected 147 vertical temperature profiles at the exact location where fish were detected. These data were collected from May through November of 1995, when the reservoir was thermally stratified and represents our most accurate information on depth. The temperature data suggested fish were usually found at depths less than 10 m, but on one occasion a fish was deeper than 30 m. Individual fish were found at average depths that varied between 3.1 and 16.8 m (Table 4). Seasonally, fish moved closer to the surface during early summer and then migrated deeper during mid-summer (Appendix C). As surface water temperatures cooled in late summer, fish once again moved closer to the surface at depths averaging <15 m.

Geographical Fidelity--There were definite areas of the reservoir where adults preferred to spawn and reside during non-spawning periods of the year (Figures 15 & 16). Adults seldom were detected downstream of South Basin Light (RK 21) or upstream of Monkey Hole (RK 77). In Cottonwood Basin, there was strong preference to the Nevada west shoreline between Nine Mile and Six Mile coves. This area was used during the spawning season by three fish (#339, 465, 384) and during the summer by five fish (#375, 258, 276, 384, 465). Tequila Cove (RK 34) was visited by all spawners except for fish #2228. The most heavily used area in the reservoir was between RK 39 and RK 47. The Arizona shoreline was used extensively by all fish during the spawning season and adults were seldom found along the more vegetated Nevada shoreline. This vegetated portion of the lake was initially used for several weeks by juvenile #2273.

Table 4. Comparison of water temperature and depth occupied by adult razorback suckers in Lake Mohave from May through November, 1995.

Fish #	Temperature (°C)	Range (Min-Max)	Depth* (m)	Range (Min-Max)
88	18.4	(14.6-27.4)	12.8	(3-25)
258	18.0	(15.4-21.9)	16.8	(8->30)
276	20.0	(16.1-24.8)	8.4	(1-20)
339	19.7	(14.9-26.6)	4.4	(1-7)
348	20.9	(14.3-25.8)	5.6	(1-9)
366	18.7	(11.7-24.6)	7.3	(3-12)
375	18.2	(15.0-27.2)	13.3	(1-25)
384	20.5	(18.5-23.3)	9.9	(1-16)
465	20.1	(17.7-22.1)	9.1	(1-16)
2228	18.7	(14.1-22.7)	3.1	(1-6)
2273*	23.5	(12.4-27.6)	4.4	(1-16)

*Average of weekly averages

The most popular 1-mile reach of the reservoir was at Owl Point (RK 45). This area was used by all ten of the study fish during spawning season (Figure 15) and by four fish (88, 348, 366, 375) during extended periods of the non-spawning season (Figure 16). Another major use area was located between Chalk Cliff Lights (RK 69) and Fire Mountain Lights (RK-60) and represented the cold/warm water interface where Hoover releases mix with the warm reservoir waters. Seven of the suckers (348, 366, 2228, 339, 276, 88, 375) used this area during the summer. On one warm, calm day, we observed an average of 6 razorback suckers per kilometer at the surface in this area.

These areas played an important role in the home range of all ten adults. Some areas were used specifically for spawning while others were only used during non-spawning periods. Some areas, like Cottonwood Basin and Owl Point were used year round by some fish, while heavily used spawning areas, such as Tequila and Yuma coves were vacant during the summer.

Adult Fish Locations - Spawning Season

Julian Dates 34639-34819, 35004-35185, and 35370-35550

Lake Mohave Razorback Sucker Telemetry Study

Prepared by the
U.S. Geological Survey
Biological Resources Division
Midcontinent Ecological Science Center
GIS and Remote Sensing Project

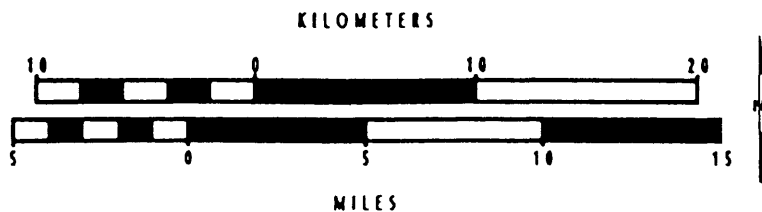


Figure 15. Map showing areas where adult razorback suckers were detected in Lake Mohave during the spawning season (November through April), 1995 and 1996.

Adult Fish Locations - Non-spawning Season

Julian Dates 34820-35003, 35186-35369, and 35551-35734

Lake Mohave Razorback Sucker Telemetry Study

Prepared by the
U.S. Geological Survey
Biological Resources Division
Midcontinent Ecological Science Center
GIS and Remote Sensing Project

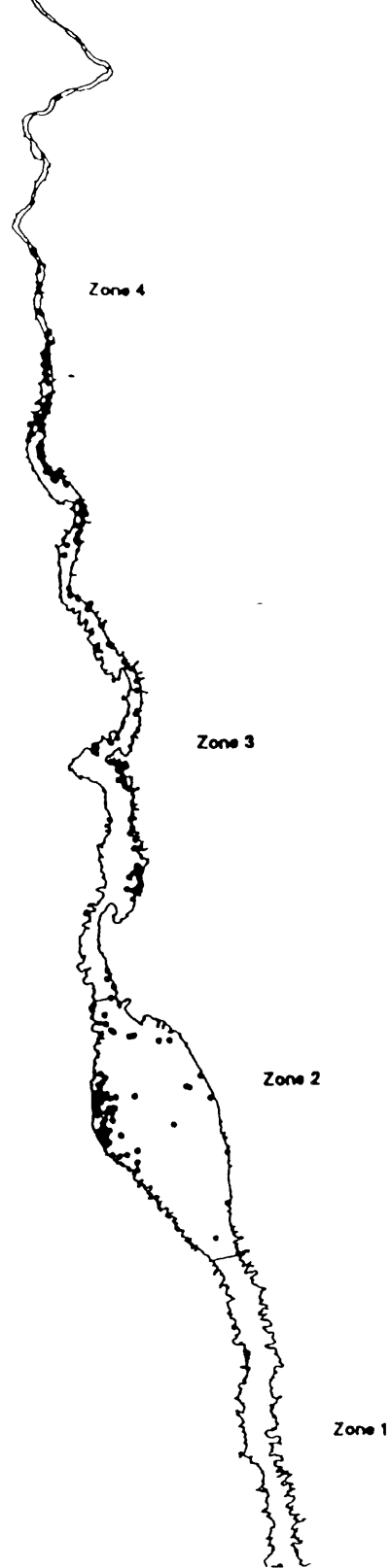
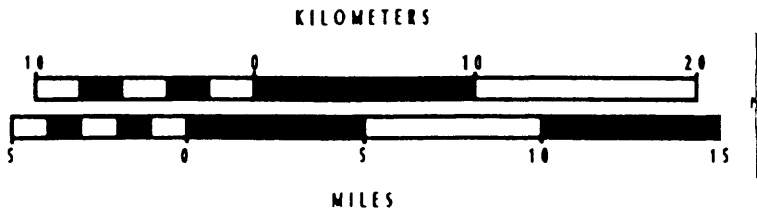


Figure 16. Map showing areas where adult razorback suckers were detected in Lake Mohave during the non-spawning season (May through October) 1995, 1996, and 1997.

DISCUSSION

Lake Mohave may not be considered pristine habitat for a riverine species. However, opportunities to study behavioral and habitat use would be difficult in natural river settings. Studies in riverine systems have been challenged by the scarcity of fish and the logistics associated with remote riverine habitats. Our fish numbers were not significantly different from previous research, but study conditions were unparalleled that provided us an unprecedented database. Reservoir water visibility exceeded 10 m, which unlike river conditions, allowed researchers to easily find spawning congregations, observe spawning, document reproduction (collect sucker larvae), and observe individual fish. These fish had a much broader and less fluctuating range of physical parameters to choose from compared to riverine conditions. Lake temperatures ranged from 12 to 30 °C, flows ranged from none to 3 m/sec, depths could exceed 40 m, and fish had the opportunity to use both littoral and pelagic habitats.

It's noteworthy that the only significant recruitment recorded in recent history occurred in reservoir, rather than river habitats (Minckley et al. 1991). Lake Mohave once was the prominent nursery for 95 percent of the wild razorback suckers that still survive. This fact illustrates the adaptability of the razorback sucker to use a wide range of physical habitat conditions. While adults have successfully spawned in a variety of conditions ranging from small ponds to cold hypolimnetic tailwaters (Minckley et al. 1991, Mueller 1989, 1995), there is no measurable recruitment suggesting their young do not survive. The dependency of young suckers on shallow, warm, shoreline habitats make them highly susceptible to nonnative predators. Unfortunately, the fish has failed to cope with exotic predator introductions. This sobering fact has until recently been ignored or discounted in an arena where fishing license sales primarily funds management programs.

Adults

Both adults and juveniles used the broad, shallow, shoreline habitats found in Arizona and Cottonwood basins and generally avoided the deeper, canyon habitat typical of the lower reservoir. Fish were seldom tracked together until the spawning season (McAda and Wydoski 1980). Adult razorbacks were quite mobile, but exhibited movement rates and ranges similar to those reported in riverine habitats (Tyus 1987, Kaeding and Osmundson 1988, Marsh and Minckley 1989b, Tyus and Karp 1990, Ryden and Pfeifer 1995 and 1996, Burdick and Bonar 1997, Modde and Wick 1997). Adults exhibited various degrees of sedentary and roaming behavior similar to those reported for other stream fish (Funk 1955).

Spawning Migrations--Spawning razorback suckers migrate (Jordan 1891, Hubbs and Miller 1953, Sigler and Miller 1963, Tyus 1987, Tyus and Karp 1990, Minckley et al. 1991, Modde and Wick 1997). We observed prespawning movements both up- and down-lake that were similar to movements reported in the Green River (Modde and Wick 1997, Tyus and Karp 1990, Tyus 1987). Some spawners traveled up to 50 km prior to, and during spawning, to form or join

large spawning aggregations.

It has been speculated that spawning migrations may be triggered by the ascending spring hydrograph (Tyus 1987, Tyus and Karp 1990). However, under reservoir conditions where flow has a minimal influence, we found suckers exhibited the same reproductive characteristics, behavioral traits, and migrations as reported for riverine populations.

Another attribute unique to the reservoir population is the spawning duration. Spawning in the Green and Colorado rivers has been reported to take between 4 and 6 weeks (Tyus 1987, Tyus and Karp 1990, Modde and Wick 1997) while reservoir spawning continued for 10 to 14 weeks (Medel-Ulmer 1983, Langhorst and Marsh 1986, Mueller 1989, Minckley et al. 1991). Spawning is usually associated with fish ovulation and gamete release and is normally reported in terms of days and even weeks. However, an examination of migration trends (Figures 2-12) suggests a broader interpretation is needed. Pre- and active spawning may actually last up to 6 months. Razorbacks migrate and stage near spawning sites as early as November and stay in those areas until late March or April. This suggests that non-hydraulic factors, such as temperature and photoperiod (Minckley et al. 1991), may not only trigger spawning, but conceivably may also influence its duration.

Spawning Site Fidelity--Tyus and Karp (1990) reported spawning site fidelity in the Green River basin and suggested the population structure might be segmented and made up of multiple "stocks." Later Scholz (et al. 1992) and Modde (et al. 1996) suggested there was evidence that fish might be imprinted to specific sites, but the results of those imprinting studies were inconclusive. Modde and Wick (1997) later suggested razorback suckers might actually spawn at several sites in the Green River. Studies of the Colorado squawfish suggest these native fish exhibit a fidelity for a particular river reach but may select spawning sites with certain characteristics based on stream flow (Osmundson et al. 1997).

The extended spawning season and survey conditions allowed us to more closely monitor individual movements. We found spawners to be highly social, forming aggregations numbering hundreds and possibly thousands of fish (Minckley et al. 1991). Adults returned annually to popular spawning sites, but, they also used other spawning sites as well. While we cannot confirm that spawning actually occurred, there is a high probability based on the presence of sucker larvae (Burke unpublished data) and the known fecundity of the species (Minckley 1983, Minckley et al. 1991). Females may produce an average of 100,000 ova, but release only a few eggs during separate spawning events. Our data show that spawning females are more mobile than males. Ripe males remain at specific spawning sites while females join them when they are ready to release their eggs (Mueller 1989), a common behavior among other catostomids (Moyle 1976). Females that ovulate over an extended period could spawn with numerous males at different locations. This behavior, combined with larval dispersal helps explain the high genetic variability described in this population (Dowling et al. 1996).

Post-Spawning--We found post-spawning migrations were as prevalent (distance and rate) as

pre-spawning migrations. Valdez and Wick (1983), Tyus and Karp (1989) and Modde and Wick (1997) reported that following spawning, razorback suckers moved into flooded lowlands which were speculated to provide more abundant food and warmer habitats. Holden (et al. 1997) reported similar movements in Lake Mead where adult razorback suckers moved from spawning areas into the more productive inflow areas of Las Vegas Bay and the Overton Arm.

We witnessed a similar trend in Lake Mohave. The majority (60%) of our fish migrated up reservoir after spawning toward the interface zone from Lake Mead. The reservoir provides warmer temperatures elsewhere, but, this mixing zone is limnologically more productive (Baker and Paulson 1980). Algal production in this cold-warm water interface is quite noticeable compared to other areas of the reservoir. Marsh (1987) reported that razorback suckers pursued a diet of planktonic crustaceans, diatoms, filamentous algae and benthic materials that are present in the mixing area. Wydoski and Wick (1998) suggested adult razorback suckers may feed on zooplankton in highly productive floodplains to regain their body condition after spawning. In Lake Mohave, adults were more active (m/d) after spawning and were found closest (<6 m) to the surface where plankton is most abundant. The need to recover body reserves after spawning may influence their spatial distribution in the reservoir.

Some fish exhibited a strong spatial fidelity to specific locations in the reservoir while movement patterns for others were less obvious. For instance, the distance between spawning and summer resting areas for some fish (348, 258, 375, and 366) averaged about 20 km. Once located in either their spawning or summer habitats, some fish became sedentary, moving less than ± 2 -5 km for 1-2 months. The remaining six fish moved more with some roaming over 30 km. Some of this movement may have been in response to changes in the location of the warm/cold interface zone. High discharges from Lake Mead and fluctuating reservoir elevations can cause this interface zone to migrate up and down the reservoir as much as 20 km and could influence fish distribution and movements (Baker and Paulson 1980).

We observed considerable territorial overlap during this study. Nine of the ten fish, regardless of whether they were captured initially in Yuma or Tequila Cove used both sites during the spawning season. The only exception was fish #2228 whose spawning range was between Yuma Cove (RK 39) and Horseshoe Rapids (R). This fish appeared to spawn in both the warm and cold portions of the lake. While the spawning areas used by the majority of fish overlapped, the areas used by fish during the summer did not and, in some cases, were at opposite ends of the reservoir. This homing pattern of spawning and non-spawning populations was described by Gerking (1958) who stated; "Spawning migrations are directed toward a specific location.... (while) the fish are usually scattered over a wide area during the non-reproductive portion of life."

Adults in Lake Mohave were most active during late morning hours (9:00 a.m.-10:00 a.m.), especially during the spawning season. McAda and Wydoski (1980) found adults in a gravel pit most active during late evening (7:00 p.m.-9:00 p.m.) and late morning (10:00 a.m.-12:00 p.m.).

Juveniles

The five juveniles equipped with external (45 day) transmitters were undoubtedly stressed during the first few days following stocking. Their behavior appeared abnormal, traveling both day and night through wide expanses of the reservoir's pelagic zone. After a few days, fish appeared to calm down and were found associated with shore, especially in shallow, vegetative coves. They skillfully hid in aquatic vegetation and usually moved nocturnally (Mueller and Marsh 1993).

Unfortunately, only one of the juveniles surgically implanted in this study retained its transmitter and remained active. We tracked juvenile #2273 for 20 months. One year following release, the juvenile became quite active, moving over 145 km around the entire reservoir. The fish came within 3 km of Davis Dam and then turned back upstream and traveled more than 80 km into the flowing portion of Lake Mohave. This behavior was quite different than the adults that had distinctly smaller ranges. However, there is a remote possibility the sucker was eaten by a large striped bass since an angler recently harvested a 30 kg striped bass that could have eaten a 50 cm razorback sucker. If this was the case, the observed movement was associated with the predator rather than the subadult razorback sucker.

Sufficient data is not yet available, but it seems logical to believe that young adults may be more active than older adults. Such behavior is reported for young flannelmouth suckers (Chart and Bergerson 1992) and young Colorado squawfish, two fishes that also evolved in this river system (Osmundson et al. 1997). Tyus (1990) speculated the migratory behavior for Colorado squawfish may have evolved in conjunction with long-distance larval drift, and Valdez (et al. 1982) further speculated that, "A net long-term movement of juveniles (squawfish) must occur to populate adult areas upstream, probably in the late young-adult stage,..." We believe similar evolutionary factors influenced the distribution and behavior of early life stages of this mainstem catostomid. If so, the implications could have significant implications for recovery efforts (Tyus 1997).

Transmitters Retention

Transmitter retention in adults was as good as, if not better than, similar studies (Creef and Clarkson 1993, Burdick and Bonar 1997, Holden et al. 1997 and Richard Bradford (AGFD personal communique). Fifty percent of the adults were still actively moving 14 months after being release. After 34 months, 6 transmitters and fish were still active. However, results with juvenile fish were disappointing. Only one of 20 surgically implanted juveniles remained active. Ryden (1997) reported similar problems but found that transmitter expulsion did not necessarily result in fish mortality because small razorback suckers shed surgically implanted transmitters and survived.

Management Implications and Recommendations

The adult razorback sucker population in Lake Mohave appears quite secure with regard to habitat requirements and the absence of major threats. The fish we studied generally remained in the center portion of the reservoir, away from the hazards of possible entrainment (Davis Dam) and remote enough to avoid propeller strike in high recreational use areas (marinas). Adult fish generally avoided deeper, canyon habitats which might lead them to Davis Dam.

However, young suckers are at risk to predation by nonnative fishes. Young use shallow, vegetated habitats that are also used by non-endemic predators such as red shiner (*Notropis lurensis*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*) and channel catfish (*Ictalurus punctatus*) (Tyus 1997). Predator distributions and densities, which historically were controlled by droughts and seasonally low flows, have been expanded due to channel degradation, reservoir fish populations, and sport fishery management. We believe the establishment and spread of nonnative fish predators has literally turned nursery habitats into lethal traps for larvae and juveniles. This concept is supported by the boom and bust sucker populations which occurred following the inundation of lakes Mohave, Roosevelt, and Mead (Minckley 1983). Razorback suckers can successfully spawn over a wide range of habitat conditions, however, meaningful recruitment has only occurred in the relative absence of non-native predators (Minckley et al. 1991, Mueller 1995).

The second concern we have is in the migratory behavior of juvenile or young adults. The limited data we collected combined with the known migratory behavior of flannelmouth suckers and Colorado squawfish, suggests that after an initial period of growth, young suckers enter a roaming or dispersal life stage. The majority of wild juveniles captured downstream of Davis Dam in recent years have been from irrigation or delivery canals (St. Amant et al. 1974, Ulmer and Anderson 1985, USFWS 1981, Mueller 1996, Minckley et al. 1991). It has been speculated that the survival of these suckers was linked to annual drainage and low predator densities, but, the possibility exists that some fish entered the canals as roaming juveniles or young adults.

If so, and dependent upon the extent of these movements, such behavior could have serious ramifications to recovery efforts. With the potential loss of the core population in the lower basin, recovery may not be possible. Moyle and Nichols (1973) suggested that dams could effectively block community dispersal. Possibly the lower basin played a critical role as the systems most stable nursery habitat which produced the majority of young suckers that periodically repatriate marginal habitats further upstream. Augmentation efforts might also be affected if young fish movements make them more susceptible to entrainment, passage through dams, and stranding in large agricultural diversions.

We recommend that the following actions be considered:

1. Conduct further research on the migratory behavior of subadult fish. As fish become sexually mature, does their roaming behavior subject them to unacceptable losses through entrainment or passage into water diversions?

2. Examine predator/prey relationships between early life stages of razorback sucker and introduced predators. Identify what habitat conditions and predatory thresholds would be necessary to insure some measurable level of razorback recruitment.
3. Review existing information and develop a stocking protocol for the lower basin which includes not only Lake Mohave but also other portions of the watershed. Prioritize the most likely areas in terms of habitat, stream length, and potential threats. Stock suckers as large as possible (>40 cm) at times when predators are less active (winter) and examine better methods of acclimation and release.
4. Examine the influence that reservoir fluctuations may have on the densities and distributions of potential predators. Assess whether current reservoir operations (or modifications) create shallow vegetated habitats which depress predator densities and would improve survival of stocked razorback suckers. .

ACKNOWLEDGMENTS

We thank numerous colleagues for their assistance on this project; Tom Burke (BOR), Kent Turner (NPS) and George Devine (FWS) contributed initial review and administrative support; Ty Wolters coordinated field surveys with numerous NPS and ASU staff; Mike Burrell (NDOW) assisted in the collection of adults, Bob Waltermire analyzed GIS and GPS data, and BOR supplied field equipment, support, and juvenile fish. Work was conducted under appropriate state and federal permits. Work was funded by USGS and technical and field assistance from ASU provided under Cooperative Agreement #1445-0009-94-1108.

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Appendix A. Individual fish Data.

Date Concerning Adult and Juvenile Telemetry Fish in Lake Mohave

Fish * Sex * Release * PIT Tag * TL * Weight Range (RM-RM)
(RK) (mm) (g) (km)

Fish #	Sex	Release (RK)	PIT Tag	TL (mm)	Weight (g)	Range (RM-RM) (km)
87	Juv.	11	1F78214F79	324	328	2 (10-11)
88	F	39	1F0B7A3A22	615	2,700	34 (32-66)
96	Juv.	26	1F7B600402	319	324	5 (26-31)
97	M	39	7F7D3D6310	566	2,170	3 (39-42)
249	M	34	7F7D7C665F	563	1,990	6 (34-40)
258	M	34	7F7D7C3D7F	595	2,260	18 (29-47)
267	M	34	7F7D78263D	555	2,420	2 (32-34)
276	F	34	7F7D78316D	654	3,610	43 (24-67)
285	F	34	1F0E5E1A5B	660	3,850	19 (24-43)
294	F	39	7F7D3D5318	645	2,810	0 (39)
339	F	39	7F7D7B333C	666	3,330	72 (27-99)
348	M	39	1F0A2C4269	526	1,750	39 (32-71)
357	M	39	7F7E430E15	585	2,410	1 (39)
366	M	39	7F7D17123E	588	2,290	31 (31-62)
375	F	34	7F7D7C3F34	680	3,350	48 (16-64)
384	F	34	1F0F31465B	631	2,760	39 (26-65)
447	M	34	1F0A485D32	605	2,350	66 (32-98)
456	M	34	7F7B075039	582	2,310	13 (26-39)
465	F	34	7F7D3B724A	614	2,940	29 (5-34)
555	F	39	1F0B722143	624	3,620	31 (34-65)
2228	M	39	1F0F143509	558	2,400	51 (39-90)
2237	F	39	7F7D406F67	675	4,210	19 (27-46)
2246	Juv.	92	1F7B025212	350	380	8 (84-92)
2255	Juv.	71	1F78090D53	334	340	0 (71)
2264	Juv.	47	1F7B4E4850	334	340	2 (47-49)
2273	Juv.	47	1F7B012D38	382	598	44 (3-47)
2327	Juv.	71	1F7A311323	332	338	2 (71-73)
2354	Juv.	47	1F7B0E3B1D	315	296	1 (47)
2363	Juv.	26	1F7A31674F	340	376	1 (26-27)
2426	Juv.	26	200A6C303A	339	374	0 (26)
2435	Juv.	11	1F7B0A5507	332	344	3 (8-11)
2444	Juv.	11	1F7B684836	336	348	8 (2-10)
2453	Juv.	92	1F77724A2E	344	392	4 (87-91)
2525	Juv.	11	1F78403871	335	340	2 (10-12)
2534	Juv.	71	1F7A2C0437	340	358	0 (71)
2543	Juv.	47	1F78117266	341	400	2 (47-49)
2633	Juv.	91	1F78107762	338	375	11 (79-91)
3335	Juv.	71	1F7B092736	347	406	10 (61-71)
3344	Juv.	91	1F78107762	335	320	6 (85-91)
3434	Juv.	26	1F77775C17	350	400	2 (25-27)

High lighted = Fish surviving >14 months.

**External Attachment of Sonic Transmitters to Juvenile Fish
 October 20, 1995
 Lake Mohave, Arizona-Nevada**

Range Data

Fish #	Sex	Release (RK)	PIT Tag	TL (mm)	Weight (g)	Range (km)	Range (RK-RK)
2	Juv.	25	2037245C29	309	--	8	(25-33)
7	Juv.	25	2037112D6B	316	288	11	(25-36)
13	Juv.	25	2037207217	303	--	3	(25-28)
67	Juv.	16	20370C2776	328	406	5	(25-30)
70	Juv.	16	1F7B102135	319	354	8	(18-26)

Appendix B. Telemetry Data

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M			
				11=.100m			
2	34996	0.5313	54	0		35-24-18	114-39-48
2	34997	0.0521	54	10		35-24-36	114-39-32
2	34998	0.0764	53			35-25-32	114-39-41
2	34999	0.2986	47	11		35-26-12	114-39-37
2	35002	0.6146	47	11		35-26-30	114-39-50
2	35004	0.5660	40	1		35-27-40	114-40-37
2	35005	0.1007	40	4		35-27-39	114-40-34
2	35011	0.0694	40	2		35-27-39	114-40-35
2	35016	0.8750	47	11		35-26-13	114-39-46
2	35031	0.5451	41	11		35-27-37	114-38-26
2	35032	0.5660	41	11		35-27-39	114-38-24
2	35033	0.1146	41	11		35-27-39	114-38-21
2	35038	0.6736	42	11		35-27-40	114-38-22
2	35044	0.8646	42	10		35-27-41	114-38-24
2	35048	0.1354	42	10		35-27-40	114-38-24
2	35087	0.6771	42	11		35-27-40	114-38-24
7	34996	0.5313	54	0		35-24-18	114-39-48
7	34997	0.0521	54	3		35-24-30	114-39-32
7	34998	0.5868	54	1		35-24-20	114-39-34
7	34999	0.2708	54	1		35-24-27	114-39-42
7	35002	0.6528	53	11		35-24-58	114-39-48
7	35004	0.4792	54	11		35-24-51	114-39-51
7	35005	0.1146	53	11		35-25-17	114-40-27
7	35011	0.1007	53	11		35-25-14	114-40-19
7	35016	0.9479	38	1		35-29-55	114-40-29
7	35030	0.6319	38	1		35-29-54	114-40-30
7	35032	0.5347	38	1		35-29-54	114-40-31
7	35033	0.1250	38	1		35-29-54	114-40-29
7	35038	0.6632	38	1		35-29-55	114-40-30
7	35046	0.7917	38	1		35-29-53	114-40-29
7	35047	0.1007	38	1		35-29-54	114-40-30
7	35074	0.7188	38	2		35-29-55	114-40-31
7	35087	0.7118	38	1		35-29-54	114-40-30
13	34996	0.5313	54	0		35-24-18	114-39-48
13	34997	0.0729	54	11		35-24-37	114-39-20
13	34998	0.0694	52			35-25-15	114-39-29
13	34999	0.2847	53	11		35-24-55	114-39-51
67	34996	0.5972	57	0		35-24-27	114-36-35
67	34997	0.0903	58	6		35-24-06	114-36-40
67	34998	0.1146	58			35-23-18	114-37-04
67	34999	0.2778	54	11		35-24-37	114-38-57
67	35004	0.4861	53	11		35-25-41	114-40-30
67	35011	0.0903	46	11		35-25-57	114-40-08
67	35016	0.7917	59	11		35-23-35	114-38-31
67	35032	0.6667	59	11		35-23-30	114-38-24
67	35038	0.6875	59	11		35-23-32	114-38-23
67	35044	0.7743	59	10		35-23-31	114-38-22
67	35048	0.2153	59	10		35-23-32	114-38-24
67	35075	0.4757	59	11		35-23-34	114-38-24
70	34996	0.5972	57	0		35-24-27	114-36-35

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M 11=.100m			
70	34997	0.0799	57	11		35-24-27	114-36-41
70	34998	0.1042	59	2		35-22-55	114-38-05
70	34999	0.3160	60	11		35-22-22	114-37-08
70	35004	0.4167	62	2		35-20-21	114-36-22
70	35011	0.1528	62	2		35-20-21	114-36-22
70	35016	0.7708	62	3		35-20-20	114-36-21
70	35032	0.6806	62	3		35-20-20	114-36-22
70	35038	0.6979	70	2		35-20-24	114-36-25
70	35044	0.7569	62	2		35-20-21	114-36-22
70	35048	0.2292	62	2		35-20-23	114-36-23
70	35075	0.4549	62	2		35-20-22	114-36-23
87	34660	0.7014	66	1		35-17-36	114-35-12
87	34662	0.4167	65			35-17-29	114-35-12
87	34673	0.6389	66	9	12.6	35-17-30	114-35-31
87	34708	0.6736	66	5	11.2	35-17-35	114-35-31
87	34711	0.3889	66	3	11.4	35-17-29	114-35-35
87	34724	0.2993	66				
87	34736	0.6875	66	2	12.1	35-17-37	114-35-32
87	34745	0.3958	65	2	12.4	35-17-43	114-35-30
87	34752	0.2861	66				
87	34758	0.6806	66	1	13.1	35-17-35	114-35-37
87	34767	0.3188	65	1	13.8	35-17-37	114-35-36
87	34772	0.4826	65		14	35-17-35	114-35-33
87	34780	0.7535	65	1	14.4	35-17-36	114-35-35
87	34787	0.5313	65			35-17-36	114-35-35
87	34792	0.6736	65	1	15.3	35-17-37	114-35-35
87	34796	0.2153	65	1	15	35-17-34	114-35-34
87	34820	0.7049	65	1	15.7	35-17-36	114-35-34
87	34824	0.2674	65	1	15.5	35-17-36	114-35-33
87	34850	0.7083	65	1	17.2	35-17-52	114-35-35
87	34853	0.2569	65	1	16.7	35-17-35	114-35-37
87	34876	0.6667	65	1	17.7	35-17-36	114-35-34
87	34904	0.6979	65	2	18	35-17-37	114-35-36
87	34932	0.7014	65	2	18.9	35-17-37	114-35-35
87	34960	0.6979	65	2	15	35-17-37	114-35-35
87	34988	0.6875	65	2	19.6	35-17-37	114-35-36
87	35016	0.7465	65	2	17.6	35-17-35	114-35-36
87	35044	0.7396	65	1	15.7	35-17-35	114-35-36
87	35087	0.5660	65	2	11.9	35-17-37	114-35-35
88	34645	0.6667	36	1		35-31-14	114-39-25
88	34652	0.7458	27		13.5	35-38-23	114-40-47
88	34662	0.8125	34		12.2		
88	34674	0.9500	36		12.1	35-31-22	114-37-35
88	34676	0.1354	36	9	12.1	35-31-43	114-39-11
88	34688	0.7639	35				
88	34709	0.9514	33	11	12.1	35-34-01	114-39-34
88	34712	0.1528	33		12.2	35-34-26	114-40-03
88	34724	0.7590	32				
88	34744	0.6986	32	1	13.5	35-35-09	114-41-23
88	34752	0.6806	32				

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M 11=.100m			
88	34759	0.8542	33	4	15.3	35-33-36	114-39-29
88	34768	0.1750	35	10	13.9	35-32-52	114-39-25
88	34780	0.6111	36	8	15.5	35-31-24	114-39-20
88	34787	0.4236	39	1	14.8	35-28-34	114-40-44
88	34796	0.1042	40	3	16.5	35-28-40	114-40-40
88	34801	0.7361	40	1	15	35-28-31	114-40-42
88	34808	0.7222	40	2	15.6	35-28-32	114-40-41
88	34821	0.7361	32	8	19.4	35-34-40	114-39-38
88	34823	0.1944	29	1	19	35-37-05	114-39-20
88	34836	0.6771	27	3	14.6	35-38-52	114-40-58
88	34852	0.2326	23	11	18.9	35-41-52	114-41-40
88	34863	0.6042	21	5	20.7	35-43-27	114-42-00
88	34864	0.5382	21	10	20.1	35-43-47	114-41-55
88	34865	0.0972	21	8	19.9	35-43-41	114-42-00
88	34891	0.6250	37	2	27.4	35-30-56	114-40-53
88	34892	0.6597	37	2	27.4	35-30-55	114-40-50
88	34905	0.7986	35	10	16.9	35-32-02	114-39-15
88	34907	0.0799	36	11	16.8	35-31-50	114-39-14
88	34908	0.0799	40	11	17.5	35-28-20	114-40-23
88	34920	0.5833	35	11	17	35-31-55	114-39-18
88	34934	0.7188	35	9	16.7	35-32-00	114-39-13
88	34935	0.1007	35	9	16.7	35-32-03	114-39-13
88	34949	0.6111	35	11	17.7	35-32-05	114-39-17
88	34961	0.6910	35	11	16.7	35-31-55	114-39-24
88	34963	0.1007	36	11	17.3	35-31-49	114-39-32
88	34974	0.6250	35	11	17.5	35-31-59	114-39-31
88	34975	0.6771	35	9	17.2	35-31-55	114-39-16
88	34976	0.0938	36	11	17	35-31-44	114-39-19
88	34989	0.6597	34	5	20.5	35-33-16	114-39-27
88	34991	0.1354	34	2	21.1	35-33-03	114-39-24
88	35006	0.1215	35	11	18.1	35-32-46	114-39-33
88	35032	0.5139	35	10	15.6	35-32-15	114-39-17
88	35046	0.7569	35	11	13.8	35-32-54	114-39-42
88	35047	0.1458	35	11	13.9	35-33-07	114-39-43
88	35074	0.6979	33	11	12.4	35-33-53	114-39-41
88	35088	0.6181	32	11	12.6	35-34-29	114-39-55
88	35098	0.6458	35	8	12.3	35-32-28	114-39-24
88	35101	0.7083	35	8	12.7	35-32-43	114-39-28
88	35108	0.6736	34	4		35-32-59	114-39-30
88	35116	0.5139	36	11	1391	35-31-10	114-39-38
88	35130	0.5000	36	5	1530	35-31-39	114-39-09
88	35137	0.8889	39	1		35-28-32	114-40-43
88	35144	0.6875	39	2		35-28-32	114-40-43
88	35172	0.3750	36			35-31-41	114-39-11
88	35185	0.7153	39	3	1267	35-28-32	114-40-43
88	35535	0.440278	36			35 31 30	114 39 12
88	35536	0.527083	39	15.7		35 28 35	114 40 40
88	35574	0.479167	22	18.5	3	35 42 34	114 42 05
88	35578	0.479167	23	14.4		35 42 10	114 41 50
88	35588	0.465278	22			35 42 33	114 42 02

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M 11=.100m			
88	35598	0.395833	24			3 35 41 11	114 40 49
88	35605	0.451389	21			10 35 43 52	114 41 48
88	35619	0.416667	20	23.5		35 44 20	114 41 47
96	34660	0.6111	54	1		35-24-29	114-39-40
96	34662	0.3681	54	9	13.8	35-24-43	114-39-51
96	34673	0.7569	43	11	11.9	35-27-11	114-39-14
96	34677	0.1944	44	11	12.3	35-27-05	114-39-17
96	34688	0.4375	44				
96	34708	0.8194	44	11	11.3	35-27-08	114-39-16
96	34711	0.2438	43	11	11.4	35-27-11	114-39-18
96	34724	0.4167	44				
96	34736	0.8333	44	11	11.8	35-27-12	114-39-33
96	34752	0.3750	44	11			
96	34758	0.7986	44	11	12.8	35-27-12	114-39-21
96	34767	0.2118	44	11	13.3	35-27-08	114-39-20
96	34772	0.6146	44	11	13.9	35-27-08	114-39-33
96	34780	0.6806	44	11	14.1	35-27-10	114-39-35
96	34787	0.4583	44			35-27-08	114-39-28
96	34792	0.7639	44	11	13.9	35-27-05	114-39-24
96	34796	0.1285	44	11	14.1	35-27-12	114-39-28
96	34820	0.7882	44	11	14.6	35-27-14	114-39-32
96	34850	0.7951	44	11	15.5	35-27-09	114-39-30
96	34853	0.1389	44	11	15.5	35-27-13	114-39-29
96	34876	0.7743	44	11	16	35-27-06	114-39-24
96	34904	0.8299	44	11	16.6	35-27-11	114-39-26
96	34932	0.8403	44	11	17.2	35-27-12	114-39-27
96	34960	0.8194	44	11	17.1	35-27-10	114-39-26
96	34988	0.7986	44	11	16.5	35-27-06	114-39-29
96	35016	0.8958	44	11	16.3	35-27-08	114-39-28
96	35044	0.8472	44	11	14.7	35-27-11	114-39-26
97	34645	0.6319	36	1		35-31-14	114-39-25
97	35032	0.4965	34	1	16.1	35-33-16	114-39-57
97	35047	0.1528	34	1	14.9	35-33-15	114-39-56
249	34646	0.3958	39	1		35-28-32	114-40-48
249	34652	0.8278	35				
249	34662	0.8194	35				
249	34737	0.9306	34	2	13.1	35-32-30	114-40-16
249	34744	0.6458	35	2	13.4	35-32-34	114-40-18
249	34752	0.6944	35				
249	34759	0.8875	35	3	15.2	35-32-25	114-40-21
249	34768	0.1458	35	4	14.7	35-32-27	114-40-20
249	34780	0.5938	35	10	15.4	35-32-26	114-40-23
249	34793	0.8264	35	6	14.6	35-32-28	114-40-24
249	34795	0.1146	35	3	14.9	35-32-26	114-40-21
249	34801	0.7639	35	3	15.4	35-32-26	114-40-25
258	34646	0.4167	39	1		35-28-32	114-40-48
258	34653	0.6597	39		15.5	35-28-22	114-40-29
258	34662	0.2708	39				
258	34673	0.8125	40	3	12.3	35-28-31	114-40-39
258	34708	0.8750	40	2	11.4	35-28-30	114-40-38

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M 11=.100m			
258	34711	0.1944	39	3	11.6	35-28-29	114-40-39
258	34724	0.4375	40				
258	34736	0.8813	40	2	12	35-28-32	114-40-39
258	34744	0.5694	40	2	13	35-28-34	114-40-46
258	34752	0.3931	40				
258	34758	0.8611	40			35-28-33	114-40-42
258	34767	0.1410	40	2	14.5	35-28-30	114-40-42
258	34772	0.6403	40			35-28-31	114-40-44
258	34787	0.0556	35				
258	34793	0.8090	34	11	13.8	35-32-45	114-39-44
258	34795	0.1319	34	11	14.5	35-32-42	114-39-53
258	34808	0.6319	32	11	14	35-35-06	114-40-20
258	34821	0.7188	31	11	16.2	35-35-12	114-40-02
258	34823	0.1563	32	10	15.5	35-35-05	114-40-28
258	34835	0.5938	32	5	16.2	35-35-12	114-40-18
258	34836	0.7222	32	11	15.7	35-34-58	114-40-34
258	34837	0.1042	32	11	15.4	35-35-03	114-40-28
258	34853	0.1563	46	11	20.7	35-26-35	114-40-34
258	34876	0.7535	46	11	21.9	35-26-16	114-40-06
258	34892	0.7049	46	11	17.5	35-25-59	114-40-07
258	34904	0.8507	40	11	16.5	35-27-54	114-40-07
258	34936	0.2153	46	11	17.3	35-26-14	114-40-16
258	34960	0.8090	46	11	17.3	35-25-53	114-40-21
258	34964	0.2083	46	11	17.9	35-25-53	114-40-37
258	34975	0.7188	46	11	17.2	35-26-00	114-40-11
258	34988	0.7778	49	11	20.1	35-26-28	114-37-47
258	34992	0.1563	49	11	19.6	35-26-30	114-37-53
258	35004	0.5347	44	11	16.5	35-27-16	114-39-37
258	35016	0.8681	49	11	17.8	35-26-28	114-37-54
258	35032	0.6042	49	11	16.6	35-26-32	114-37-52
258	35044	0.8958	39	3		35-28-33	114-40-42
258	35048	0.1146	39	2		35-28-32	114-40-41
258	35087	0.6944	39	3		35-28-32	114-40-44
258	35098	0.4792	39	2		35-28-31	114-40-42
258	35101	0.7465	39	1	12.6	35-28-35	114-40-42
258	35116	0.4861	40	2		35-28-34	114-40-44
258	35130	0.5347	39	1	1422	35-28-31	114-40-42
258	35137	0.8889	39	1	1352	35-28-32	114-40-43
258	35144	0.6875	39	2	1258	35-28-32	114-40-43
258	35173	0.6875	35	11	1237	35-32-06	114-39-14
258	35185	0.7153	39	3	1202	35-28-32	114-40-43
267	34646	0.3715	39	1		35-28-32	114-40-48
267	34653	0.6597	39	10	14.7	35-28-16	114-39-49
267	34662	0.2847	40				
267	34673	0.7986	40	10	12.1	35-28-18	114-39-48
267	34677	0.1590	40	11	12.1	35-28-16	114-39-54
267	34688	0.4653	40				
267	34708	0.8542	40	11	11.3	35-28-14	114-40-00
267	34711	0.2153	40	11	11.5	35-28-18	114-39-55
267	34724	0.4375	40				

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M			
				11=.100m			
267	34736	0.8750	40	10	11.9	35-28-32	114-40-01
267	34744	0.6042	40	3	12.8	35-28-30	114-40-44
267	34752	0.3889	40				
267	34758	0.8403	40	11	12.9	35-28-26	114-39-59
267	34767	0.1528	40	11	13.6	35-28-19	114-39-59
267	34772	0.6444	40	11	14.2	35-28-19	114-39-56
267	34780	0.6597	40	11	15.1	35-28-23	114-39-59
267	34787	0.4375	40		14.6	35-28-21	114-39-55
267	34792	0.7778	40	11	13.9	35-28-19	114-40-01
267	34796	0.1076	40	11	14.3	35-28-26	114-39-57
267	34820	0.8056	40	11	15	35-28-22	114-39-56
267	34850	0.8090	40	11	15.5	35-28-27	114-40-00
267	34853	0.1215	40	11	15.7	35-28-25	114-39-55
267	34876	0.7917	40	11	14.7	35-28-19	114-40-01
267	34904	0.8646	40	11	17	35-28-18	114-39-57
267	34932	0.8542	40	11	17.6	35-28-24	114-40-01
267	34960	0.8403	40	11	17.4	35-28-18	114-39-57
267	34988	0.8125	40	11	17.2	35-28-24	114-40-01
267	35016	0.9340	40	11	17.1	35-28-24	114-40-01
267	35044	0.8715	40	10	14.5	35-28-23	114-40-01
276	34646	0.4097	39	1		35-28-32	114-40-48
276	34653	0.7292		11	16	35-24-50	114-40-07
276	34662	0.3403	53				
276	34673	0.7500	47	11	12.2	35-26-10	114-40-18
276	34677	0.1319	39	9	12	35-28-44	114-39-59
276	34688	0.3681	54				
276	34708	0.8125	46	11	11.9	35-26-53	114-40-11
276	34711	0.1944	39	3	11.6	35-28-29	114-40-39
276	34724	0.4375	40				
276	34736	0.8813	40	2	12	35-28-32	114-40-39
276	34744	0.5694	40	2	13	35-28-34	114-40-46
276	34752	0.3931	40				
276	34759	0.7292	23	5	13.5	35-41-22	114-40-51
276	34768	0.1139	36	4	14.5	35-31-25	114-39-22
276	34773	0.8056	36	11	15.4	35-31-28	114-39-20
276	34780	0.5472	32	10	15.4	35-34-37	114-40-13
276	34787	0.0139	32	2	13.2	35-39-39	114-40-01
276	34793	0.8125	34	11	14.1	35-32-49	114-39-31
276	34795	0.1667	33	3	15	35-33-59	114-39-23
276	34808	0.6354	32	11	14.2	35-34-36	114-40-24
276	34821	0.6632	26	10	17.3	35-38-57	114-41-13
276	34823	0.2465	25	11	17.3	35-40-13	114-41-17
276	34836	0.6250	24	11	16.1	35-41-01	114-40-54
276	34852	0.2743	20	11	17	35-44-23	114-41-48
276	34864	0.6007	25	4	21	35-40-30	114-40-57
276	34877	0.6979	23	3	24.8	35-41-44	114-41-17
276	34879	0.3021	25	10	23.9	35-40-21	114-41-01
276	34904	0.8681	39	11	17.1	35-29-15	114-40-17
276	34908	0.1285	46	11	18.8	35-26-00	114-40-46
276	34920	0.6701	53	11	18.1	35-25-37	114-40-30

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M 11=.100m			
276	34922	0.0972	53	11	18	35-25-35	114-40-32
276	34932	0.7847	46	11	18.6	35-25-51	114-40-36
276	34936	0.1528	46	11	19.4	35-26-01	114-40-41
276	34949	0.6528	46	11	22.3	35-26-45	114-40-24
276	34960	0.8056	46	11	20.5	35-25-53	114-40-23
276	34964	0.1667	53	10	22.4	35-25-24	114-40-40
276	34975	0.7326	53	11	17.4	35-25-24	114-40-28
276	34988	0.7639	51	11	20.6	35-25-33	114-38-17
276	34992	0.1181	41	11	20.5	35-27-39	114-38-43
276	35004	0.5278	45	11	16.8	35-26-44	114-40-17
276	35016	0.8854	45	11	17	35-27-28	114-40-22
276	35032	0.6458	54	10	16.7	35-24-22	114-39-19
276	35044	0.8194	53	11	14.4	35-25-17	114-40-11
276	35048	0.1944	53	11	15	35-25-07	114-40-20
276	35075	0.5278	39	2		35-28-33	114-40-43
276	35087	0.6528	46	11	12	35-25-48	114-40-34
276	35099	0.4514	53	5	12.3	35-25-05	114-40-26
276	35101	0.7882	54	2	13	35-24-43	114-40-10
276	35110	0.9375	54	2		35-24-52	114-40-22
276	35116	0.4861	40	2		35-28-34	114-40-44
276	35130	0.4583	32	11	1368	35-34-45	114-40-41
276	35137	0.8194	33	5	1292	35-33-44	114-39-29
276	35144	0.6597	34	11	1255	35-32-42	114-39-30
276	35173	0.6319	32	6	1153	35-34-40	114-39-47
276	35185	0.6667	35	6	1181	35-32-25	114-39-19
276	35535	0.447917	35	14.4		35 32 40	114 39 19
276	35537	0.479167	37	16.9		35 32 53	114 39 34
276	35574	0.694444	24	19.2	11	35 40 55	114 40 48
276	35574	0.444444	25	19.1	10	35 40 29	114 40 57
276	35578	0.423611	27		5	35 38 35	114 40 41
276	35584	0.368056	33		7	35 34 21	114 39 39
276	35588	0.451389	23	20.4		35 41 48	114 41 19
276	35598	0.395833	24	20	10	35 40 43	114 41 00
285	34646	0.3819	39	1		35-28-32	114-40-48
285	34653	0.7569	56		15.7		
285	34674	0.8889	33	11	12.4		
285	34676	0.1944	34	11	12.7	35-33-39	114-40-04
285	34688	0.7569	34				
285	34709	0.9792	34	11	12.1	35-33-44	114-40-04
285	34712	0.1250	34	10	12.1	35-33-41	114-40-02
285	34724	0.7708	33				
285	34744	0.6597	34	11	13.3	35-33-46	114-40-06
285	34752	0.6875	34				
285	34759	0.8611	33	11	14.3	35-33-44	114-40-10
285	34768	0.1944	34	7	14	35-33-46	114-40-06
285	34773	0.7882	34	11	13.9	35-33-46	114-40-05
285	34780	0.5729	34	11	15.1	35-33-39	114-40-03
285	34793	0.7917	33	11	14.1	35-33-40	114-40-06
285	34795	0.1493	34	11	14.4	35-33-32	114-39-54
285	34802	0.3056	34	11	14.4	35-33-39	114-40-05

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M			
				11=.100m			
285	34821	0.7500	33	11	16.8	35-33-41	114-40-07
285	34850	0.8333	34	11	17.5	35-33-42	114-40-00
285	34852	0.1076	34	11	17.8	35-33-41	114-40-05
285	34877	0.7847	34	11	19.7	35-33-42	114-40-04
285	34905	0.7847	33	11	26.5	35-33-42	114-40-02
285	34961	0.6736	33	11	21.9	35-33-39	114-40-02
285	34989	0.6528	33	11	19.6	35-33-39	114-40-05
285	35047	0.1597	34	10	13.9	35-33-39	114-40-04
294	34645	0.5972	36	1		35-31-14	114-39-25
294	34653	0.6042	36		14.3	35-31-14	114-39-25
339	34645	0.6146	36	1		35-31-14	114-39-25
339	34652	0.8333	35		13.8		
339	34653	0.6250	37	11	14	35-30-51	114-40-32
339	34674	0.8958	35	2	12.1	35-32-51	114-39-28
339	34676	0.1354	36	9	11.9	35-31-43	114-39-11
339	34688	0.3750	53				
339	34708	0.7708	53	3	11.9	35-25-40	114-40-43
339	34711	0.2917	46	3	11.2	35-25-17	114-40-38
339	34724	0.7708	33				
339	34737	0.8542	28	2	12.6	35-37-48	114-40-01
339	34744	0.6875	32	2	13.4	35-35-32	114-40-09
339	34752	0.6875	33				
339	34759	0.8333	33	11	15.4	35-34-01	114-39-36
339	34768	0.3632	23	6	13	35-42-01	114-42-07
339	34779	0.6215	2	4	12.5	35-59-30	114-44-22
339	34802	0.3160	33	8	14.8	35-34-25	114-39-43
339	34807	0.6111	32	3	14.7	35-34-34	114-39-38
339	34808	0.6458	32	7	14.7	35-34-39	114-39-59
339	34810	0.0938	32	11	13.8	35-34-36	114-40-00
339	34823	0.2049	29	3	17.6	35-37-16	114-39-34
339	34836	0.6597	26	3	16.9	35-39-08	114-41-15
339	34852	0.2882	20	5	17.4	35-44-47	114-41-44
339	34864	0.5243	20	11	19.1	35-44-33	114-41-48
339	34877	0.6979	23	3	25.1	35-41-44	114-41-17
339	34879	0.3472	22	5	24.4	35-43-29	114-42-06
339	34892	0.4757	17	4	21	35-47-25	114-41-58
339	34905	0.6806	20	6	23.4	35-44-49	114-41-56
339	34907	0.2257	20	10	26.6	35-44-46	114-41-46
339	34920	0.4931	23	10	18.8	35-42-00	114-41-30
339	34934	0.6319	17	2	14.3	35-47-45	114-42-08
339	34935	0.2431	10	3	13.9	35-53-05	114-40-40
339	34949	0.4514	5	4	14	35-56-20	114-43-31
339	34963	0.2917	3	4	13.4	35-59-03	114-44-37
339	34975	0.5972	23	4	16.1	35-42-02	114-41-34
339	34989	0.5903	23	3	14.9	35-42-14	114-41-53
339	34991	0.1910	23	11	14.9	35-41-52	114-41-36
339	35004	0.6563	23	7	15.5	35-41-50	114-41-31
339	35032	0.4132	23	10	13.3	35-41-54	114-41-40
339	35046	0.7813	38	11	15.4	35-29-50	114-40-51
339	35047	0.1076	37	10	14.5	35-31-21	114-40-02

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M			
				11=.100m			
339	35074	0.6840	32	7	12.5	35-34-38	114-40-03
339	35088	0.6111	32	5	12.5	35-34-44	114-40-12
339	35101	0.6667	33	2	12.5	35-33-59	114-39-22
339	35108	0.6458	32	5		35-34-24	114-39-45
339	35116	0.5764	31	8	12.95	35-35-25	114-39-27
339	35144	0.5972	25	9	13.19	35-40-04	114-41-06
339	35152	0.3542	32	3	13.05	35-34-40	114-40-10
339	35173	0.6528	32	7	11.96	35-34-30	114-39-43
339	35185	0.6528	34	3	12.10	35-33-07	114-39-26
339	35535	0.471528	33	14.2	2	35 34 21	114 39 40
339	35537	0.519444	33	15.3		35 34 16	114 39 33
339	35578	0.444444	24	18.9	10	35 41 02	114 40 48
339	35588	0.493056	19	18		35 45 32	114 41 48
339	35598	0.423611	21	16.7	2	35 43 59	114 41 44
339	35605	0.458333	20	20.6		35 44 54	114 41 45
339	35613	0.4375	19			35 45 09	114 41 52
339	35619	0.430556	19	20.8	1	35 45 41	114 41 43
339	35626	0.430556	17	21.3	4	35 47 13	114 42 00
348	34645	0.6528	36	1		35-31-14	114-39-25
348	34653	0.7743	50				
348	34662	0.2708	39				
348	34677	0.1389	39	9	12	35-28-34	114-40-38
348	34708	0.8681	40	2	11.8	35-28-33	114-40-44
348	34711	0.1944	39	3	11.6	35-28-29	114-40-39
348	34724	0.4375	40				
348	34736	0.8819	40	2	12	35-28-32	114-40-39
348	34744	0.5694	40	2	13	35-28-34	114-40-46
348	34752	0.3931	40				
348	34758	0.8611	40			35-28-33	114-40-42
348	34767	0.1410	40	2	14.3	35-28-30	114-40-42
348	34772	0.6403	40			35-28-31	114-40-44
348	34780	0.6563	40	5	16.5	35-28-35	114-40-42
348	34787	0.4236	39	2		35-28-34	114-40-44
348	34792	0.7917	39	3	14.6	35-29-42	114-40-22
348	34795	0.1424	34	3	15.2	35-33-16	114-39-24
348	34802	0.3368	32	10	15.1	35-34-39	114-40-04
348	34807	0.6076	32	4	14.9	35-34-39	114-39-42
348	34808	0.6493	32	2	14.5	35-34-42	114-39-50
348	34810	0.1076	32	3	14	35-34-40	114-39-56
348	34821	0.7396	32	4	19.6	35-34-38	114-39-39
348	34823	0.1285	32	3	19.5	35-34-41	114-39-55
348	34836	0.7014	30	11	17.9	35-36-31	114-39-12
348	34851	0.6111	22	3	18.8	35-42-36	114-42-01
348	34852	0.2604	21	5	14.3	35-44-03	114-41-44
348	34864	0.5521	22	4	20.8	35-42-42	114-42-07
348	34877	0.6667	21	3	21.5	35-43-36	114-41-47
348	34879	0.3264	22	7	21.2	35-43-14	114-42-11
348	34890	0.7014	23	2	26.5	35-42-08	114-41-47
348	34892	0.5486	23	6	24.9	35-42-01	114-41-31
348	34893	0.1007	23	6	19.1	35-41-43	114-41-14

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M 11=.100m			
348	34905	0.7118	23	1	25.8	35-42-18	114-41-57
348	34907	0.1944	23	2	22.1	35-42-10	114-41-47
348	34920	0.4861	22	7	23	35-42-37	114-42-04
348	34949	0.5313	22	4	24.5	35-42-27	114-42-05
348	34963	0.1563	30	6	23.3	35-35-59	114-39-11
348	34975	0.6354	30	5	19.2	35-35-55	114-39-14
348	35003	0.6215	35	11	15.2	35-32-14	114-39-21
348	35004	0.6007	35	9	18.6	35-32-14	114-39-13
348	35006	0.1007	35	7	18.5	35-32-10	114-39-07
348	35032	0.5451	39	11	16.2	35-28-33	114-40-35
348	35044	0.8958	39	2	15.9	35-28-33	114-40-42
348	35048	0.1146	39	4		35-28-32	114-40-41
348	35075	0.5278	39	2		35-28-33	114-40-43
348	35087	0.6944	39	3		35-28-32	114-40-44
348	35098	0.4792	39	2		35-28-33	114-40-47
348	35099	0.4375	39	3		35-28-33	114-40-47
348	35101	0.7465	39	2	12.7	35-28-30	114-40-41
348	35116	0.4861	40	2		35-28-34	114-40-44
348	35130	0.5347	39	1	1473	35-28-31	114-40-42
348	35137	0.8889	39	1		35-28-32	114-40-43
348	35144	0.6875	39	2		35-28-32	114-40-43
348	35173	0.6597	33	8	1225	35-34-14	114-39-30
348	35185	0.5903	32	2		35-34-40	114-39-41
348	35534	0.423611	21	23.3	2	35 43 08	114 42 03
348	35535	0.464583	33	15.8		35 34 01	114 39 20
348	35537		32	17.2	2	35 34 42	114 39 59
348	35574	0.493056	22	18.9	1	35 42 49	114 42 02
348	35578	0.465278	23		2	35 42 08	114 41 46
348	35588	0.486111	20	21.4		35 45 00	114 41 46
348	35598	0.409722	22	21	1	35 42 24	114 42 00
348	35605	0.458333	20		1	35 44 45	114 41 42
357	34645	0.6076	36	1		35-31-14	114-39-25
357	34653	0.5799	35	10		35-31-56	114-40-05
357	34662	0.8194	35				
357	34674	0.9028	35				
357	34688	0.7639	35				
357	34711	0.1736	36	11	12.2	35-31-58	114-40-04
357	34724	0.7917	35				
357	34737	0.9792	36	11	13.1	35-31-53	114-40-05
357	34752	0.7014	36	11			
357	34768	0.1250	35	11	14.1	35-32-04	114-39-47
357	34773	0.7917	35	11	14	35-32-01	114-40-04
357	34780	0.6042	35	11	15	35-32-00	114-40-08
357	34787	0.0556	35				
357	34793	0.8299	35	11	14.2	35-32-02	114-40-05
357	34795	0.1076	35	11	14.1	35-32-06	114-39-57
357	34821	0.7813	35	11	15.5	35-32-03	114-40-05
357	34850	0.8299	35	11	16.3	35-32-03	114-40-07
357	34852	0.1007	35	11	15.9	35-32-02	114-40-09
357	34876	0.8264	35	11	16.8	35-32-00	114-40-06

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M			
				11=.100m			
357	34905	0.8125	35	11	18.6	35-32-02	114-40-08
357	34961	0.6840	35	11	18.1	35-32-00	114-40-07
357	34989	0.6667	35	11	17.8	35-31-59	114-40-08
357	35047	0.1319	35	11	14.5	35-31-59	114-40-07
366	34645	0.5729	36	1		35-31-14	114-39-25
366	34652	0.7708	31		13.4	35-34-58	114-39-32
366	34662	0.8194	35				
366	34673	0.8125	40			35-28-31	114-40-39
366	34677	0.1319	39	9	12	35-28-34	114-40-38
366	34688	0.7292	28				
366	34709	0.0417	36	5	11.9	35-31-29	114-39-05
366	34711	0.1319	35	5	11.7	35-31-39	114-39-09
366	34724	0.8042	36				
366	34737	0.9514	35		13.6	35-32-41	114-39-14
366	34744	0.6736	32	3	13.3	35-43-56	114-40-15
366	34752	0.7014	36				
366	34768	0.2194	33	2	14.5	35-34-35	114-39-37
366	34774	0.6528	31	10	15.7	35-34-36	114-39-43
366	34793	0.7743	32	6	14.3	35-34-37	114-39-39
366	34795	0.1806	32	11	15	35-34-33	114-39-51
366	34802	0.3264	32	5	15.1	35-34-37	114-39-42
366	34807	0.6111	32	3		35-34-34	114-39-38
366	34808	0.6528	32	5	14.8	35-34-36	114-39-40
366	34810	0.1146	32	2	14.2	35-34-37	114-39-40
366	34821	0.7396	32	2	20	35-34-38	114-39-34
366	34823	0.1458	32	2	19.6	35-34-37	114-39-35
366	34836	0.7917	32	1	20.8	35-34-35	114-39-35
366	34852	0.1181	33	10	22.1	35-34-30	114-39-49
366	34877	0.7743	33	10	17.2	35-34-13	114-39-39
366	34879	0.2569	33	8	24.6	35-34-12	114-39-38
366	34905	0.7292	25	3	20.1	35-40-16	114-40-54
366	34907	0.1771	25	3	18.9	35-40-17	114-40-58
366	34961	0.6111	23	11	16.8	35-41-55	114-41-35
366	34963	0.1979	23	8	15.9	35-41-56	114-41-32
366	34975	0.5903	23	11	15.2	35-41-53	114-41-41
366	34989	0.6007	24	3	17	35-41-18	114-40-50
366	35004	0.6111	34	5	18.1	35-33-20	114-39-32
366	35030	0.6146	36	3	16.5	35-31-35	114-39-11
366	35032	0.5208	36	5	15.8	35-31-36	114-39-11
366	35044	0.8958	39	3		35-28-33	114-40-42
366	35048	0.1146	39	2		35-28-32	114-40-41
366	35075	0.5278	39	2		35-28-33	114-40-43
366	35087	0.6944	39	3		35-28-32	114-40-44
366	35101	0.6910	35	2	12.5	35-32-40	114-39-09
366	35108	0.6458	32	4		35-34-44	114-40-20
366	35116	0.5347	33	11	1362	35-34-02	114-39-30
366	35130	0.4653	32	2	1510	35-34-41	114-39-46
366	35144	0.6319	32	2	1314	35-34-36	114-39-37
366	35152	0.3889	32	2	1389	35-34-37	114-39-36
366	35173	0.6528	32	1	1084	35-34-34	114-39-34

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M			
				11=.100m			
366	35185	0.5903	32	1	12.59	35-34-37	114-39-38
366	35534	0.81875	39				
366	35571	0.784722	32		2	35 34 32	114 39 46
366	35573	0.8125	32	20.6	1	35 34 33	114 39 43
366	35578	0.375	32		1	35 34 40	114 39 36
366	35584	0.375	33			35 34 31	114 39 42
366	35588	0.388889	32			35 34 35	114 39 45
366	35597	0.569444	32		1	35 34 38	114 39 43
366	35598	0.354167	32		1	35 34 39	114 39 33
366	35605	0.361111	32		1	35 34 42	114 40 02
366	35613	0.416667	21		1	35 43 08	114 42 03
366	35619	0.409722	21		5	35 43 41	114 41 56
375	34646	0.4306	39	1		35-28-32	114-40-48
375	34653	0.6736	41		15.9	35-27-49	114-38-58
375	34673	0.6604	63	9	12.5	35-20-06	114-36-14
375	34677	0.3576	63	5	12	35-19-32	114-35-54
375	34688	0.7569	34				
375	34709	0.9931	34	5	12.1	35-33-32	114-40-04
375	34711	0.1389	35	5	11.8	35-31-41	114-39-08
375	34724	0.7590	32				
375	34737	0.9028	34	11	13	35-32-40	114-39-54
375	34752	0.7014	36				
375	34759	0.9097	36	2	14.7	35-31-23	114-39-17
375	34768	0.2313	32	10	14.2	35-34-45	114-40-17
375	34774	0.5521	32	3	14.3	35-34-39	114-39-41
375	34779	0.7986	31	6	15.7	35-35-31	114-39-16
375	34787	0.0139	32	2		35-34-40	114-40-09
375	34793	0.7639	32	9	13.7	35-34-41	114-40-14
375	34795	0.2083	32	11	15	35-34-47	114-40-23
375	34808	0.6181	31	11	14	35-35-18	114-39-51
375	34821	0.6771	28	7	18.4	35-37-42	114-40-03
375	34836	0.6528	25	11	15.2	35-39-58	114-41-22
375	34864	0.5868	23	11	15	35-41-51	114-41-37
375	34877	0.6875	22	10	15.2	35-42-02	114-41-46
375	34879	0.3125	23	10	14.9	35-42-04	114-41-54
375	34892	0.6076	33	7	27.2	35-34-02	114-39-30
375	34904	0.7674	53	11	17.2	35-25-29	114-40-26
375	34908	0.1597	46	11	16.9	35-25-42	114-40-26
375	34920	0.6701	53	11	17.4	35-25-37	114-40-29
375	34932	0.7917	46	11	18.5	35-26-03	114-40-42
375	34936	0.1979	46	11	19.5	35-25-59	114-40-39
375	34947	0.6458	46	10	18.8	35-26-46	114-40-34
375	34949	0.6771	53	11	18.8	35-25-20	114-40-24
375	34960	0.7639	53	11	17.8	35-25-19	114-40-28
375	34964	0.1458	46	11	17.7	35-26-21	114-40-23
375	34975	0.7396	53	11	17.6	35-25-15	114-40-25
375	34988	0.7431	54	11	20.5	35-24-37	114-39-27
375	34992	0.1875	54	3	20.7	35-24-25	114-39-27
375	35004	0.6215	33	6	18	35-34-13	114-39-39
375	35032	0.5000	34	5	15.4	35-33-08	114-40-03

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M			
				11=.100m			
375	35046	0.7326	33	11	13.8	35-33-35	114-39-41
375	35047	0.1667	34	11	13.8	35-33-37	114-39-54
375	35074	0.6944	33	4	12.8	35-33-57	114-40-08
375	35088	0.6007	31	4	12.5	35-35-20	114-40-00
375	35101	0.6736	33	1	12.8	35-34-03	114-39-26
375	35110	0.9375	54	2		35-24-53	114-40-22
375	35130	0.4861	33	6	1518	35-34-14	114-39-30
375	35137	0.8194	32			35-34-39	114-39-45
375	35144	0.6319	32	3	1418	35-34-39	114-39-44
375	35152	0.3819	32	7	1409	35-34-38	114-39-43
375	35173	0.6250	32	10	1240	35-34-38	114-39-54
375	35185	0.6458	33	3	1327	35-34-09	114-39-28
384	34646	0.4444	39	1		35-28-32	114-40-48
384	34653	0.7431		9	16	35-24-46	114-40-00
384	34662	0.2847	40				
384	34676	0.2431	31		12.2	35-35-03	114-39-43
384	34688	0.7500	33				
384	34709	0.0625	36	10	11.8	35-31-23	114-39-23
384	34711	0.1458	36	5	11.7	35-31-22	114-39-20
384	34724	0.8042	36				
384	34736	0.9076	39	3	12.3	35-29-43	114-40-19
384	34752	0.6667	30				
384	34759	0.8681	34	11	15	35-33-20	114-39-29
384	34768	0.3028	31	11	14.3	35-35-13	114-39-36
384	34774	0.5313	32	8	14.7	35-34-40	114-40-02
384	34779	0.7604	29	4	15.4	35-37-17	114-39-29
384	34793	0.7674	32	11	14.1	35-34-37	114-39-51
384	34795	0.1840	32	8	15.1	35-34-43	114-40-11
384	34802	0.5382	32	10	15.7	35-34-34	114-39-50
384	34808	0.6389	32	10	14.3	35-34-39	114-40-10
384	34821	0.6944	29	3	18.3	35-37-08	114-39-27
384	34877	0.6875	22	8	22.9	35-42-08	114-41-52
384	34892	0.5938	32	8	20.5	35-35-05	114-40-30
384	34905	0.7604	31	11	20.8	35-35-19	114-39-50
384	34907	0.1111	32	11	18.2	35-34-56	114-40-29
384	34920	0.6458	46	11	18.5	35-26-29	114-40-34
384	34932	0.7569	53	11	19.2	35-25-26	114-40-18
384	34936	0.1806	46	11	20.4	35-26-34	114-40-38
384	34949	0.6597	46	11	21.1	35-26-22	114-40-34
384	34964	0.2188	46	11	22.4	35-26-13	114-40-37
384	34975	0.7222	46	11	23.3	35-25-52	114-40-12
384	34991	0.1042	36	3	20.5	35-31-27	114-39-13
384	35004	0.5590	41	11		35-27-45	114-39-43
384	35032	0.4549	32	11	15.1	35-34-09	114-40-07
384	35044	0.8056	54	3	15.9	35-24-47	114-40-10
384	35048	0.1146	39	2		35-28-32	114-40-41
384	35075	0.5069	53	11	12.3	35-25-19	114-40-27
384	35088	0.6597	36	7	12.1	35-31-27	114-39-19
384	35101	0.7153	36	2	13.7	35-31-23	114-39-20
447	34646	0.4583	39	1		35-28-32	114-40-48

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M			
				11=.100m			
447	34662	0.7083	8		13.3		
447	34688	0.6042	3				
447	34709	0.0278	35	5	11.8	35-31-59	114-39-05
447	34724	0.8042	36				
447	34768	0.3222	29	1	13.6	35-37-07	114-39-20
447	34773	0.7361	30	5	14.7	35-35-52	114-39-11
447	34780	0.5590	33	11	15.5	35-34-02	114-39-28
447	34786	0.9722	31	2		35-35-04	114-39-52
447	34802	0.5313	31	5	15.1	35-35-15	114-40-14
447	34808	0.6875	33	11	14.5	35-34-03	114-39-36
447	34820	0.8125	40	3	17.1	35-28-35	114-40-43
447	34824	0.1146	40	2	18.6	35-28-31	114-40-42
456	34646	0.4375	39	1		35-28-32	114-40-48
456	34653	0.6951	45		16	35-26-49	114-40-31
456	34662	0.3125	46				
456	34673	0.7986	40	9	12.5	35-27-53	114-40-20
456	34677	0.2188	45	9	12	35-27-21	114-40-27
456	34688	0.3750	53				
456	34708	0.7569	54	3	11.6	35-24-57	114-40-21
456	34711	0.2778	45	5	11.3	35-26-30	114-40-46
456	34724	0.4028	46				
456	34736	0.8194	46	11	13.2	35-26-13	114-40-41
456	34745	0.3333	45	4	12.1	35-27-11	114-40-36
456	34752	0.3931	40				
456	34767	0.1076	37	3	14.6	35-30-30	114-40-54
465	34646	0.4722	39	1		35-28-32	114-40-48
465	34652	0.8250	35				
465	34653	0.5917	35		13.9	35-31-41	114-39-26
465	34662	0.8194	35				
465	34674	0.9306	36	9	12.1	35-31-35	114-39-12
465	34676	0.1458	36	9		35-31-35	114-39-13
465	34688	0.7778	36				
465	34709	0.9653	34	11	12	35-33-49	114-39-59
465	34712	0.1250	34	10	12.1	35-33-41	114-40-00
465	34724	0.7590	32				
465	34737	0.8958	33		13.2	35-34-07	114-39-35
465	34744	0.6299	36	3	13.2	35-31-29	114-38-50
465	34752	0.3382	54				
465	34758	0.8611	40			35-28-33	114-40-42
465	34768	0.2396	32	11	14	35-34-27	114-40-20
465	34774	0.5486	32	5	14	35-34-36	114-39-36
465	34780	0.5472	32	8	15.5	35-34-38	114-40-12
465	34787	0.0556	35				
465	34795	0.0938	36	5	13.7	35-31-42	114-39-10
465	34801	0.7535	36	10	14.3	35-31-37	114-39-10
465	34808	0.6979	35	11	14.4	35-32-01	114-39-11
465	34820	0.8125	40	3	16.7	35-28-35	114-40-43
465	34824	0.1111	40	2	18.7	35-28-28	114-40-46
465	34853	0.1840	49	3	21.8	35-26-45	114-37-25
465	34880	0.2361	63	8	24.4	35-19-43	114-36-06

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M			
				11=.100m			
465	34892	0.7188	53	11	21	35-25-19	114-40-29
465	34904	0.8160	46	11	18.9	35-26-20	114-40-36
465	34908	0.1389	46	11	19.2	35-26-02	114-40-46
465	34920	0.6563	46	11	17.9	35-25-54	114-40-36
465	34932	0.7639	53	8	22.1	35-25-11	114-40-34
465	34936	0.1667	46	11	19	35-26-15	114-40-35
465	34949	0.6875	54	11	19.2	35-24-47	114-40-00
465	34960	0.7674	53	11	18.8	35-25-26	114-40-34
465	34975	0.7951	41	11	17.7	35-27-47	114-39-38
465	34988	0.8438	36	6	20.6	35-31-36	114-39-10
465	34991	0.1111	36	3	20.7	35-31-40	114-39-11
465	35004	0.4736	54	11	19.1	35-24-37	114-39-39
465	35016	0.8264	53	2	18.1	35-25-26	114-40-46
465	35032	0.5521	39	11	16.3	35-28-21	114-40-30
465	35046	0.7674	36	2	14	35-31-26	114-39-16
465	35047	0.1215	36	6	13.9	35-31-39	114-39-11
465	35075	0.5278	39	2		35-28-33	114-40-43
465	35088	0.6285	33	8	12.4	35-34-01	114-39-32
465	35098	0.6563	35	5	12	35-32-43	114-39-29
465	35101	0.7049	35	5	12.5	35-32-39	114-39-16
465	35108	0.6806	34	5		35-32-21	114-39-20
465	35116	0.5417	32	10	12.90	35-34-27	114-39-44
465	35130	0.4722	33	11	14.14	35-33-59	114-39-33
465	35137	0.8194	32	2	13.15	35-34-37	114-39-42
465	35144	0.6597	34	5	12.83	35-32-42	114-39-19
465	35152	0.3750	32	11	13.19	35-34-34	114-39-52
465	35173	0.7153	39	3	12.08	35-28-33	114-40-43
465	35185	0.5764	32	2	12.71	35-34-41	114-39-44
465	35535	0.457639	32	13.8		35 32 54	114 39 25
465	35537	0.520833	33			35 34 01	114 39 31
465	35571	0.902778	40				
465	35575	0.395833	49		8	35 26 12	114 37 08
465	35577	0.875	57		7	35 24 50	114 36 38
465	35595	0.895833	62	22.3	1	35 20 24	114 36 32
465	35604	0.958333	41				
555	34645	0.6840	36	1		35-31-14	114-39-25
555	34652	0.7083	22		13.5	35-43-03	114-42-18
555	34662	0.7778	24		13.1		
555	34674	0.8056	25	1	13.2	35-40-31	114-40-56
555	34676	0.3021	25	3	13	35-40-27	114-40-52
555	34688	0.7083	24				
555	34709	0.8403	25	3	12.3	35-40-30	114-40-55
555	34712	0.2361	25	3	12.3	35-40-27	114-40-54
555	34724	0.7153	25				
555	34737	0.8333	25	2	13	35-40-30	114-40-53
555	34752	0.6389	25				
555	34759	0.7431	25	7	13.6	35-40-28	114-40-53
555	34768	0.3493	25	8	13.2	35-40-31	114-40-56
555	34773	0.6875	25		13.1	35-40-27	114-40-59
555	34779	0.7292	25	3	13.8	35-40-28	114-40-57

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M			
				11=.100m			
555	34786	0.9097	25	3	13.1	35-40-27	114-40-58
555	34793	0.7118	25	5	13.4	35-40-31	114-40-56
555	34795	0.2500	25	5	13.6	35-40-28	114-40-56
555	34821	0.6597	25	4	14.8	35-40-26	114-40-56
555	34851	0.6319	25	4	14.7	35-40-25	114-40-56
555	34852	0.2188	25	4	14.7	35-40-25	114-40-58
555	34877	0.7118	25	3	15.3	35-40-29	114-40-57
555	34905	0.7257	25	2	17.1	35-40-26	114-40-56
555	34961	0.6181	25	2	17	35-40-28	114-40-56
555	34989	0.6076	25	2	15.2	35-40-29	114-40-56
555	35046	0.6806	25	2	14	35-40-29	114-40-55
2228	34645	0.6701	36	1		35-31-14	114-39-25
2228	34652	0.8125	34		14		
2228	34653	0.5764	35	11	14	35-31-45	114-39-51
2228	34662	0.8333	36				
2228	34674	0.9306	36	9	12.1	35-31-35	114-39-12
2228	34676	0.1458	36	9		35-31-35	114-39-13
2228	34688	0.7799	36				
2228	34709	0.0417	36		11.8	35-31-23	114-39-15
2228	34711	0.1458	35	5	11.6	35-31-30	114-39-15
2228	34724	0.7222	27				
2228	34737	0.7153	7	2	12.7	35-55-01	114-42-28
2228	34752	0.5694	7	2	12.9	35-54-55	114-42-26
2228	34759	0.6250	7	1	12.7	35-55-00	114-42-35
2228	34768	0.4438	7	1	12.5	35-54-57	114-42-34
2228	34773	0.5361	7	1	12.8	35-54-55	114-42-31
2228	34779	0.7396	25	3	14.4	35-39-47	114-41-10
2228	34780	0.6146	36	8	15.8	35-31-29	114-39-18
2228	34787	0.0451	33		13.2	35-35-54	114-39-41
2228	34793	0.7882	33	11	15.4	35-34-04	114-39-33
2228	34795	0.1597	33	11	14.9	35-34-07	114-39-32
2228	34802	0.3299	32	4	15.1	35-34-43	114-39-52
2228	34808	0.6458	32	3	14.8	35-34-41	114-39-57
2228	34821	0.7431	32	7	19.3	35-34-38	114-39-45
2228	34823	0.2257	27	2	18	35-38-44	114-40-35
2228	34836	0.6875	29	3	18.3	35-37-05	114-39-22
2228	34852	0.2500	22	5	18	35-42-53	114-42-25
2228	34864	0.5347	21	11	20.9	35-43-42	114-41-57
2228	34879	0.3611	20	9	22.7	35-44-44	114-41-47
2228	34905	0.6736	19	4	22.6	35-45-39	114-41-43
2228	34920	0.4444	14	5	14.1	35-50-08	114-41-49
2228	34934	0.6042	12	5	14.3	35-51-37	114-41-22
2228	34935	0.2014	12	10	14	35-51-36	114-41-20
2228	34949	0.4861	12	6	14.2	35-51-36	114-41-22
2228	34961	0.5486	12	7	14.6	35-51-37	114-41-21
2228	34963	0.2465	12	6	14.2	35-51-39	114-41-19
2228	34975	0.5382	12	4	13.8	35-51-40	114-41-18
2228	34989	0.5382	12	7	14.3	35-51-39	114-41-21
2228	35130	0.4306	29	1	15.7	35-36-47	114-38-59
2228	35137	0.8194	32	1	14.43	35-34-39	114-39-45

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M			
				11=.100m			
2228	35144	0.6319	32	4	1452	35-34-40	114-39-53
2228	35152	0.3681	32	2	1439	35-34-42	114-39-53
2228	35173	0.6250	32	4	1277	35-34-39	114-39-49
2228	35185	0.5903	32	2		35-34-40	114-39-41
2237	34645	0.6424	36	1		35-31-14	114-39-25
2237	34653	0.7083	53		16.2	35-25-11	114-40-27
2237	34662	0.8194	35				
2237	34674	0.9028	36	2	12	35-31-22	114-39-18
2237	34676	0.1667	35	9	12.1	35-32-38	114-39-20
2237	34688	0.7639	35				
2237	34711	0.1181	35	11	11.9	35-31-52	114-39-09
2237	34724	0.7431	31				
2237	34737	0.8889	31	3	13	35-35-01	114-39-29
2237	34744	0.7125	31	4	13.3	35-34-58	114-39-31
2237	34752	0.6729	31				
2237	34759	0.7917	31	5	14.6	35-34-58	114-39-34
2237	34768	0.2569	31	10	13.7	35-34-57	114-39-35
2237	34773	0.7500	31	10	14.2	35-35-00	114-39-36
2237	34779	0.8090	31	6	15	35-34-54	114-39-32
2237	34786	0.9722	31			35-34-57	114-39-36
2237	34793	0.7500	31	10	14.2	35-34-58	114-39-34
2237	34795	0.2222	31	10	14.3	35-34-52	114-39-35
2237	34821	0.7153	31	8	17	35-34-58	114-39-31
2237	34851	0.6875	31	10	18.2	35-35-00	114-39-37
2237	34852	0.1632	31	10	19.8	35-34-56	114-39-38
2237	34877	0.7431	31	5	22.2	35-34-58	114-39-34
2237	34905	0.7743	31	9	27	35-34-57	114-39-35
2237	34961	0.6528	31	7	27.3	35-34-57	114-39-35
2237	34989	0.6424	31	6	21	35-34-56	114-39-34
2237	35046	0.7153	31	6	13.9	35-34-56	114-39-34
2246	34661	0.4965	6	1		35-55-57	114-42-38
2246	34662	0.6875	6	9		35-56-03	114-42-51
2246	34674	0.7188	11		13.3	35-51-50	114-40-33
2246	34688	0.6458	11				
2246	34712	0.3403	11	2	12.7	35-51-48	114-40-32
2246	34724	0.6597	11				
2246	34737	0.7500	11	2	12.7	35-51-47	114-40-34
2246	34752	0.5903	11				
2246	34759	0.6597	11	1	12.8	35-51-47	114-40-34
2246	34768	0.4215	11	1	12.5	35-51-47	114-40-34
2246	34773	0.5757	11	2	12.9	35-51-47	114-40-33
2246	34779	0.6667	11	1	12.8	35-51-47	114-40-35
2246	34786	0.8299	11			35-51-47	114-40-34
2246	34793	0.6458	11	1	13	35-51-49	114-40-35
2246	34795	0.3021	11	1	12.7	35-51-46	114-40-34
2246	34821	0.5833	11	2	13.5	35-51-47	114-40-32
2246	34851	0.5278	11	1	13.6	35-51-48	114-40-32
2246	34852	0.3438	11	1	13.7	35-51-49	114-40-35
2246	34877	0.5972	11	1	14.1	35-51-48	114-40-34
2246	34905	0.6389	11	1	14.2	35-51-45	114-40-33

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M 11=.100m			
2246	34961	0.5417	11	2	14.5	35-51-48	114-40-34
2246	34989	0.5313	11	1	14.4	35-51-47	114-40-34
2246	35046	0.6215	11	1	13.9	35-51-49	114-40-36
2246	35088	0.5104	11	2	13.4	35-51-46	114-40-35
2255	34661	0.5833	18	1		35-46-38	114-41-52
2255	34662	0.6528	18		14.1		
2255	34676	0.3458	18	2	13.1	35-46-36	114-41-54
2255	34709	0.7569	18	2	12.5	35-46-40	114-41-52
2255	34712	0.2917	18	3	12.7	35-46-37	114-41-53
2255	34722	0.6090	18	2	12.3	35-46-37	114-41-52
2255	34726	0.1250	18	2	12.5	35-46-38	114-41-54
2255	34737	0.7986	18	2	12.9	35-46-36	114-41-53
2255	34752	0.6111	18				
2255	34759	0.6875	18	1	13	35-46-38	114-41-52
2255	34768	0.3924	18	2	12.8	35-46-39	114-41-55
2255	34773	0.6299	18	2	13.3	35-46-37	114-41-58
2255	34779	0.6944	18	2	13.2	35-46-39	114-41-35
2255	34793	0.6806	18	2	13.4	35-46-37	114-41-54
2255	34795	0.2743	18	2	13.1	35-46-39	114-41-56
2255	34821	0.6285	18	2	14.1	35-46-37	114-41-53
2255	34851	0.5590	18	2	14.3	35-46-35	114-41-55
2255	34852	0.3056	18	2	14	35-46-38	114-41-55
2255	34877	0.6285	18	2	14.7	35-46-38	114-41-55
2255	34905	0.6667	18	2	15.5	35-46-39	114-41-55
2255	34961	0.5833	18	2	15.8	35-46-37	114-41-55
2255	34989	0.5625	18	2	14.7	35-46-38	114-41-55
2255	35046	0.6528	18	2	14	35-46-37	114-41-55
2264	34661	0.6042	31	1		35-35-17	114-39-18
2264	34662	0.6042	31	9	12.3	35-35-03	114-39-36
2264	34662	0.8056	31				
2264	34674	0.8611	30	9		35-35-51	114-39-27
2264	34676	0.2604	30	11	12.3	35-35-28	114-39-17
2264	34687	0.6201	31	11	11.6	35-35-37	114-39-26
2264	34688	0.0000	30				
2264	34690	0.1042	31	11	11.8	35-35-38	114-39-25
2264	34709	0.8889	30	11	12.1	35-35-41	114-39-20
2264	34712	0.1924	31	11	12.2	35-35-40	114-39-24
2264	34724	0.7458	31				
2264	34744	0.7222	31	11	13.1	35-35-47	114-39-23
2264	34752	0.6667	30				
2264	34759	0.7708	31	11	13.4	35-35-38	114-39-25
2264	34768	0.3125	31	11	13.3	35-35-38	114-39-30
2264	34773	0.7292	30		13.1	35-35-36	114-39-26
2264	34779	0.7847	30	11	13.8	35-35-44	114-39-20
2264	34786	0.9722	30		12.9	35-35-31	114-39-28
2264	34793	0.7431	30	11	13.5	35-35-39	114-39-25
2264	34795	0.2257	30	11	13.7	35-35-31	114-39-24
2264	34821	0.7014	30	11	14.4	35-35-39	114-39-21
2264	34851	0.6701	30	11	14.8	35-35-38	114-39-26
2264	34852	0.1806	30	11	14.8	35-35-38	114-39-22

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M 11=.100m			
2264	34877	0.7326	30	11	15.1	35-35-39	114-39-27
2264	34905	0.7569	30	11	16.6	35-35-41	114-39-26
2264	34961	0.6458	30	11	16.4	35-35-40	114-39-25
2264	34989	0.6285	30	11	15.1	35-35-39	114-39-26
2264	35046	0.7049	30	11	13.8	35-35-39	114-39-25
2273	34661	0.6042	31	1		35-35-17	114-39-18
2273	34662	0.6042	31	1	13.6	35-35-15	114-39-21
2273	34662	0.8042	31				
2273	34759	0.8125	32	3	15.4	35-34-40	114-41-11
2273	34768	0.2500	32	1	13.9	35-34-37	114-41-07
2273	34773	0.7639	32	5	14	35-34-37	114-41-14
2273	34778	0.6250	32	2	16.3	35-34-39	114-41-13
2273	34780	0.5694	34	10	15.3	35-33-32	114-40-08
2273	34781	0.1354	32	10	14.7	35-34-47	114-40-01
2273	34795	0.2014	32	3	14.2	35-34-23	114-40-50
2273	34806	0.6563	32	5		35-34-22	114-40-55
2273	34808	0.6771	32	4		35-34-22	114-40-53
2273	34809	0.0938	32	11	13.8	35-34-29	114-40-57
2273	34821	0.7257	32	3	17.1	35-34-21	114-40-54
2273	34823	0.1215	32	2	18.9	35-34-21	114-40-54
2273	34834	0.6354	32	1	17.8	35-34-21	114-40-55
2273	34836	0.8021	32	1	17	35-34-20	114-40-57
2273	34837	0.0972	32	1	17.9	35-34-20	114-40-57
2273	34850	0.8646	32	1	21.9	35-34-19	114-40-57
2273	34852	0.1458	32	1	21.2	35-34-18	114-41-00
2273	34862	0.6424	32	1	22.8	35-34-23	114-40-57
2273	34864	0.6458	32	1	23.7	35-34-18	114-40-59
2273	34866	0.0938	32	1	21.7	35-34-20	114-40-58
2273	34879	0.2500	35	4	24.5	35-32-32	114-40-25
2273	34891	0.6563	35	2	27.8	35-32-06	114-40-22
2273	34892	0.6458	35	3	27.6	35-32-12	114-40-23
2273	34894	0.0868	35	3	26.9	35-32-27	114-40-23
2273	34905	0.7778	32	3	28.1	35-34-23	114-40-55
2273	34907	0.1354	32	2	26.9	35-34-19	114-40-55
2273	34919	0.6667	32	10	26.4	35-34-34	114-40-59
2273	34920	0.5625	32	10	24.3	35-34-36	114-41-03
2273	34921	0.0938	32	11	22.2	35-34-52	114-40-46
2273	34935	0.1215	32	11	21.2	35-34-49	114-40-36
2273	34948	0.5938	35	11	25.7	35-32-41	114-40-11
2273	34949	0.5938	33	10	18.3	35-34-19	114-39-44
2273	34950	0.2431	33	8	25	35-34-13	114-39-35
2273	34961	0.6667	32	6	25.8	35-34-35	114-39-44
2273	34963	0.1319	32	1	26.4	35-34-34	114-39-34
2273	34974	0.6285	35	11	17.3	35-32-07	114-39-18
2273	34975	0.6771	35	11	16.9	35-31-56	114-39-17
2273	34976	0.1111	35	2	22.7	35-32-34	114-39-09
2273	34988	0.8368	36	6	21.3	35-31-25	114-39-19
2273	34991	0.1076	36	3	20.7	35-31-37	114-39-10
2273	35003	0.6181	36	5	15.4	35-31-35	114-39-16
2273	35004	0.5972	35	11	15.3	35-32-01	114-39-18

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M			
				11=.100m			
2273	35016	0.9097	40	11	18.2	35-27-57	114-39-42
2273	35032	0.5625	41	11	16.4	35-27-43	114-38-53
2273	35044	0.7257	70	4	15.8	35-12-54	114-34-15
2273	35048	0.2604	70	4	15.5	35-12-55	114-34-15
2273	35088	0.6667	36	7	12.4	35-31-38	114-39-09
2273	35173	0.7083	39	10	12.90	35-28-48	114-40-08
2273	35185	0.7014	39	8	12.69	35-28-29	114-40-03
2273	35535	0.589583	5			35 56 17	114 43 22
2273	35598	0.520833	5				
2327	34661	0.5625	18	1		35-46-38	114-41-52
2327	34674	0.7569	16		13.1	35-48-23	114-42-41
2327	34676	0.3542	16	2	12.9	35-48-19	114-42-44
2327	34688	0.6806	16				
2327	34712	0.3056	16	3	12.7	35-48-17	114-42-52
2327	34724	0.6806	16				
2327	34737	0.7847	16	8	12.9	35-48-25	114-42-42
2327	34752	0.6042	16				
2327	34759	0.6806	16	2	13.1	35-48-20	114-42-49
2327	34768	0.4000	16	1	13.1	35-48-18	114-42-49
2327	34773	0.6118	16	2	13.6	35-48-20	114-42-48
2327	34779	0.6875	16	1	13.2	35-48-18	114-42-49
2327	34786	0.8542	16			35-48-22	114-42-45
2327	34793	0.6701	16	1	13.8	35-48-17	114-42-50
2327	34795	0.2813	16	1	13.1	35-48-18	114-42-50
2327	34821	0.6111	16	2	14.5	35-48-19	114-42-51
2327	34851	0.5486	16	1	14.7	35-48-18	114-42-48
2327	34852	0.3229	16	1	14.1	35-48-21	114-42-52
2327	34877	0.6181	16	1	15.1	35-48-16	114-42-48
2327	34905	0.6597	16	1	15.5	35-48-17	114-42-49
2327	34961	0.5729	16	2	15.5	35-48-19	114-42-48
2327	34989	0.5556	16	1	15	35-48-20	114-42-54
2327	35046	0.6424	16	1	14	35-48-17	114-42-49
2327	35088	0.5347	16	1	13.3	35-48-19	114-42-48
2354	34661	0.6042	31	1		35-35-17	114-39-18
2354	34662	0.6042	31	1		35-35-15	114-39-21
2354	34676	0.2500	31	9	12.9	35-35-15	114-39-21
2354	34687	0.6042	31	2	12.1	35-35-16	114-39-20
2354	34688	0.7389	31				
2354	34690	0.1125	31	2	11.9	35-35-16	114-39-24
2354	34709	0.9028	31	2	12.2	35-35-18	114-39-24
2354	34712	0.1806	31		12.2	35-35-16	114-39-20
2354	34724	0.7361	32				
2354	34737	0.8750	31	2	12.9	35-35-16	114-39-21
2354	34744	0.7153	31	2	13.3	35-35-19	114-39-22
2354	34752	0.6729	31				
2354	34759	0.7847	31	2	14.2	35-35-16	114-39-23
2354	34768	0.2931	31	1	13.7	35-35-17	114-39-24
2354	34773	0.7465	31	2	13.7	35-35-15	114-39-23
2354	34779	0.8021	31	1	15.1	35-35-17	114-39-21
2354	34793	0.7465	31	1	14	35-35-17	114-39-20

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M 11=.100m			
2354	34795	0.2222	31	1		35-35-17	114-39-20
2354	34821	0.7083	31	2	16.6	35-35-16	114-39-21
2354	34851	0.6840	31	1	16.4	35-35-20	114-39-24
2354	34852	0.1701	31	1	17.4	35-35-17	114-39-20
2354	34877	0.7431	31	1	19.1	35-35-17	114-39-23
2354	34905	0.7708	31	1	25.2	35-35-17	114-39-21
2354	34961	0.6493	31	1		35-35-17	114-39-22
2354	34989	0.6389	31	1	19.7	35-35-17	114-39-21
2354	35046	0.7083	31	1	14.1	35-35-17	114-39-22
2363	34660	0.6285	54	1		35-24-29	114-39-40
2363	34673	0.7083	55	11	12	35-24-27	114-39-16
2363	34677	0.2778	53	11	12.2	35-25-11	114-39-54
2363	34686	0.6458	54	11	11.4	35-24-43	114-39-31
2363	34688	0.3750	53				
2363	34689	0.1250	54	11	11.5	35-24-43	114-39-47
2363	34708	0.7500	54	11	11.4	35-24-46	114-39-46
2363	34711	0.3333	54	11	11.4	35-24-42	114-39-50
2363	34724	0.3750	54				
2363	34736	0.7639	54	11	11.7	35-24-45	114-39-50
2363	34745	0.3542	54	11	12.7	35-24-37	114-39-31
2363	34752	0.3382	54				
2363	34753	0.1181	54	11	12.6	35-24-47	114-39-44
2363	34758	0.7292	54	11	12.8	35-24-45	114-39-46
2363	34767	0.2694	54	11	13.3	35-24-40	114-39-44
2363	34772	0.5639	54	11	13.9	35-24-40	114-39-46
2363	34780	0.7153	54	11	14	35-24-39	114-39-42
2363	34792	0.7222	54	11	14.2	35-24-38	114-39-42
2363	34796	0.1667	54	11	14.3	35-24-35	114-39-44
2363	34801	0.6563	54	11	15	35-24-39	114-39-43
2363	34820	0.7535	54	11	14.8	35-24-39	114-39-46
2363	34824	0.2188	54	11	15.2	35-24-36	114-39-44
2363	34850	0.7604	54	11	15.6	35-24-41	114-39-39
2363	34853	0.2153	54	11	15.5	35-24-40	114-39-37
2363	34876	0.7083	54	11	16	35-24-39	114-39-41
2363	34904	0.7604	54	11	16.4	35-24-37	114-39-40
2363	34932	0.7535	54	11	16.8	35-24-38	114-39-40
2363	34960	0.7535	54	11	17	35-24-38	114-39-44
2363	34988	0.7361	54	11	16.3	35-24-39	114-39-44
2363	35016	0.8194	54	11	15.9	35-24-39	114-39-45
2363	35044	0.8021	54	11	14.6	35-24-40	114-39-45
2426	34660	0.6389	54	1		35-24-29	114-39-40
2435	34660	0.6771	66	1		35-17-36	114-35-12
2435	34662	0.4167	65			35-17-29	114-35-12
2435	34752	0.2917	66	2	13.4	35-17-13	114-35-10
2435	34758	0.6736	67	2	15.5	35-16-46	114-35-16
2435	34767	0.3389	66	2	14.3	35-16-48	114-35-16
2435	34772	0.4764	66	2	15.1	35-16-46	114-35-15
2435	34780	0.7535	66	2	15.5	35-16-48	114-35-15
2435	34792	0.6632	66	2	16.3	35-16-47	114-35-16
2435	34796	0.2222	66	2	16.2	35-16-47	114-35-15

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M			
				11=.100m			
2444	34660	0.7083	66	1		35-17-36	114-35-12
2444	34662	0.4167	65			35-17-29	114-35-12
2444	34711	0.4167	71	10	11	35-12-07	114-34-08
2444	34723	0.6319	71	10	11.1	35-12-05	144-34-07
2444	34725	0.1771	71				
2444	34736	0.6667	71	10	11.8	35-12-07	114-34-07
2444	34745	0.4167	71	10	12	35-12-29	114-33-58
2444	34752	0.2639	71				
2444	34758	0.6590	71	10	12.7	35-12-06	114-34-12
2444	34767	0.3625	71	8	13	35-12-08	114-34-05
2444	34772	0.4340	71	10	13.3	35-12-04	114-34-10
2444	34780	0.7743	71	10	13.7	35-12-09	114-34-08
2444	34787	0.5764	71			35-12-09	114-34-08
2444	34792	0.6424	71	10	15	35-12-07	114-34-08
2444	34796	0.2396	71	10	15	35-12-09	114-34-10
2444	34801	0.6076	71	10	15.1	35-12-08	114-34-07
2444	34820	0.6528	71	10	15	35-12-08	114-34-07
2444	34824	0.2951	71	10	15	35-12-08	114-34-09
2444	34850	0.6771	71	10	16	35-12-07	114-34-07
2444	34853	0.2743	71	10	16	35-12-08	114-34-10
2444	34876	0.6458	71	10	16.3	35-12-08	114-34-09
2444	34904	0.6597	71	10	16.5	35-12-08	114-34-12
2444	34932	0.6632	71	10	17.3	35-12-08	114-34-11
2444	34960	0.6563	71	10	17.3	35-12-07	114-34-10
2444	34988	0.6632	71	10	18.7	35-12-06	114-34-10
2444	35016	0.7257	71	10	16.4	35-12-06	114-34-11
2444	35044	0.7083	71	10	15.7	35-12-07	114-34-08
2444	35087	0.5243	71	10	12.1	35-12-08	114-34-11
2453	34661	0.4861	6	1		35-55-57	114-42-38
2453	34662	0.6875	6			35-55-51	114-42-34
2453	34688	0.6319	9				
2453	34709	0.6875	8	2	12.7	35-54-01	114-41-55
2453	34712	0.3681	9	1	12.5	35-54-00	114-41-59
2453	34724	0.6458	8				
2453	34737	0.7292	8	2	12.6	35-54-02	114-41-57
2453	34751	0.6528	8	1	12.9	35-54-25	114-41-37
2453	34752	0.5750	8				
2453	34754	0.1458	8	1	12.4	35-53-56	114-41-57
2453	34759	0.6319	8	1	12.9	35-54-02	114-41-58
2453	34768	0.4403	8	1	12.1	35-54-01	114-41-59
2453	34773	0.5514	8	1	13	35-54-04	114-41-51
2453	34779	0.6493	8	1	12.6	35-54-00	114-41-58
2453	34786	0.8056	8			35-54-02	114-41-53
2453	34793	0.6319	8	2	13.1	35-54-00	114-42-00
2453	34795	0.3160	8	1	12.6	35-54-03	114-41-59
2453	34821	0.5521	8	1	13.2	35-54-02	114-41-59
2453	34851	0.5000	8	1	13.6	35-54-02	114-41-57
2453	34852	0.3611	8	1	13.4	35-54-01	114-41-59
2453	34877	0.5833	8	1	14.1	35-54-03	114-42-00
2453	34905	0.6181	8	1	14.4	35-54-03	114-42-01

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M 11=.100m			
2453	34961	0.5278	8	1	14.5	35-54-01	114-41-59
2453	34989	0.5104	8	1	14.5	35-54-02	114-42-00
2525	34660	0.6944	66	1		35-17-36	114-35-12
2525	34662	0.4167	65			35-17-29	114-35-12
2534	34661	0.5694	18	1		35-46-38	114-41-52
2534	34662	0.6528	18			35-46-39	114-42-05
2534	34662	0.7500	18				
2534	34674	0.7667	18		13.2	35-46-32	114-42-01
2534	34688	0.6875	18				
2534	34709	0.7639	18	9	12.5	35-46-35	114-41-56
2534	34712	0.2986	18	11	12.6	35-46-29	114-41-59
2534	34722	0.6181	18	10	12.3	35-46-34	114-42-00
2534	34724	0.6875	18	10			
2534	34726	0.1319	18	4	12.5	35-46-31	114-42-03
2534	34737	0.7917	18	6	13.3	35-46-34	114-41-59
2534	34752	0.6111	18	5			
2534	34759	0.6944	18	4	12.8	35-46-31	114-42-07
2534	34768	0.3903	18	6	12.7	35-46-30	114-42-06
2534	34773	0.6319	18		12.9	35-46-28	114-42-05
2534	34779	0.6944	18	9	13	35-46-31	114-42-07
2534	34786	0.8819	18			35-46-31	114-42-07
2534	34793	0.6840	18	5	13	35-46-28	114-42-04
2534	34795	0.2708	18	5	13.1	35-46-35	114-42-00
2534	34821	0.6319	18	5	13.9	35-46-30	114-42-04
2534	34851	0.5625	18	4	13.9	35-46-28	114-42-06
2534	34852	0.3056	18	5	13.9	35-46-28	114-42-06
2534	34877	0.6285	18	8	14.4	35-46-30	114-42-04
2534	34905	0.6701	18	8	14.7	35-46-29	114-42-03
2534	34961	0.5833	18	8	14.8	35-46-28	114-42-03
2534	34989	0.5660	18	8	14.5	35-46-29	114-42-04
2534	35046	0.6563	18	6	13.7	35-46-26	114-42-04
2543	34661	0.6042	31	1		35-35-17	114-39-18
2543	34674	0.8472	30	1	13.1	35-35-51	114-39-27
2543	34709	0.8958	30	11	12.1	35-35-33	114-39-23
2543	34712	0.1944	31	11	12.1	35-35-36	114-39-26
2543	34724	0.7396	30				
2543	34737	0.8750	30	11	12.3	35-35-33	114-39-25
2543	34752	0.6667	30				
2543	34759	0.7778	31	11	13.4	35-35-33	114-39-25
2543	34768	0.3153	31	11	13.2	35-35-37	114-39-24
2543	34773	0.7431	31		13	35-35-31	114-39-22
2543	34779	0.7917	30	11	13.9	35-35-36	114-39-20
2543	34786	0.9722	30			35-35-31	114-39-28
2543	34793	0.7396	30	11	13.4	35-35-39	114-39-25
2543	34795	0.2257	30	11	13.7	35-35-38	114-39-19
2543	34821	0.7049	30	11	14.5	35-35-35	114-39-20
2543	34851	0.6701	30	11	14.9	35-35-35	114-39-27
2543	34852	0.1771	30	11	14.9	35-35-37	114-39-22
2543	34877	0.7396	30	11	15.2	35-35-36	114-39-25
2543	34905	0.7569	30	11	16.7	35-35-34	114-39-22

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M			
				11=.100m			
2543	34961	0.6458	30	11	16.4	35-35-34	114-39-23
2543	34989	0.6354	30	11	15.4	35-35-35	114-39-24
2543	35046	0.7083	30	11	14.3	35-35-35	114-39-24
2633	34661	0.5069	6	1		35-55-57	114-42-38
2633	34662	0.6944	6				
2633	34676	0.3819	13	1	13.1	35-51-11	114-42-09
2633	34688	0.6667	13				
2633	34712	0.3264	13	2	12.6	35-51-10	114-42-08
2633	34737	0.7639	13	3	12.8	35-51-12	114-42-08
2633	34752	0.5972	13				
2633	34759	0.6667	13	2	12.9	35-51-14	114-42-09
2633	34768	0.4167	13	1	12.6	35-51-14	114-42-10
2633	34773	0.5903	13	2	13.4	35-51-08	114-42-10
2633	34779	0.6736	13	1	12.8	35-51-11	114-42-09
2633	34793	0.6563	13	1	14.6	35-51-12	114-42-12
2633	34795	0.2951	13	1	12.9	35-51-13	114-42-09
2633	34821	0.5903	13	2	14.5	35-51-15	114-42-12
2633	34851	0.5347	13	1	14.6	35-51-11	114-42-11
2633	34852	0.3368	13	1	13	35-51-12	114-42-09
2633	34864	0.4931	13	1	14.8	35-51-13	114-42-09
2633	34877	0.6076	13	1	14.9	35-51-13	114-42-12
2633	34905	0.6424	13	1	15.6	35-51-13	114-42-12
2633	34961	0.5625	13	2	16.3	35-51-13	114-42-10
2633	34989	0.5417	13	2	17	35-51-12	114-42-11
2633	35046	0.6285	13	1	16.3	35-51-13	114-42-11
2633	35088	0.5243	13	2	16.5	35-51-13	114-42-10
3335	34661	0.5903	18	1		35-46-38	114-41-52
3335	34662	0.7500	18				
3335	34674	0.7917	22	9		35-42-26	114-41-58
3335	34676	0.3215	23	2	12.9	35-42-21	114-41-56
3335	34688	0.7014	22				
3335	34709	0.8056	23	2	12.4	35-42-20	114-41-52
3335	34712	0.2639	23	2	12.4	35-42-17	114-41-55
3335	34724	0.7014	22				
3335	34737	0.8194	23	2	13	35-42-13	114-41-55
3335	34752	0.6319	23				
3335	34759	0.7222	22	1	13.5	35-42-16	114-41-57
3335	34768	0.3604	23	2	13.3	35-42-19	114-41-58
3335	34773	0.6736	22	2	13.2	35-42-17	114-41-57
3335	34779	0.7153	22	1	14.1	35-42-18	114-41-58
3335	34786	0.9028	22			35-42-01	114-41-45
3335	34793	0.7014	22	1	13.6	35-42-19	114-41-58
3335	34795	0.2569	23	1	13.5	35-42-18	114-41-57
3335	34821	0.6493	22	1	14.7	35-42-19	114-41-59
3335	34851	0.6181	23	1	14.7	35-42-21	114-41-58
3335	34852	0.2396	23	1	14.6	35-42-19	114-41-58
3335	34877	0.6806	22	1	15.2	35-42-19	114-42-00
3335	34905	0.7118	23	1		35-42-18	114-41-57
3335	34961	0.6042	22	1	17.9	35-42-20	114-41-57
3335	34989	0.5833	23	1	15.7	35-42-19	114-41-58

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M			
				11=.100m			
3335	35046	0.6771	23	1	14.2	35-42-18	114-41-58
3344	34661	0.5139	6	1		35-55-57	114-42-38
3344	34662	0.6979	7		13		
3344	34674	0.7083	10		13.4	35-52-51	144-40-28
3344	34676	0.4167	10	1	13.4	35-52-44	114-40-19
3344	34688	0.6389	10	10			
3344	34709	0.7083	10	3	12.8	35-52-46	114-40-20
3344	34712	0.3542	10	10	12.5	35-52-46	114-40-23
3344	34724	0.6528	10				
3344	34737	0.7431	10	3	12.6	35-52-48	114-40-19
3344	34751	0.6590	10	1	12.6	35-52-46	114-40-21
3344	34752	0.5799	10				
3344	34754	0.1556	10	1	12.7	35-52-47	114-40-34
3344	34759	0.6389	10	1	12.7	35-52-46	114-40-22
3344	34768	0.4313	10	2	12.5	35-52-46	114-40-22
3344	34773	0.5660	10	2	12.9	35-52-47	114-40-22
3344	34779	0.6563	10	2	12.7	35-52-44	114-40-26
3344	34786	0.8194	10			35-52-39	114-40-14
3344	34793	0.6424	10	2	13	35-52-47	114-40-23
3344	34795	0.3090	10	1	12.6	35-52-47	114-40-23
3344	34821	0.5729	10	1	13.3	35-52-46	114-40-24
3344	34851	0.5069	10	1	13.5	35-52-44	114-40-20
3344	34852	0.3576	10	1	13.5	35-52-46	114-40-24
3344	34877	0.5903	10	1	13.8	35-52-47	114-40-23
3344	34905	0.6285	10	1	14.1	35-52-46	114-40-22
3344	34961	0.5347	10	2	13.1	35-52-47	114-40-22
3344	34989	0.5174	10	2	14.1	35-52-47	114-40-24
3434	34660	0.5972	54	1		35-24-29	114-39-40
3434	34662	0.3681	54	10			
3434	34673	0.7083	55	11	12.1	35-24-27	114-39-16
3434	34677	0.2917	54	11	12	35-34-20	114-39-17
3434	34686	0.6556	54	11	11.5	35-24-28	114-39-16
3434	34689	0.1181	54	11	11.6	35-24-21	114-39-11
3434	34708	0.7292	55	11	11.4	35-24-24	114-39-21
3434	34711	0.3403	54	11	11.4	35-24-26	114-39-20
3434	34724	0.3542	55				
3434	34736	0.7528	55	11	11.6	35-24-29	114-39-18
3434	34745	0.3542	54	11	12.6	35-24-22	114-39-19
3434	34752	0.3382	54				
3434	34753	0.1111	54	11	12.7	35-24-35	114-39-21
3434	34758	0.7222	54	11	12.8	35-24-27	114-39-16
3434	34767	0.2778	54	11	13.3	35-24-26	114-39-17
3434	34772	0.5618	54	11	13.8	35-24-16	114-39-18
3434	34780	0.7188	54	11	13.9	35-24-24	114-39-20
3434	34792	0.7153	54	11	14	35-24-36	114-39-24
3434	34796	0.1736	54	11	14.3	35-24-24	114-39-20
3434	34801	0.6528	54	11	15.1	35-24-21	114-39-23
3434	34820	0.7500	54	11	14.8	35-24-23	114-39-19
3434	34850	0.7569	54	11	15.5	35-24-24	114-39-26
3434	34853	0.2153	54	11	15.4	35-24-24	114-39-24

LAKE MOHAVE RAZORBACK SUCKER TELEMETRY STUDY Nov 1994 to July 1997							
Fish ID#	DATE	TIME	WP	SHORE	TEMP C	LAT.	LONG.
	(JULIAN)	(24-hr)		1-10=X10M			
				11=.100m			
3434	34876	0.7083	54	11	16.2	35-24-27	114-39-20
3434	34904	0.7500	54	11	16.6	35-24-24	114-39-16
3434	34932	0.7465	54	11	17.1	35-24-24	114-39-16
3434	34960	0.7431	54	11	17.1	35-24-25	114-39-16
3434	34988	0.7292	54	11	16.3	35-24-24	114-39-16
3434	35016	0.8160	54	11	15.9	35-24-24	114-39-16
3434	35044	0.7917	54	11	14.5	35-24-25	114-39-17

Juvenile Razorback Suckers (YOY) Released in Lake Mohave With External Transmitters

Fish #	Location	Location	Dist/m	Julian Day	Time	Julian Day	Time	# Days	m/day	Total meter
2	1	2	1741	34997	0.0521	34998	0.0764	1	1741	1741
2	2	3	1237	34998	0.0764	34999	0.2986	1	1237	2978
2	3	4	644	34999	0.2986	35002	0.6146	3	215	3622
2	4	5	2462	35002	0.6146	35004	0.566	2	1231	6084
2	5	6	82	35004	0.566	35005	0.1007	1	82	6166
2	6	7	25	35005	0.1007	35011	0.0694	6	4	6191
2	7	8	2925	35011	0.0694	35016	0.875	5	585	9116
2	8	9	3283	35016	0.875	35031	0.5451	15	219	12399
2	9	10	80	35031	0.5451	35032	0.566	1	80	12479
2	10	11	76	35032	0.566	35033	0.1146	1	76	12555
2	11	12	40	35033	0.1146	35038	0.6736	5	8	12595
2	12	13	59	35038	0.6736	35044	0.8646	6	10	12654
2	13	14	31	35044	0.8646	35048	0.1354	4	8	12685
2	14	15	0	35048	0.1354	35087	0.6771	39	0	12685
7	1	2	312	34997	0.0521	34998	0.5868	1	312	312
7	2	3	295	34998	0.5868	34999	0.2708	1	295	607
7	3	4	967	34999	0.2708	35002	0.6528	3	322	1574
7	4	5	229	35002	0.6528	35004	0.4792	2	115	1803
7	5	6	1211	35004	0.4792	35005	0.1146	1	1211	3014
7	6	7	222	35005	0.1146	35011	0.1007	6	37	3236
7	7	8	8665	35011	0.1007	35016	0.9479	5	1733	11901
7	8	9	40	35016	0.9479	35030	0.6319	14	3	11941
7	9	10	25	35030	0.6319	35032	0.5347	2	13	11966
7	10	11	50	35032	0.5347	35033	0.125	1	50	12016
7	11	12	40	35033	0.125	35038	0.6632	5	8	12056
7	12	13	67	35038	0.6632	35046	0.7917	8	8	12123
7	13	14	40	35046	0.7917	35047	0.1007	1	40	12163
7	14	15	40	35047	0.1007	35074	0.7188	27	1	12203
7	15	16	40	35074	0.7188	35087	0.7118	13	3	12243
13	1	2	1193	34997	0.0729	34998	0.0694	1	1193	1193
13	2	3	830	34998	0.0694	34999	0.2847	1	830	2023
67	1	2	659	34996	0.5972	34997	0.0903	1	659	659
67	2	3	1599	34997	0.0903	34998	0.1146	1	1599	2258

Juvenile Razorback Suckers (YOY) Released in Lake Mohave With External Transmitters

Fish #	Location	Location	Dist/m	Julian Day	Time	Julian Day	Time	# Days	m/day	Total meter
67	3	4	3750	34998	0.1146	34999	0.2778	1	3750	6008
67	4	5	3066	34999	0.2778	35004	0.4861	5	613	9074
67	5	6	742	35004	0.4861	35011	0.0903	7	106	9816
67	6	7	5015	35011	0.0903	35016	0.7917	5	1003	14831
67	7	8	234	35016	0.7917	35032	0.6667	16	15	15065
67	8	9	67	35032	0.6667	35038	0.6875	6	11	15132
67	9	10	40	35038	0.6875	35044	0.7743	6	7	15172
67	10	11	59	35044	0.7743	35048	0.2153	4	15	15231
67	11	12	62	35048	0.2153	35075	0.4757	27	2	15293
70	1	2	151	34996	0.5972	34997	0.0799	1	151	151
70	2	3	3541	34997	0.0799	34998	0.1042	1	3541	3692
70	3	4	1762	34998	0.1042	34999	0.316	1	1762	5454
70	4	5	3906	34999	0.316	35004	0.4167	5	781	9360
70	5	6	0	35004	0.4167	35011	0.1528	7	0	9360
70	6	7	40	35011	0.1528	35016	0.7708	5	8	9400
70	7	8	25	35016	0.7708	35032	0.6806	16	2	9425
70	8	9	145	35032	0.6806	35038	0.6979	6	24	9570
70	9	10	120	35038	0.6979	35044	0.7569	6	20	9690
70	10	11	67	35044	0.7569	35048	0.2292	4	17	9757
70	11	12	31	35048	0.2292	35075	0.4549	27	1	9788

Appendix C. Temperature and Depth Data

Temperature Data --Lake Mohave -- 1995

Date 34823
 Fish # 348
 Waypoint 32
 Depth (m) Temp (C)
 0 19.5
 1 19.5
 3 19.2
 5 18.1
 7 17.8
 9 17.5

Date 34823
 Fish # 88
 Waypoint 29
 Depth (m) Temp (C)
 0 18.6
 1 18.6
 3 18.5
 5 17.3
 7 16.8
 9 16.2
 11 15.9
 13 15.1
 15 15

Date 34836
 Fish # 375
 Waypoint 25
 Depth (m) Temp (C)
 0 17.2
 1 17
 3 15.9
 5 15.5
 7 15.1
 9 14.7
 11 14.4
 13 14.4
 15 14.4

Date 34836
 Fish # 2228
 Waypoint 29
 Depth (m) Temp (C)
 0 18.7
 1 18.7
 3 18.4
 5 18
 7 17.7
 9 17.2
 11 16.1
 13 15.7
 15 14.6
 17 14.6

Date 34823
 Fish # 366
 Waypoint 32
 Depth (m) Temp (C)
 0 19.5
 1 19.5
 3 19.1

Date 34823
 Fish # 339
 Waypoint 29
 Depth (m) Temp (C)
 0 18.2
 1 18.3
 3 18.2
 5 17.6
 7 17
 9 16.1
 11 15.3

Date 34823
 Fish # 276
 Waypoint 25
 Depth (m) Temp (C)
 0 17.1
 1 17.1
 3 16.9
 5 15.8
 7 15.1
 9 14.6
 11 14.5
 13 14.4

Date 34836
 Fish # 339
 Waypoint 26
 Depth (m) Temp (C)
 0 18.1
 1 17.7
 3 17
 5 16.7
 7 16.5
 9 15.6
 11 14.9
 13 14.8
 15 14.6
 17 14.4

Date 34836
 Fish # 348
 Waypoint 30
 Depth (m) Temp (C)
 0 18.7

Date=Julian
 Date 34823
 Fish # 258
 Waypoint 32
 Depth (m) Temp (C)
 0 18.8
 1 18.9
 3 18.5
 5 17.7
 7 17.1
 9 16.8
 11 16.2
 13 15.5

Date 34823
 Fish # 2228
 Waypoint 27
 Depth (m) Temp (C)
 0 18.1
 1 18.1
 3 16.7
 5 16.5

Date 34836
 Fish # 276
 Waypoint 24
 Depth (m) Temp (C)
 0 16.7
 1 16.5
 3 15.8
 5 15.6
 7 15.6
 9 15.2
 11 15
 13 14.7
 15 14.4

Date 34836
 Fish # 88
 Waypoint 27
 Depth (m) Temp (C)
 0 19
 1 18.6
 3 17.4
 5 17
 7 16.8
 9 16.4
 11 14.5

Date 34836
 Fish # 2273
 Waypoint 33
 Depth (m) Temp (C)
 0 17.6

Temperature Data --Lake Mohave -- 1995

Date	34836	1	18.7
Fish #	366	3	18.5
Waypoint	32	5	18.2
Depth (m)	Temp (C)	7	18
0	18.8	9	17
1	18.2	11	15.8
3	17.9	13	15.3
		15	15
		17	14.8

Date	34851
Fish #	348
Waypoint	22
Depth (m)	Temp (C)
0	19.2
1	19
3	18.2
5	17.6
7	14.6
9	14.5

Date	34852
Fish #	2228
Waypoint	22
Depth (m)	Temp (C)
0	18.2
1	18.2
3	17.5
5	16.9
7	15
9	14.5

Date	34852
Fish #	339
Waypoint	20
Depth (m)	Temp (C)
0	17.5
1	17.5
3	17.4
5	15
7	14.2
9	14.2
11	14.2

Date	34864
Fish #	339
Waypoint	20
Depth (m)	Temp (C)
0	19.3
1	19.2
3	18.7
5	17.4
7	15.5
9	15.06

Date	34851
Fish #	366-285
Waypoint	33
Depth (m)	Temp (C)
0	22.1
1	22.1
3	22.1
5	21.7
7	21.5
9	21
11	16.5
13	15.6

Date	34852
Fish #	348
Waypoint	21
Depth (m)	Temp (C)
0	17.7
1	17.6
3	17.3
5	14.8

Date	34853
Fish #	465
Waypoint	49
Depth (m)	Temp (C)
0	21.5
1	21.5
3	21.5
5	21.2

Date	34862
Fish #	2273
Waypoint	33
Depth (m)	Temp (C)
0	23
1	23
3	23
Date	34864
Fish #	2228
Waypoint	21
Depth (m)	Temp (C)

Date=Julian	1	17.6
	3	17.6

Date	34850
Fish #	2273
Waypoint	33
Depth (m)	Temp (C)
0	21.6
1	21.6
3	20.8

Date	34851
Fish #	2273
Waypoint	33
Depth (m)	Temp (C)
0	21.5
1	21.5

Date	34852
Fish #	88
Waypoint	23
Depth (m)	Temp (C)
0	18.6
1	18.5
3	17.8
5	17
7	16.4
9	15
11	14.6

Date	34852
Fish #	276
Waypoint	21
Depth (m)	Temp (C)
0	17.7
1	17.4
3	16.2
5	14.3
7	14.2
9	14.2
11	14.2

Date	34863
Fish #	88
Waypoint	23
Depth (m)	Temp (C)
0	20.5
1	20.4
3	19.6
5	19.2
7	17.4
9	16.6

Temperature Data --Lake Mohave -- 1995

Date	34879	1	24.6
Fish #	348-339	3	24.4
Waypoint	22	5	22.2
Depth (m)	Temp (C)	7	15.9
0	24.5	9	15.1
1	24.5	11	15
3	24.3		
5	17.2		
7	15.6		
9	15.4		
11	14.9		
13	14.9		

Date	34892
Fish #	339
Waypoint	17
Depth (m)	Temp (C)
0	20.4
1	21.3
3	21
5	19.1
7	17.6
9	16.7
11	15.8
13	15.5
15	15.3

Date	34892
Fish #	2273
Waypoint	35
Depth (m)	Temp (C)
0	27.3
1	27.3
3	27.3
5	27.3

Date	34892
Fish #	465
Waypoint	53
Depth (m)	Temp (C)
0	26.6
1	26.6
3	26.7
5	26.6
7	26.6
9	26.6
11	24.5
13	20.5
15	18.8
17	17.5

Date	34905
Fish #	2228

Date	34891
Fish #	2273
Waypoint	34
Depth (m)	Temp (C)
0	27.8
1	27.8
3	27.8

Date	34892
Fish #	348
Waypoint	23
Depth (m)	Temp (C)
0	26.5
1	26.5
3	26.5
5	26.1
7	26.1

Date	34892
Fish #	375
Waypoint	33
Depth (m)	Temp (C)
0	27.1
1	27.1
3	27.1
5	27
7	27
9	26.6
11	20.5
13	19.2
15	18.2
17	17.8

Date	34893
Fish #	348
Waypoint	?
Depth (m)	Temp (C)
0	25.4
1	25.4
3	25.4
5	25.3
7	24.1
9	19.2
11	18

Date	34904
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Date=Julian

Date	34880
Fish #	465
Waypoint	63
Depth (m)	Temp (C)
0	24.3
1	24.4
3	24.4
5	24.4
7	24.4
9	24.3
11	24.2
13	20.7
15	18.4

Date	34892
Fish #	384
Waypoint	32
Depth (m)	Temp (C)
0	27.5
1	27.5
3	27.5
5	27.4
7	27.4
9	27.2
11	22.5

Date	34892
Fish #	88
Waypoint	37
Depth (m)	Temp (C)
0	28
1	28
3	27.9
5	27.7
7	27.6
9	27.5

Date	34893
Fish #	2273
Waypoint	34
Depth (m)	Temp (C)
0	26.7
1	26.7
3	26.7

Date	34904
Fish #	375
Waypoint	53
Depth (m)	Temp (C)
0	27.9
1	28.5
3	27.7

Temperature Data --Lake Mohave -- 1995

Waypoint 19
 Depth (m) Temp (C)
 0 24.9
 1 23.3
 3 21
 5 18.2
 7 17.6
 9 17.2

Date 34905
 Fish # 339
 Waypoint 20
 Depth (m) Temp (C)
 0 26.9
 1 26.9
 3 25.2
 5 20.7
 7 19.3

Date 34907
 Fish # 88
 Waypoint 36
 Depth (m) Temp (C)
 0 28
 1 27.9
 3 27.9
 5 27.8
 7 27.7
 9 27.6
 11 22.7
 13 20
 15 18.4
 17 17.8
 19 17.4
 21 17

Date 34907
 Fish # 366
 Waypoint 25
 Depth (m) Temp (C)
 0 27.2
 1 27.3
 3 27.3
 5 27.3
 7 24

Date 34908
 Fish # 88
 Waypoint 40
 Depth (m) Temp (C)
 0 29.4
 1 29.4
 3 28.2

Fish # 465
 Waypoint 46
 Depth (m) Temp (C)
 0 27.7
 1 27.8
 3 27.8
 5 27.7
 7 27.6
 9 26.6
 11 25.1
 13 20
 15 18.4

Date 34905
 Fish # 88
 Waypoint 35
 Depth (m) Temp (C)
 0 27.7
 1 27.7
 3 27.7
 5 27.7
 7 27.6
 9 27.6
 11 21.4
 13 19
 15 17.7
 17 17.4
 19 17.1

Date 34907
 Fish # 2273
 Waypoint 32
 Depth (m) Temp (C)
 0 27.6
 1 27.6
 3 27.5

Date 34907
 Fish # 348
 Waypoint 23
 Depth (m) Temp (C)
 0 26.9
 1 26.9
 3 26.9
 5 26.9
 7 21.3
 8 18

Date 34908
 Fish # 276
 Waypoint 46
 Depth (m) Temp (C)
 0 27.9

Date=Julian

5 27.7
 7 27.6
 9 26.8
 11 26.2
 13 20.1
 15 18.7
 17 18.2
 19 17.8
 21 17.7
 23 17.6

Date 34905
 Fish # 348
 Waypoint 22
 Depth (m) Temp (C)
 0 27.6
 1 27.6
 3 27.4
 5 27.3
 7 25

Date 34907
 Fish # 384
 Waypoint 32
 Depth (m) Temp (C)
 0 28
 1 28
 3 28
 5 28
 7 27.6
 9 24.7
 11 19.4
 13 18.2
 15 18
 17 17.8

Date 34907
 Fish # 339
 Waypoint 20
 Depth (m) Temp (C)
 0 26.3
 1 26.4
 3 26.3
 5 25.2
 7 16.1
 9 15.2
 11 14.8
 13 14.8
 15 14.7
 17 14.7

Date 34908
 Fish # 375

Temperature Data --Lake Mohave -- 1995

5 28
7 27.9
9 25.4
11 19.9
13 19
15 18.3
17 18
19 17.8
21 17.8
23 17.8
25 17.4

Date 34920
Fish # 2228
Waypoint 14
Depth (m) Temp (C)
0 15.4
1 15.2
3 14.3
5 14.2

Date 34920
Fish # 348
Waypoint 22
Depth (m) Temp (C)
0 28.8
1 28.7
3 28.7
5 28.1
7 17.3
9 15.7

Date 34920
Fish # 465
Waypoint 46
Depth (m) Temp (C)
0 29.7
1 29.7
3 29.7
5 29.7
7 29.6
9 22
11 18.9
13 17.8

Date 34920
Fish # 2273
Waypoint 32
Depth (m) Temp (C)
0 29.3
1 29.3
3 29.3
5 29.3

1 27.9
3 27.9
5 27.9
7 27.8
9 24.3
11 20

Date 34908
Fish # 2273
Waypoint 32
Depth (m) Temp (C)
0 29.4
1 29.4
3 29.4
5 29.4
7 28.4
9 22.6

Date 34920
Fish # 339
Waypoint 23
Depth (m) Temp (C)
0 29
1 29
3 28.9
5 27.4
7 19

Date 34920
Fish # 384
Waypoint 46
Depth (m) Temp (C)
0 29.8
1 29.8
3 29.8
5 29.8
7 29.7
9 24.8
11 19.5
13 18.3

Date 34920
Fish # 375-276
Waypoint 53
Depth (m) Temp (C)
0 29.6
1 29.6
3 29.6
5 29.6
7 29.6
9 22.2
11 19.1
13 17.9

Date=Julian

Waypoint 46
Depth (m) Temp (C)
0 27.7
1 27.7
3 27.7
5 27.7
7 27.7
9 22.42
11 20
13 18.6
15 18.3
17 18.2
19 17.9
21 17.7
23 17.4
25 17.3

Date 34920
Fish # 2273
Waypoint 32
Depth (m) Temp (C)
0 29.4
1 29.4
3 29.4
5 29.4
7 29.3

Date 34920
Fish # 88
Waypoint 35
Depth (m) Temp (C)
0 29.3
1 29.3
3 29.3
5 29.2
7 29.1
9 22.2
11 19
13 17.7
15 17.2
17 17.1
19 16.7

Date 34922
Fish # 276
Waypoint ?
Depth (m) Temp (C)
0 29.2
1 29.2
3 29.2
5 29.2
7 29.2
9 22.1

Temperature Data --Lake Mohave -- 1995

7 29.2

Date 34932
Fish # 384
Waypoint 53

Depth (m)	Temp (C)
0	28.9
1	28.9
3	28.5
5	28.1
7	28
9	22.7
11	19.3
13	18.3
15	18.1
17	18
19	17.7
21	17.5
23	17.3

Date 34934
Fish # 2228
Waypoint 12

Depth (m)	Temp (C)
0	14.1
15	14.1

Date 34934
Fish # 88
Waypoint 35

Depth (m)	Temp (C)
0	29.3
1	29.3
3	29.2
5	28.9
7	25.9
9	22.5
11	20.3
13	18.5
15	17.5
17	16.6
19	16.4

Date 34935
Fish # 2228
Waypoint 12

Depth (m)	Temp (C)
0	14.1
9	13.9

Date 34936
Fish # 384
Waypoint 46

15 17.6
17 17.4
19 17.2
21 17.1

Date 34932
Fish # 465
Waypoint 53

Depth (m)	Temp (C)
0	29.9
1	29
3	28.2
5	28.1
7	28

Date 34932
Fish # 375
Waypoint 46

Depth (m)	Temp (C)
0	29.8
1	29.8
3	28.4
5	28.1
7	28
9	23.3
11	19.5
13	18.5

Date 34935
Fish # 2273
Waypoint 32

Depth (m)	Temp (C)
0	29.1
1	29.1
3	29.1
5	28.3
7	26.7
9	22.8
11	17.2
13	16.9

Date 34935
Fish # 339
Waypoint 10

Depth (m)	Temp (C)
0	13.9
9	13.8

Date 34936
Fish # 465
Waypoint 46

Depth (m)	Temp (C)
0	28.1

Date=Julian

11 20
13 18.1
15 17.9
17 17.8
19 17.7
21 17.5

Date 34932
Fish # 276
Waypoint 46

Depth (m)	Temp (C)
0	29.3
1	29.3
3	28.4
5	28.1
7	28
9	23.3
11	19.1
13	18.2
15	18.2
17	18

Date 34934
Fish # 339
Waypoint 17

Depth (m)	Temp (C)
0	14.3
15	14.3

Date 34935
Fish # 88
Waypoint 36

Depth (m)	Temp (C)
0	28.9
1	28.9
3	28.9
5	28.8
7	28.5
9	23.1
11	19.9
13	18.3
15	17.5

Date 34936
Fish # 375-276
Waypoint 46

Depth (m)	Temp (C)
0	28.2
1	28.2
3	28.2
5	28.1
7	27.9
9	26.6

Temperature Data --Lake Mohave -- 1995

Depth (m)	Temp (C)		
0	28	1	28.2
1	28.1	3	28.1
3	28.1	5	28.1
5	28.1	7	28
7	28	9	26.4
9	26.4	11	19.9
		13	18.5
		15	18.4

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34948	2273	35	0	28.5
			1	28.6
			3	28.6
			5	28.5
			7	28.4

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34949	339	5	0	14.1
			9	14

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34949	2273	33	0	28.9
			1	28.9
			3	28.9
			5	28.9
			7	27.8
			9	20.2
			11	18.6
			13	18.3
			15	18

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34949	384	46	0	29.2
			1	29.2
			3	29.2
			5	29.2
			7	28
			9	23.7
			11	19.5
			13	19
			15	18.7

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34936	375	46	0	29.6
			1	29.6
			3	29.5
			5	29.4
			7	29.4
			9	29.4
			11	19.8
			13	19.4

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34949	2228	12	0	14.2
			11	13.9

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34949	88	35	0	28.8
			1	28.8
			3	28.8
			5	28.8
			7	28.7
			9	22.1
			11	19.5
			13	18.8
			15	18.2
			17	17.8
			19	16.8

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34949	375	53	0	29.2
			1	29.2
			3	29.2
			5	29.2

Date=Julian	Temp (C)
11	20.1
13	18.9
15	17.8

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34936	258	46	0	28.1
			1	28.2
			3	28.2
			5	28.2
			7	28.1
			9	26.1
			11	21
			13	18.7
			15	18
			17	17.8
			19	17.8
			21	17.7
			23	17.3

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34949	348	22	0	28.6
			1	28.6
			3	28.4
			5	28.2
			7	26
			9	17

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34949	276	45	0	29.2
			1	29.2
			3	29.2
			5	29.2
			7	29
			9	25.2
			11	20.3
			13	19
			15	18.2
			17	17.7
			19	17.5

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34949	465	54	0	29.2
			1	29.2
			3	29.2
			5	29.2

Temperature Data --Lake Mohave -- 1995

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34949	2273	32	0	28.6
			1	28.6
			3	28.6
			5	28.6
			7	28.2
			9	22.5
			7	24.8
			9	21.6
			11	20.4
			13	19.2
			15	18.2
			17	17.6
			19	17.4
			21	17.3
			23	17.2

Date=Julian	Temp (C)
0	29.2
1	29.2
3	29.2
5	29.2
7	26.3
9	21.6
11	19.7
13	18.7
15	18.3
17	17.9
19	17.6
21	17.4
23	17.3
25	17

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34960	276-258	46	0	28
			1	28.1
			3	28.1
			5	27.9
			7	27.7
			9	20.7
			11	19.3
			13	18
			15	17.7
			17	17.5
			19	17.4
			21	17.3
			23	17.2

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34960	375-465	53	0	28.4
			1	28.4
			3	28.3
			5	28
			7	27.8
			9	21.2
			11	18.8
			13	18.3
			15	18
			17	17.6
			19	17.5

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34961	2228	12	0	14.3
			11	14.2

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34961	366	23	0	26.7
			1	26.7
			3	26.4
			5	26.2
			7	23.1
			9	16.9
			11	16.6

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34961	88	35	0	27.7
			1	27.6
			3	27.4
			5	27.1
			7	26.9
			9	24.6
			11	19.6
			13	18.5
			15	16.8
			17	16.6
			19	16.5
			21	16.4

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34961	2273	33	0	27.2
			1	27.2
			3	27.1
			5	26.8
			7	26.1
			9	20.5

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34963	2273	33	0	26.5
			1	26.5
			3	26.5

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34963	348	30	0	26.5
			1	26.6
			3	25.5
			5	26.6
			7	26.4
			9	21.1
			11	18.7
			13	17.2
			15	16.7

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34963	366	23	0	25.8
			1	25.8
			3	25.8
			5	25.4
			7	22.8
			9	16.2

Date	Fish #	Waypoint	Depth (m)	Temp (C)
34963	2228	12	0	14.1
			9	14

Date	Fish #
34964	375

Temperature Data --Lake Mohave -- 1995

Date 34963 Waypoint 46
 Fish # 339 Depth (m) Temp (C)
 Waypoint 3
 Depth (m) Temp (C)
 0 13.3
 3 13.3

Date 34964 Waypoint 46
 Fish # 258
 Waypoint 46
 Depth (m) Temp (C)
 0 26.3
 1 26.4
 3 26.4
 5 26.4
 7 25.8
 9 23.4
 11 21.9
 13 19.1
 15 18.1

Date 34975 Waypoint 12
 Fish # 2228
 Waypoint 12
 Depth (m) Temp (C)
 0 14.2
 7 14.1

Date 34975 Waypoint 23
 Fish # 339
 Waypoint 23
 Depth (m) Temp (C)
 0 22.6
 1 21.8
 3 21.3
 5 19.1

Date 34975 Waypoint 53
 Fish # 384
 Waypoint 53
 Depth (m) Temp (C)
 0 23.4
 1 23.4
 3 23.4
 5 23.4
 7 23.3
 9 22.7
 11 21.7
 13 20.7
 15 19.4
 17 18.2
 19 17.6
 21 17.5

Waypoint 46
 Depth (m) Temp (C)
 0 26.1
 1 26
 3 26.2
 5 26.1
 7 23.7
 9 23
 11 19.6
 13 18.4
 15 17.8
 17 17.6
 19 17.5
 21 17.3

Date 34974 Waypoint 35
 Fish # 2273
 Waypoint 35
 Depth (m) Temp (C)
 0 23
 1 23
 3 22.9
 5 22.8
 7 22.8
 9 22.4
 11 18.6
 13 17.9
 15 17.6
 17 17.2
 19 17.2

Date 34975 Waypoint 30
 Fish # 348
 Waypoint 30
 Depth (m) Temp (C)
 0 23.1
 1 23
 3 22.3
 5 22.1
 7 21.3
 9 18.2
 11 17.3
 13 15.8
 15 15.7
 17 15.6
 19 15.5
 21 15.3

Date 34975 Waypoint 53
 Fish # 375
 Waypoint 53
 Depth (m) Temp (C)

Date=Julian 34964
 Date 34964
 Fish # 276
 Waypoint 53
 Depth (m) Temp (C)
 0 26.3
 1 26.4
 3 26.4
 5 26.4
 7 24.4
 9 23.2

Date 34964 Waypoint 46
 Fish # 384
 Waypoint 46
 Depth (m) Temp (C)
 0 26.2
 1 26.2
 3 26.2
 5 26.2
 7 25.2
 9 23.3
 11 20.6
 13 18.4

Date 34975 Waypoint 23
 Fish # 366
 Waypoint 23
 Depth (m) Temp (C)
 0 22.3
 1 21.8
 3 21.6
 5 19.4
 7 15.7
 9 15.2

Date 34975 Waypoint 35
 Fish # 88
 Waypoint 35
 Depth (m) Temp (C)
 0 22.9
 1 22.9
 3 22.9
 5 22.9
 7 22.7
 9 21.5
 11 19.2
 13 17.7
 15 17.3
 17 17.1
 19 16.7

Date 34975
 Fish # 465

Temperature Data --Lake Mohave -- 1995

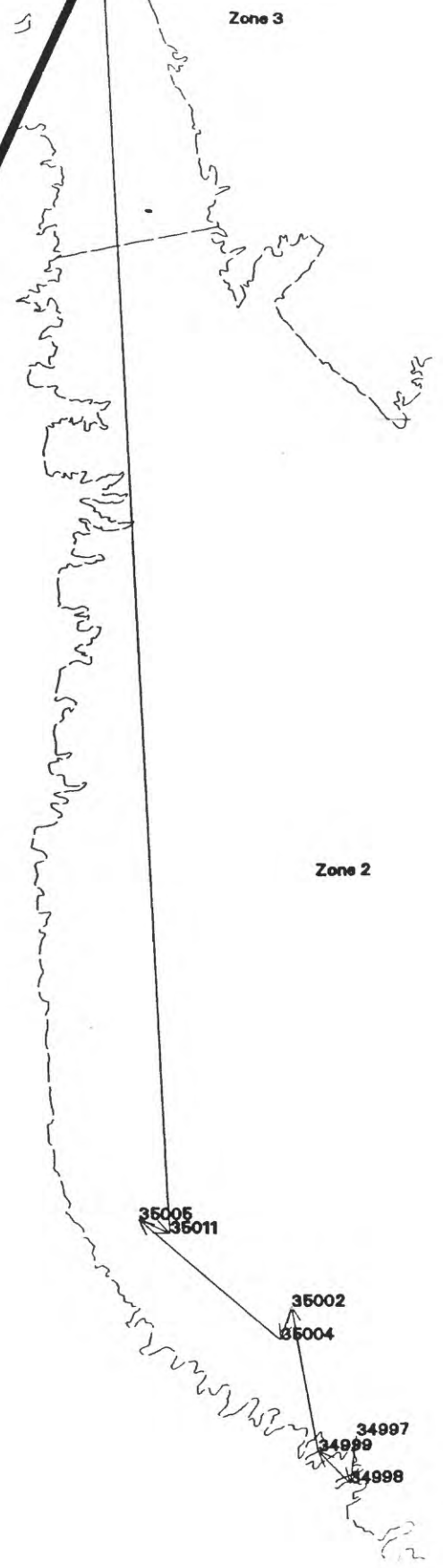
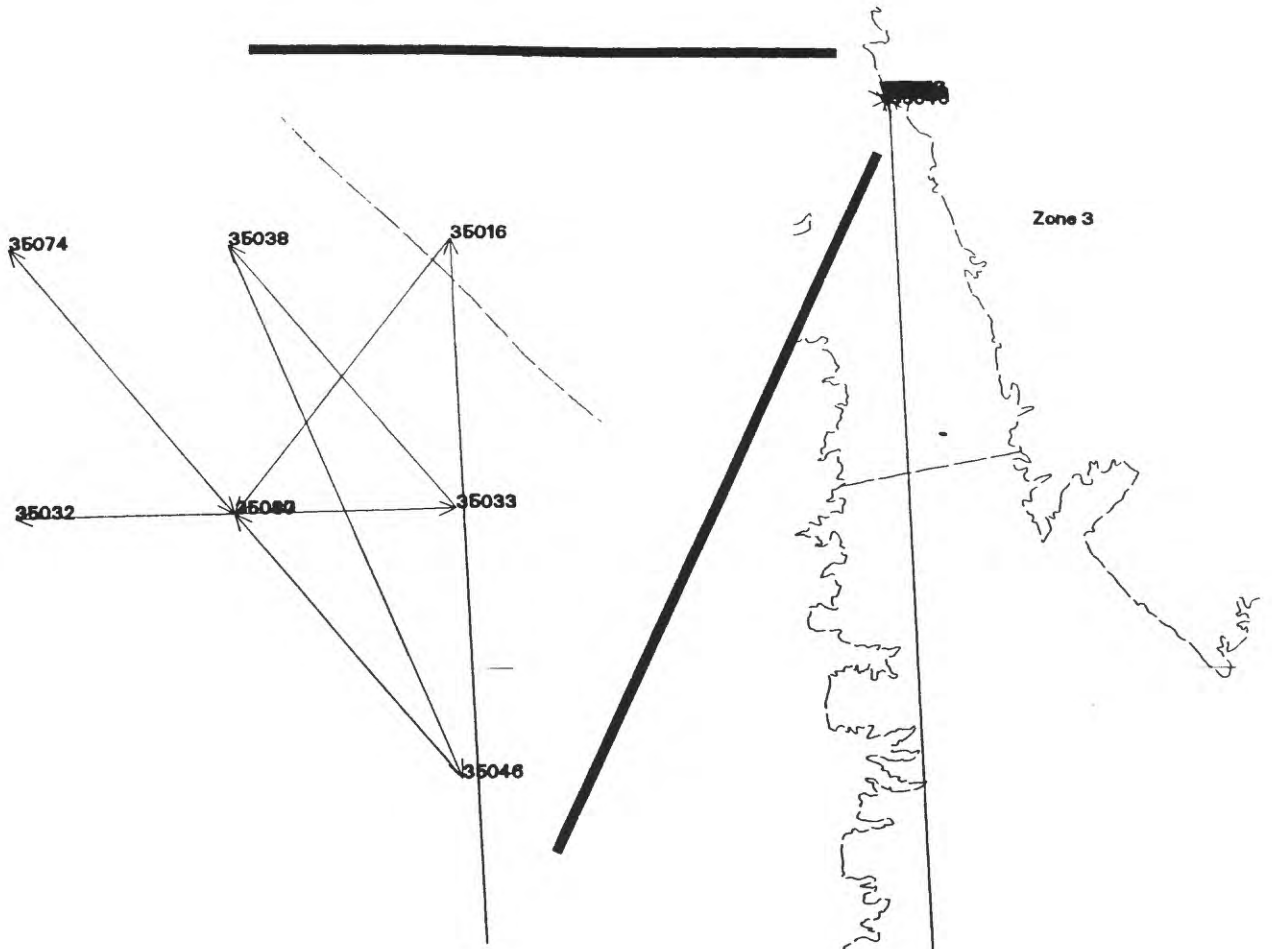
Date	34975	0	23.4
Fish #	2273	1	23.4
Waypoint	?	3	23.4
Depth (m)	Temp (C)	5	23.4
0	22.2	7	22.8
1	22.2	9	22.2
3	22.2	11	21.9
5	22.2	13	20
7	22.2	15	18.1
9	20.3	17	17.8
11	18.3	19	17.6
13	17.5	21	17.5

Date=Julian

Waypoint	41
Depth (m)	Temp (C)
0	23.3
1	23.3
3	23.3
5	23.3
7	23.3
9	23.3
11	23.2
13	22.5
15	18.5
17	17.6
19	17.6
21	17.4

Date	34976
Fish #	88
Waypoint	35
Depth (m)	Temp (C)
0	22.2
1	22.2
3	22.2
5	22.2
7	22.2
9	22.1
11	17.8
13	17.3
15	17.1
17	16.9
19	16.7

Appendix D. Individual Movement Maps

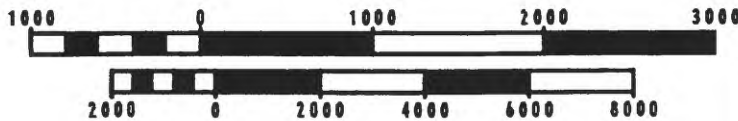


Juvenile Fish 7

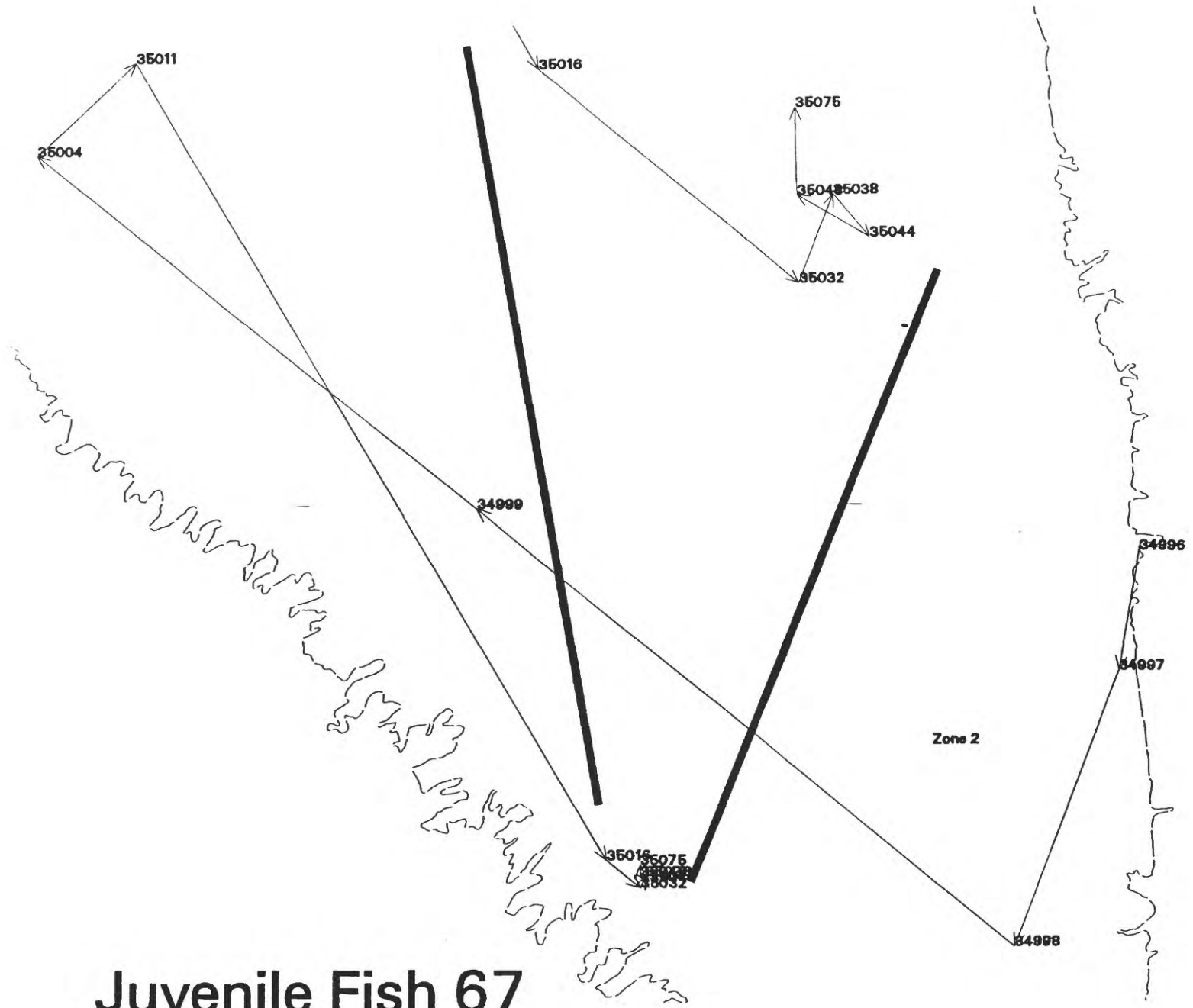
Lake Mohave Razorback Sucker Telemetry Study

Prepared by the
 U.S. Geological Survey
 Biological Resources Division
 Midcontinent Ecological Science Center
 GIS and Remote Sensing Project

The scale bar applies to the base map shown on the far right.
 METERS



FEET
 Universal Transverse Mercator Projection
 Zone 11
 North American Datum 1927

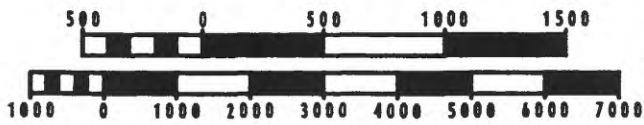


Juvenile Fish 67

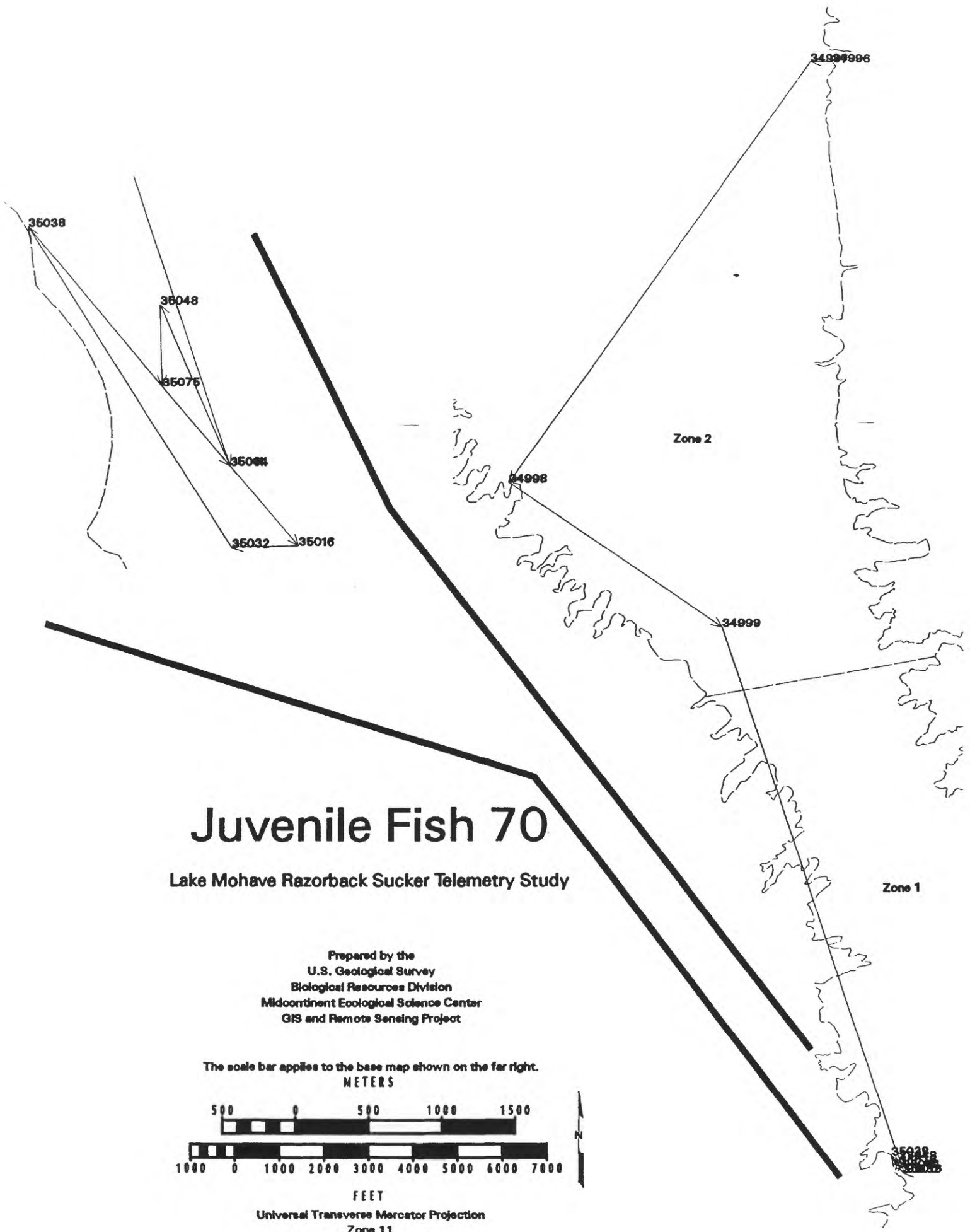
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The scale bar applies to the lower base map.
 METERS



FEET
 Universal Transverse Mercator Projection
 Zone 11
 North American Datum 1927

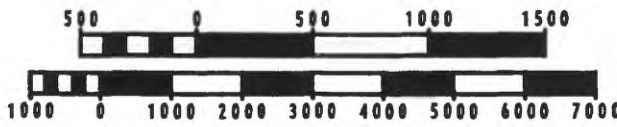


Juvenile Fish 70

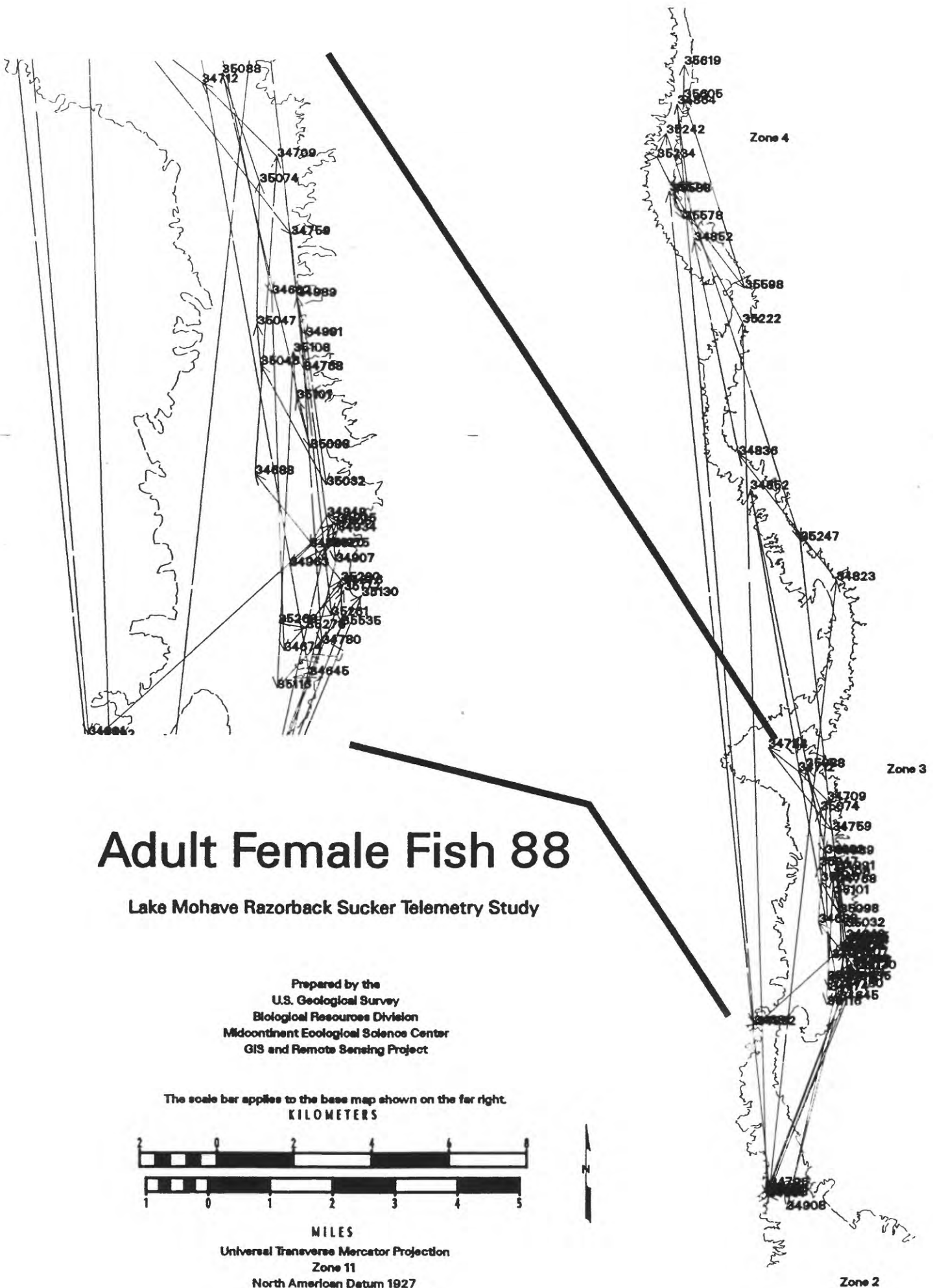
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The scale bar applies to the base map shown on the far right.
 METERS



FEET
 Universal Transverse Mercator Projection
 Zone 11
 North American Datum 1927

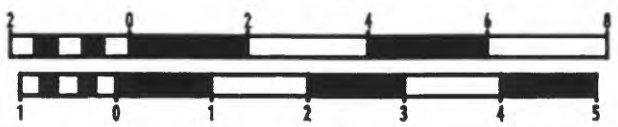


Adult Female Fish 88

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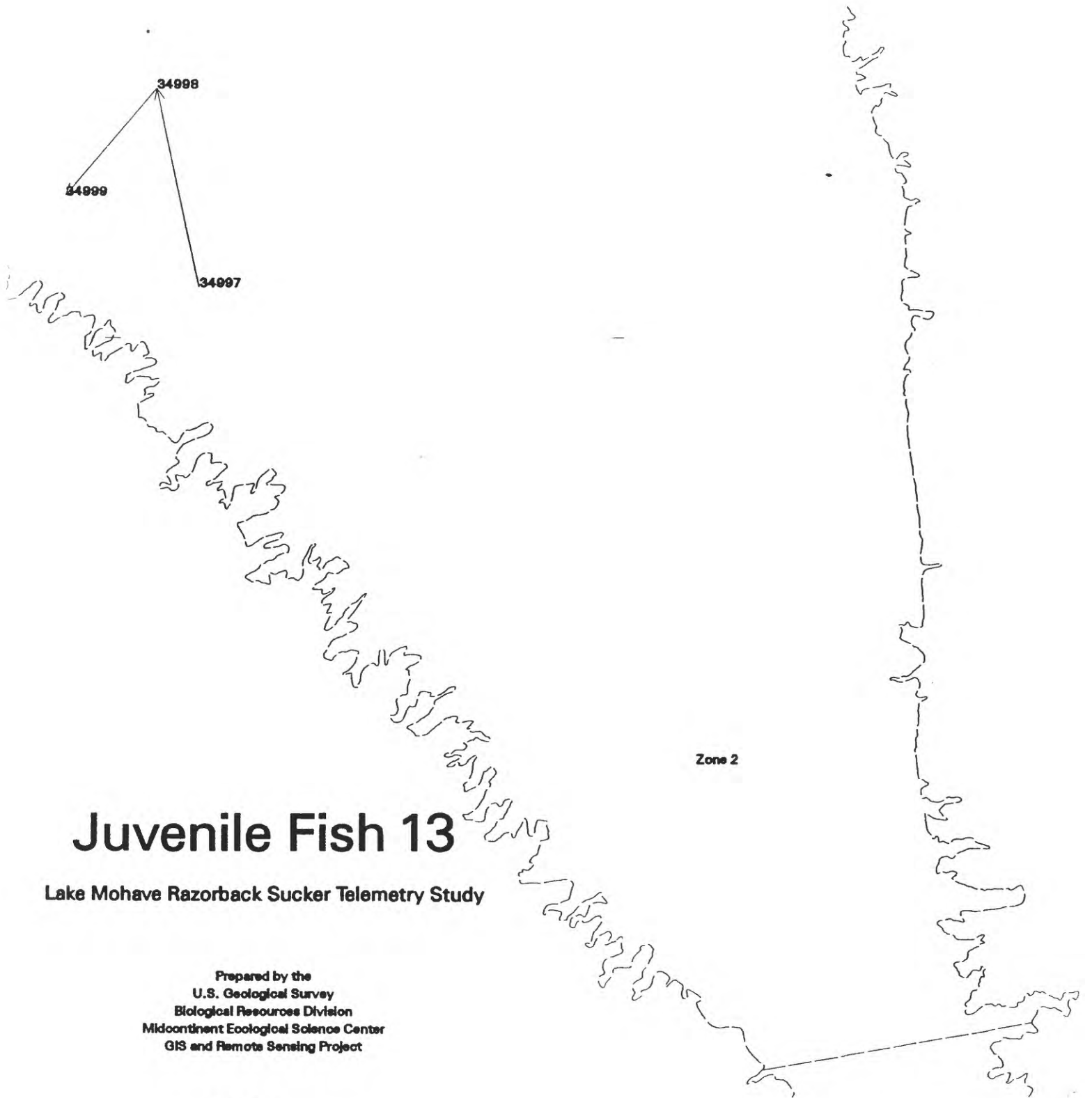
Prepared by the
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The scale bar applies to the base map shown on the far right.
 KILOMETERS



MILES

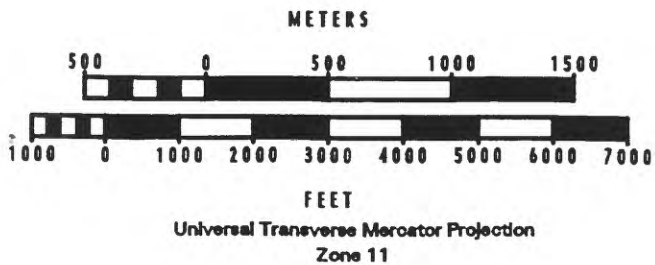
Universal Transverse Mercator Projection
 Zone 11
 North American Datum 1927

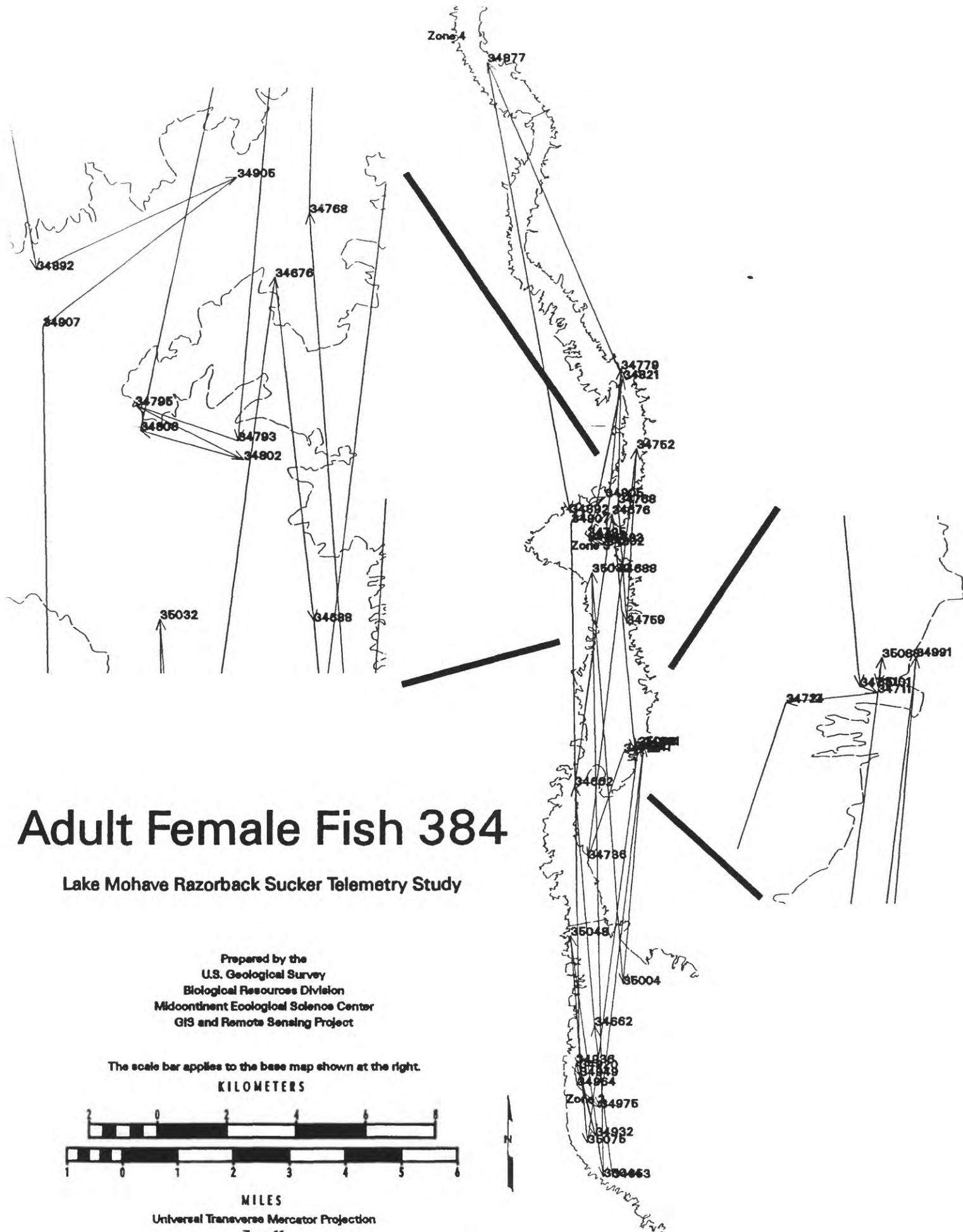


Juvenile Fish 13

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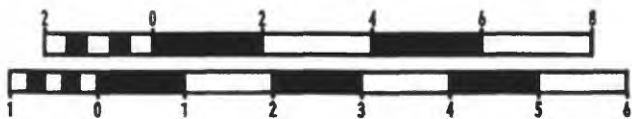
Adult Female Fish 384

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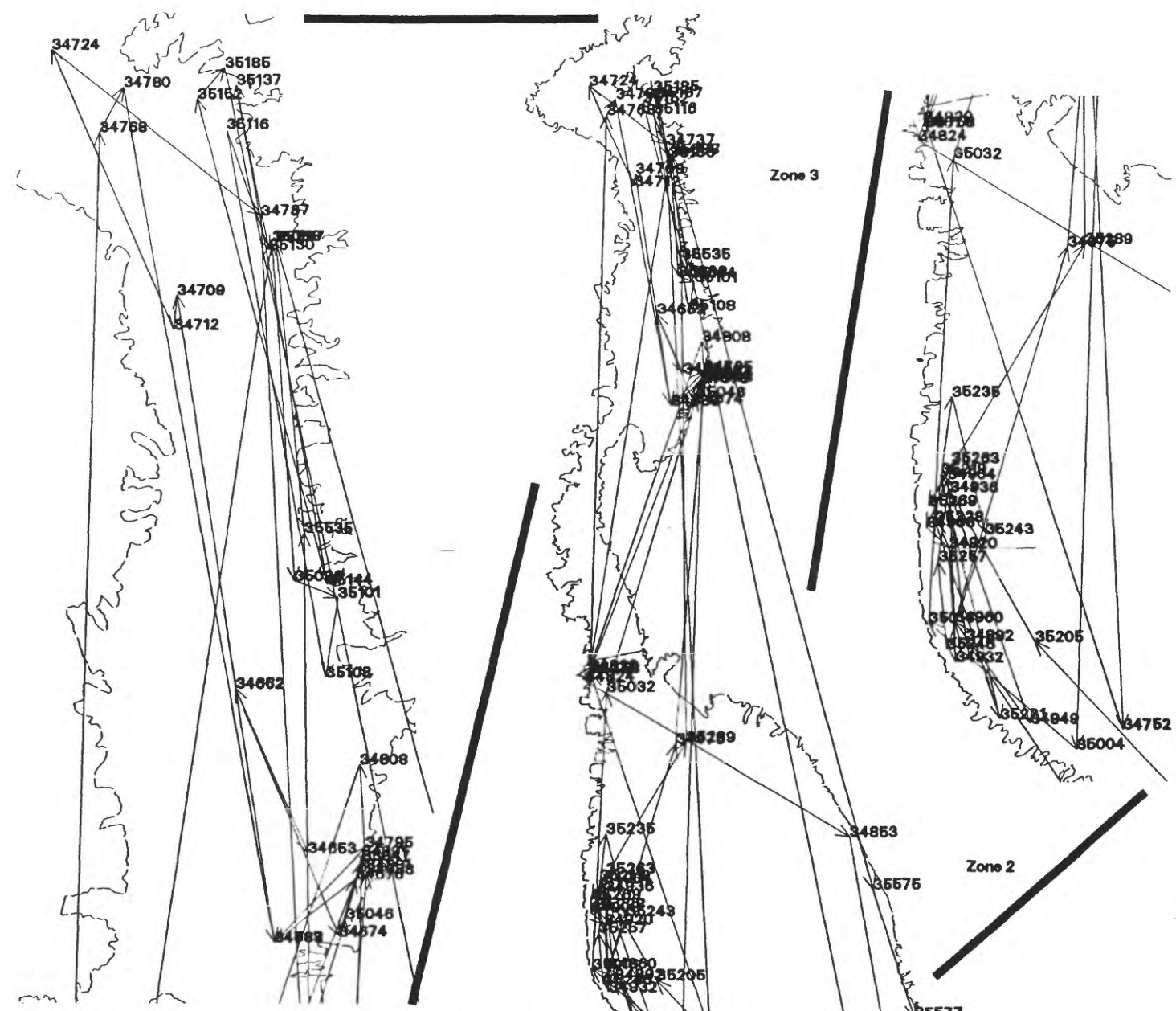
The scale bar applies to the base map shown at the right.

KILOMETERS



MILES

Universal Transverse Mercator Projection
 Zone 11
 North American Datum 1927



Adult Female Fish 465

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KILOMETERS



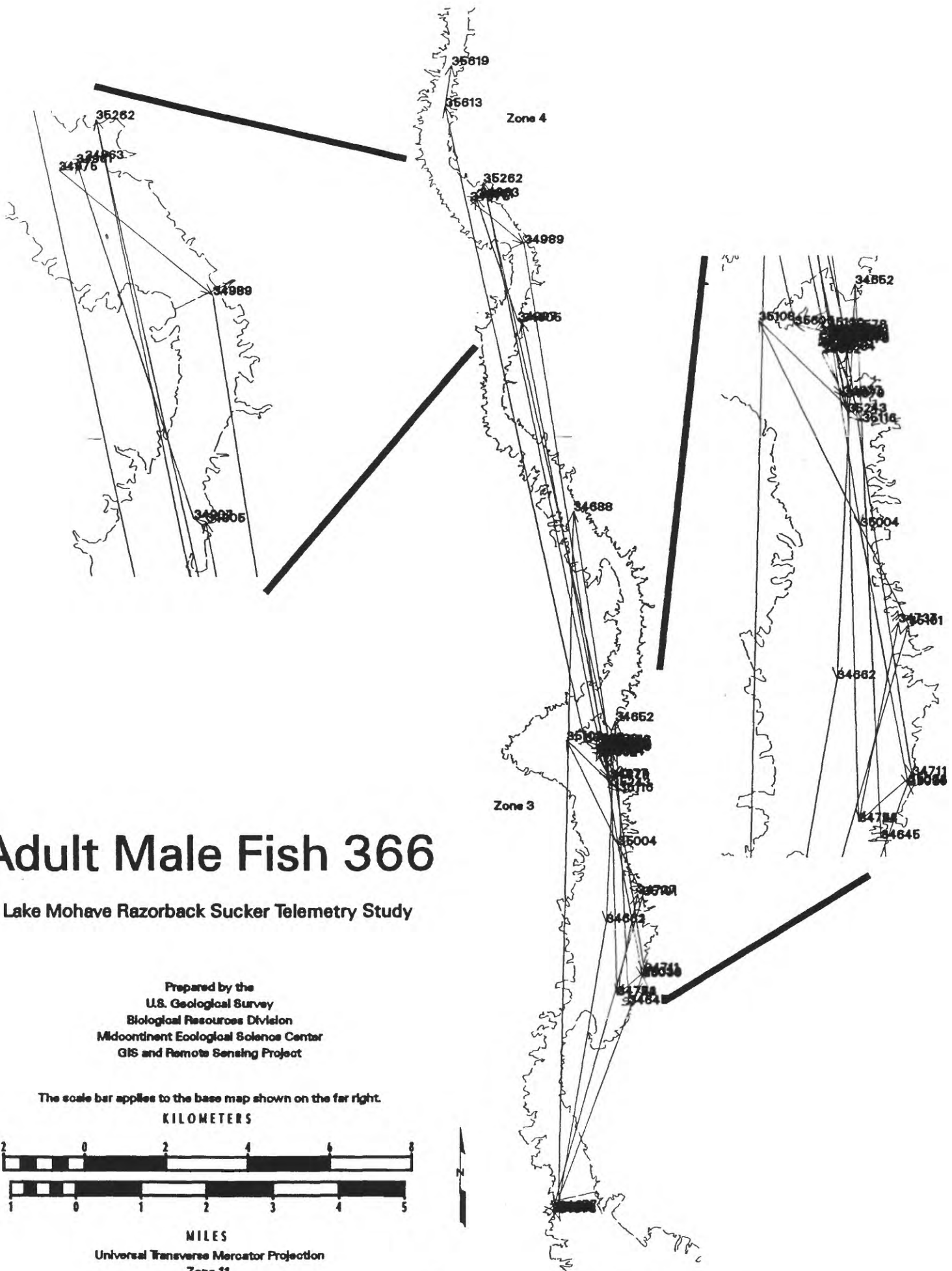
MILES



82

Universal Transverse Mercator Projection
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Zone 1



Adult Male Fish 366

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The scale bar applies to the base map shown on the far right.

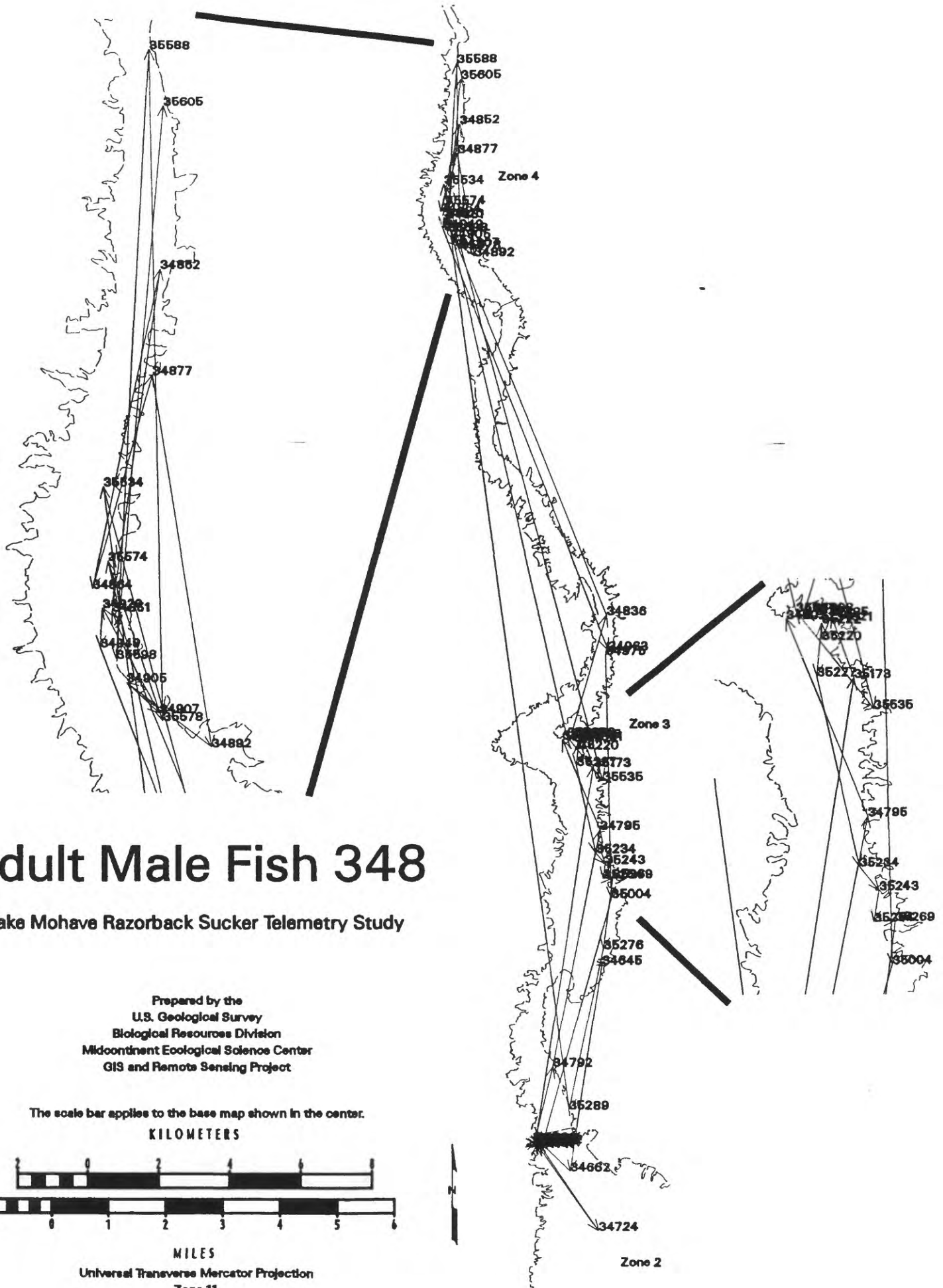
KILOMETERS



MILES

Universal Transverse Mercator Projection
 Zone 11

North American Datum 1927



Adult Male Fish 348

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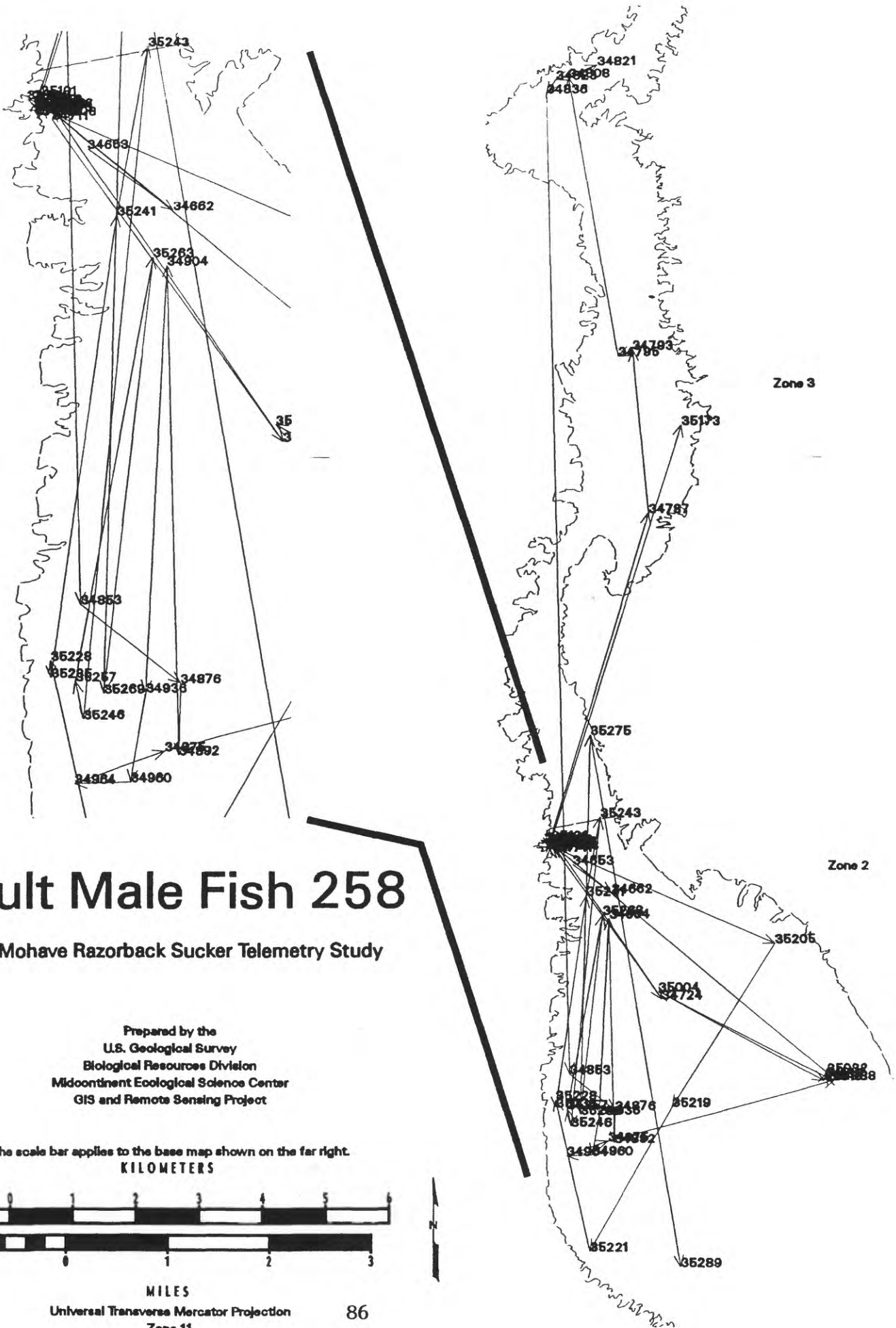
The scale bar applies to the base map shown in the center.

KILOMETERS



MILES

Universal Transverse Mercator Projection
 Zone 11
 North American Datum 1927

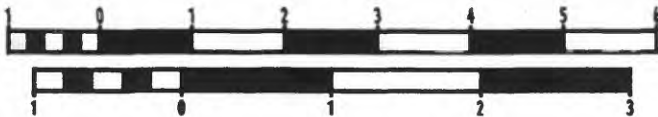


Adult Male Fish 258

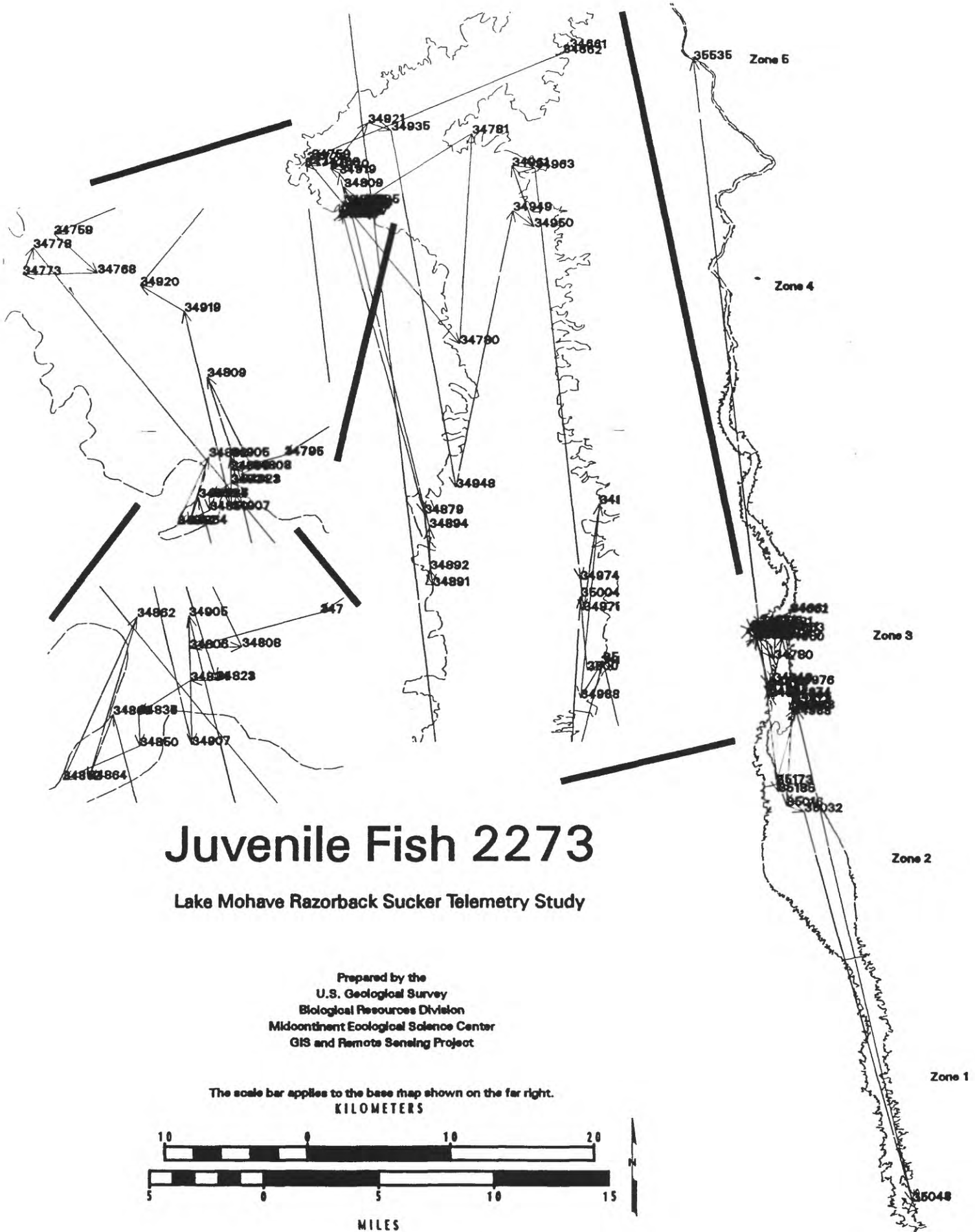
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The scale bar applies to the base map shown on the far right.
 KILOMETERS



MILES
 Universal Transverse Mercator Projection
 Zone 11
 North American Datum 1927



Juvenile Fish 2273

Lake Mohave Razorback Sucker Telemetry Study

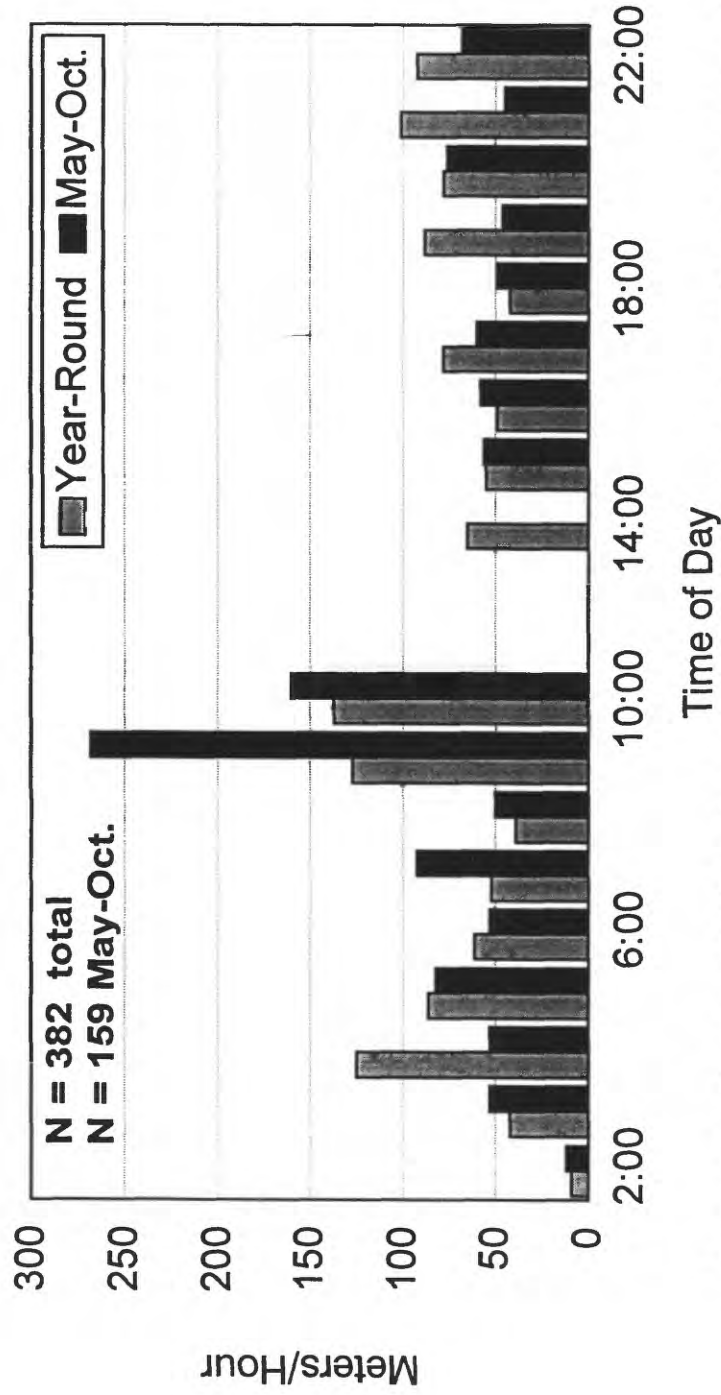
Prepared by the
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 Biological Resources Division
 Midcontinent Ecological Science Center
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The scale bar applies to the base map shown on the far right.
 KILOMETERS



MILES

Universal Transverse Mercator Projection
 Zone 11
 North American Datum 1927



Comparison of Total and Summer Hourly Movements of Adult Razorback Suckers in Lake Mohave, 1994-1996.