



**State of Utah**

**DEPARTMENT OF NATURAL RESOURCES**

*Division of Wildlife Resources - Native Aquatic Species*

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**LEAST CHUB**  
*(Iotichthys phlegethontis)*

**MONITORING SUMMARY**

**Snake Valley, 2001**

Publication Number 01-28  
Utah Division of Wildlife Resources  
1594 West North Temple  
Salt Lake City, Utah  
John F. Kimball, Director

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**Final Report**  
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Prepared by:

Richard A. Fridell  
Ron W. Malecki

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John F. Kimball, Director

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## INTRODUCTION

Least chub (*Iotichthys phlegethontis*) historically occupied a variety of habitats including rivers, clear streams, springs, ponds, and marshes (Sigler and Miller 1963). However, all known populations are currently restricted to isolated springs and associated marshes. Least chub habitat typically consists of small springs or ponds with cool stable temperatures, relatively low, stable dissolved oxygen values, and low conductivities (Perkins et al. 1998). Least chub are typically found in habitats consisting of moderate to dense emergent, floating, and submergent vegetation. Wetland vegetation most commonly associated with least chub habitat includes: olney threesquare (*Scirpus americanus*), common threesquare (*S. pungens*), softstem bulrush (*S. validus*), wiregrass (*Juncus balticus*), clustered field sedge (*Carex praegracilis*), common cattail (*Typha domingensis*), common spikerush (*Eleocharis palustris*), duckweed (*Lemna sp.*), cutleaf water parsnip (*Berula erecta*), and waterfern (*Azolla mexicana*).

Least chub, which are endemic to the Bonneville Basin of Utah, have been declining since the 1940s (Holden et al. 1974), and studies during the last 20 years indicate a continued decline in their distribution and abundance (Perkins et al. 1998). Collections within the Bonneville Basin indicate that the approximate range of least chub once included Big Cottonwood Creek, the Provo River, Utah Lake, Beaver River, Parowan Creek, and Snake Valley (Sigler and Miller 1963, Crist 1990). However, Workman et al. (1979) surveyed historically occupied areas in Millard, Juab, Weber, Salt Lake, and Tooele counties, and concluded that least chub had been extirpated from a majority of their original range. Specifically, Workman and his colleagues determined that least chub distribution was limited to areas within Snake Valley, including the Gandy Salt Marsh complex, Leland Harris Spring complex, Callao Spring complex, Twin Springs (Bishop Springs), and Redden Springs. Surveys conducted by Utah Division of Wildlife Resources in the mid 1990s found two previously unknown populations of least chub in Juab County: one in the Sevier River drainage within Mills Valley, and another near the town of Mona in Juab Valley (Perkins et al. 1998).

The first recorded collection of least chub in Snake Valley was by C. L. Hubbs in 1942 at the Gandy Salt Marsh complex in Millard County (Sigler and Miller 1963). In 1970, R. R. Miller collected least chub from the Leland Harris spring complex in Juab County (Sigler and Sigler 1996). These findings prompted the West Desert survey conducted by Workman et al. (1979), who concluded that the distribution of least chub was limited to Snake Valley. Osmundson (1985) found that least chub were most abundant in the Gandy Salt Marsh spring complex and Leland Harris spring complex within Snake Valley. He noted that least chub were least abundant in Miller Springs (near Leland) and Bishop Springs (Twin and Central Springs). Further research has indicated that least chub have been extirpated from the Callao and Redden Spring complexes (Crist 1990). Thus, within Snake Valley, least chub are limited to the Gandy Salt Marsh complex, Leland Harris spring complex, and Bishop Springs complex (Perkins et al. 1998).

Due to their declining distribution and abundance, least chub are currently classified as a conservation species by the State of Utah (Perkins et al. 1998). In 1998, the Conservation Agreement and Strategy for Least Chub (*Iotichthys phlegethontis*) in the State of Utah (Perkins et al. 1998) was developed in an effort to expand least chub populations and enhance their habitat. Conservation actions identified in the Conservation Agreement include: wetland re-vegetation, water quality improvements, grazing exclosure construction, surveys of suitable least chub habitat, control of nonnative species, genetic analysis, and monitoring of least chub populations. Long-term population monitoring is necessary to determine least chub trends and their response to implementation of conservation actions.

In August 2001, the Utah Division of Wildlife Resources conducted the ninth consecutive year of least chub monitoring in Snake Valley, Utah. The objective of this ongoing effort is to monitor least chub populations and their habitat trends in Snake Valley within the West Desert Geographic Management Unit (Perkins et al. 1998). The areas sampled and methodology used are consistent with monitoring conducted in previous years (Fridell et al. 1999).

## METHODS

In Snake Valley, least chub were sampled at three spring complexes: Leland Harris, Gandy Salt Marsh, and Bishop Springs (Figures 1-3). A total of 77 sites were visited within these complexes (Leland Harris = 12, Gandy = 52, Bishop Springs = 13). Each of the 77 sites have been designated as an annual monitoring site and have been individually marked with permanent stakes. To determine the presence/absence of least chub, a minimum of one wire minnow trap (44.5 cm long, 22.9 cm diameter, 0.66 cm mesh) was placed at each site where water depth was sufficient to submerge the trap openings. All traps were set at a minimum depth of 13 cm (5") and were left for two to four hours before being removed. Trap locations, trap depths, and total trapping times were recorded at each site. All captured fish were positively identified and respective lengths were measured and recorded. Least chub size distribution was examined for each spring complex by plotting length frequency histograms in 1 mm increments. In addition, mean length for least chub was calculated for each spring complex.

Habitat inventories were conducted at all springs to assess physical parameters of the site and to determine species occurrence and abundance of aquatic flora. Pool size, maximum water depth, substrate depth, bank condition, livestock damage, and other habitat indices were recorded on standardized data sheets. Limited water quality parameters, including pH, dissolved oxygen, and temperature were also recorded at each station.

## RESULTS

From August 20, 2001 to August 24, 2001, a field crew totaling seven individuals surveyed 77 pre-established sites within the Leland Harris, Gandy Salt Marsh, and Bishop Springs complexes. Least chub comprised 45.5% (least chub = 1,018; Utah chub = 909; speckled dace = 308) of all fish captured in Snake Valley (Tables 4, 6, and 8). Of the 77 springs sampled, least chub occurred in 26 (33.8%), Utah chub (*Gila atraria*) occurred in 24 (31.2%), and speckled dace (*Rhinichthys osculus*) occurred in 11 (14.3%) (Tables 1-3). A brief synopsis of the spring complexes follows.



#### **Leland Harris** (Sample # 01-001 - 01-012)

Least chub were captured in seven of 12 (58.3%) sites sampled at Leland Harris (Table 1). Species present in this complex included least chub and Utah chub (Table 5). Least chub comprised 24.4% (least chub = 210, Utah chub = 649) of all fish captured (Table 4). Most springs were classified as having low livestock damage consisting of minimal bank disturbance. Springs 2a, 2b, 4, and 10 were classified as having moderate livestock damage consisting of cropped vegetation around spring heads and unstable banks resulting from trampling. Among sites containing least chub, average water depth ranged from 0.06 to 0.76 m and surface water temperature ranged from 13° to 21° C ( $\bar{x}$  = 15.8° C). Dissolved oxygen ranged from 0.45 to 6.6 mg/L ( $\bar{x}$  = 2.6 mg/L), and pH ranged from 7.7 to 8.9 ( $\bar{x}$  = 8.3). Substrates at all sites in Leland Harris were primarily organic and silt.

Length frequency distributions of least chub at Leland Harris (Figure 4) show that the greatest number of fish caught were between the lengths of 38 and 50 mm. Mean length of least chub captured at Leland Harris was  $41 \pm 4.3$  mm.

#### **Gandy Salt Marsh** (Sample # 01-013 - 01-064)

Least chub were captured in 11 of 52 (21.2%) sites sampled at Gandy Salt Marsh complex (Table 1). Species present in this complex included least chub, Utah chub, and speckled dace (Table 7). Least chub comprised 70.6% (least chub = 755; Utah chub = 12; speckled dace = 302) of all fish captured (Table 6). Black spot cysts (*Uvulifer ambloplitis*) appeared on a small number of least chub and Utah chub captured throughout Gandy Salt Marsh complex. Livestock damage was concentrated at sites outside of exclosures. Among sites containing least chub, average water depth ranged from 0.03 to 1.68 m and surface water temperatures ranged from 14° to 24° C ( $\bar{x}$  = 15.9° C). Dissolved oxygen ranged from 1.1 to 10.6 mg/L ( $\bar{x}$  = 2.8 mg/L), and pH ranged from 7.0 to 7.8 ( $\bar{x}$  = 7.2). Substrate of the majority of sites in the Gandy Salt Marsh complex was organic with an occurrence of silt to a lesser extent. Water levels at the Gandy Salt

Marsh complex were the lowest since annual monitoring began in 1993, with most water being confined to spring heads.

Length frequency distribution of least chub at Gandy Salt Marsh (Figure 5) showed that the majority of fish collected were between 38 and 50 mm in length. Mean length of least chub captured at Gandy Salt Marsh was  $43 \pm 4.5$  mm.

#### **Bishop Springs (Sample # 01-065 - 01-077)**

Least chub were captured in eight of 13 (61.5%) sites sampled at Bishop Springs (Table 1). Species present in this complex included least chub, Utah chub, and speckled dace (Table 9). Least chub comprised 17.3% (least chub = 53; Utah chub = 248; speckled dace = 6) of all trapped fish (Table 8). Black spot cysts appeared on many least chub and Utah chub captured throughout Bishop Springs. Livestock damage was low at all sites, with the exception of South Twin, 1, 2, and 4 where damage was high. Among sites containing least chub, water depth ranged from 0.09 to >8.0 m, with surface water temperatures ranging from 15° to 30°C ( $\bar{x} = 21.4^\circ\text{C}$ ). Dissolved oxygen ranged from 2.0 to 29.8 mg/L ( $\bar{x} = 8.0$  mg/L), and pH ranged from 7.1 to 8.7 ( $\bar{x} = 7.7$ ). The major substrate at all Bishop Springs sites was organic material or clay.

Least chub length frequency distribution for Bishop Springs shows that most fish collected were between 37 and 51 mm in length (Figure 6). Mean length of least chub captured at Bishop Springs was  $40 \pm 8.1$  mm.

## SUMMARY

### Leland Harris

- Least chub were trapped in seven of 12 (58.3%) springs at Leland Harris (Table 1).
- Since annual monitoring began in 1993, Leland Harris for the first time has not yielded the highest percentage of springs where least chub were captured (Table 1).
- Site 9 has not yielded least chub since annual monitoring began in 1993 (Table 5).

### Gandy Salt Marsh

- Least chub were trapped in 11 of 52 (21.2%) springs at Gandy Salt Marsh (Table 1). This is the lowest percentage recorded since monitoring began in 1993.
- Water levels at Gandy Salt Marsh complex were the lowest since annual monitoring began in 1993. Spring 57 was dry for the second consecutive year.
- Livestock damage has been controlled by the construction of exclosures, and has been confined to areas outside of these exclosures.
- Least chub have been captured in a total of 29 different springs since 1993 (Table 7).

### Bishop Springs

- Least chub were trapped in eight of 13 (61.5%) springs at Bishop Springs (Table 1).
- Largemouth bass (*Micropterus salmoides*) and goldfish (*Carassius auratus*) that had been previously observed at North Twin and South Twin were not observed this year.
- Sites 1 and 2 that have been dry or had less than 5.1 cm (2 inches) of water since 1997 contained adequate water to be sampled and least chub were captured in site 2 (Table 9).
- Diversions at Foote Reservoir continue to de-water habitat and threaten long-term viability of least chub at Bishop Springs.

Table 1. Number and percentage of springs where least chub were captured at Leland Harris, Gandy Salt Marsh, and Bishop Springs from 1993 to 2001.

Year	Leland Harris	Gandy	Bishop Springs	Total
1993	07 of 11 (63.6%)	22 of 50 (44.0%)	11 of 13 (84.6%)	40 of 74 (54.1%)
1994	08 of 12 (66.7%)	18 of 50 (36.0%)	07 of 13 (53.8%)	33 of 75 (44.0%)
1995	10 of 12 (83.3%)	15 of 50 (30.0%)	05 of 11 (45.5%)	30 of 73 (41.1%)
1996	08 of 12 (66.7%)	15 of 50 (30.0%)	08 of 13 (61.5%)	31 of 75 (41.3%)
1997	10 of 12 (83.3%)	13 of 50 (26.0%)	05 of 13 (38.5%)	28 of 75 (37.3%)
1998	09 of 12 (75.0%)	15 of 51 (29.4%)	09 of 13 (69.2%)	33 of 76 (43.4%)
1999	10 of 12 (83.3%)	15 of 51 (29.4%)	07 of 13 (53.9%)	32 of 76 (42.1%)
2000	09 of 12 (75.0%)	15 of 52 (28.9%)	08 of 13 (61.5%)	32 of 77 (41.6%)
2001	07 of 12 (58.3%)	11 of 52 (21.2%)	08 of 13 (61.5%)	26 of 77 (33.8%)

Table 2. Number and percentage of springs where Utah chub were captured at Leland Harris, Gandy Salt Marsh, and Bishop Springs from 1993 to 2001.

Year	Leland Harris	Gandy	Bishop Springs	Total
1993	09 of 11 (81.8%)	07 of 50 (14.0%)	10 of 13 (76.9%)	26 of 74 (35.1%)
1994	07 of 12 (58.3%)	08 of 50 (16.0%)	08 of 13 (61.5%)	23 of 75 (30.7%)
1995	08 of 12 (66.7%)	14 of 50 (28.0%)	09 of 11 (81.8%)	31 of 73 (42.5%)
1996	08 of 12 (66.7%)	10 of 50 (20.0%)	09 of 13 (69.2%)	27 of 75 (36.0%)
1997	10 of 12 (83.3%)	05 of 50 (10.0%)	06 of 13 (46.2%)	21 of 75 (28.0%)
1998	08 of 12 (66.7%)	09 of 51 (17.7%)	09 of 13 (69.2%)	26 of 76 (34.2%)
1999	09 of 12 (75.0%)	04 of 51 (7.8%)	07 of 13 (53.9%)	20 of 76 (26.3%)
2000	08 of 12 (66.7%)	04 of 52 (7.7%)	09 of 13 (69.2%)	21 of 77 (27.3%)
2001	10 of 12 (83.3%)	04 of 52 (7.7%)	10 of 13 (77.0%)	24 of 77 (31.2%)

Table 3. Number and percentage of springs where speckled dace were captured at Leland Harris, Gandy Salt Marsh, and Bishop Springs from 1993 to 2001.

Year	Leland Harris	Gandy	Bishop Springs	Total
1993	00 of 11 (00.0%)	27 of 50 (54.0%)	05 of 13 (38.5%)	32 of 74 (43.2%)
1994	00 of 12 (00.0%)	13 of 50 (26.0%)	02 of 13 (15.4%)	15 of 75 (20.0%)
1995	00 of 12 (00.0%)	15 of 50 (30.0%)	03 of 11 (27.3%)	18 of 73 (24.7%)
1996	00 of 12 (00.0%)	21 of 50 (42.0%)	00 of 13 (00.0%)	21 of 75 (28.0%)
1997	00 of 12 (00.0%)	14 of 50 (28.0%)	00 of 13 (00.0%)	14 of 75 (18.7%)
1998	00 of 12 (00.0%)	07 of 51 (13.7%)	02 of 13 (15.4%)	09 of 76 (11.8%)
1999	00 of 12 (00.0%)	03 of 51 (05.9%)	02 of 13 (15.4%)	05 of 76 (06.6%)
2000	00 of 12 (00.0%)	10 of 52 (19.2%)	02 of 13 (15.4%)	12 of 77 (15.6%)
2001	00 of 12 (00.0%)	07 of 52 (13.5%)	04 of 13 (30.8%)	11 of 77 (14.3%)

Table 4. Species and number of fish captured at Leland Harris springs (n = 12), Snake Valley, Utah from 1999 to 2001.

Spring No.	Species/Numbers 1999	Species/Numbers 2000	Species/Numbers 2001
1	LC = 19, UC = 31	UC = 5	UC = 4
2a	LC = 81, UC = 28	LC = 32, UC = 15	LC = 34, UC = 123
2b	LC = 84, UC = 36	LC = 16, UC = 16	LC = 4, UC = 84
3	LC = 120, UC = 2	LC = 32	LC = 19, UC = 52
4	LC = 15	LC = 12	LC = 21
5	LC = 210	LC = 14	LC = 7, UC = 3
6	LC = 2	LC = 4	UC = 12
7	LC = 42, UC = 165	LC = 8, UC = 99	LC = 32, UC = 185
8	LC = 6, UC = 17	UC = 4	-
9	UC = 182	UC = 5	UC = 138
10	UC = 34	LC = 1, UC = 1	UC = 46
11	LC = 16, UC = 123	LC = 213, UC = 30	LC = 93, UC = 2
Total	LC = 595, UC = 618	LC = 332, UC = 175	LC = 210, UC = 649

LC = least chub, UC = Utah chub

Table 5. Fish species captured at Leland Harris, Snake Valley, Utah from 1993 to 2001.

Spring	1993	1994	1995	1996	1997	1998	1999	2000	2001
1	LC, UC	LC, UC	LC, UC	LC, UC	UC	LC, UC	LC, UC	UC	UC
2a	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC
2b	not sampled	LC, UC	LC, UC	LC, UC	LC, UC	LC	LC, UC	LC, UC	LC, UC
3	LC	LC	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC	LC	LC, UC
4	LC	LC	LC	LC	LC	LC	LC	LC	LC
5	UC	-	LC	-	LC	LC	LC	LC	LC, UC
6	LC, UC	LC, UC	LC, UC	LC	LC, UC	UC	LC	LC	UC
7	UC	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC
8	LC, UC	-	LC	-	LC, UC	LC	LC, UC	UC	-
9	UC		UC	UC	UC	UC	UC	UC	UC
10	UC	-	-	UC	LC, UC	UC	UC	LC, UC	UC
11	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC

LC = least chub, UC = Utah chub

Table 6. Species and number of fish captured by spring (n = 52) in the Gandy Salt Marsh complex, Snake Valley, Utah from 1999 to 2001.

Spring No.	Species/Numbers 1999	Species/Numbers 2000	Species/Numbers 2001
1	-	-	-
2	-	-	-
3	-	-	-
4	SD = 1	-	-
5	LC = 19	LC = 9, SD = 1	LC = 22, SD = 4
6	LC = 1	LC = 7, SD = 2	-
7	Water depth < 5 cm	Water depth < 5 cm	Water depth < 5 cm
8	LC = 11	LC = 33	LC = 115, SD = 13
9	-	-	-
10	-	-	-
11	-	-	-
12	-	LC = 1	-
13	-	-	-
14	LC = 164, UC = 1	LC = 25, UC = 4	LC = 51, UC = 2
15	LC = 3	-	Water depth < 5 cm
16	LC = 1, UC = 1	LC = 1	LC = 4, UC = 7
17	LC = 13	LC = 21	LC = 72, UC = 2, SD = 1
18	-	Water depth < 5 cm	-
19	-	-	-
20	LC = 5	LC = 4, UC = 2	LC = 14
21	-	-	-
22	-	-	-
23	-	-	-
24	-	-	-
25	Water depth < 5 cm	-	Water depth < 5 cm
26	LC = 2, UC = 4, SD = 1	SD = 1	UC = 1
27	-	-	-



Table 6. (continued)

Spring No.	Species/Numbers 1999	Species/Numbers 2000	Species/Numbers 2001
28	LC = 335	LC = 56, SD = 8	LC = 16, SD = 8
29	LC = 18	LC = 40, SD = 5	-
38	LC = 134	LC = 219	LC = 378, SD = 273
39	SD = 1	LC = 9, SD = 3	LC = 54, SD = 273
40	-	SD = 1	SD = 4
41	-	-	-
42	-	-	-
43	-	-	-
44	LC = 5, UC = 2	LC = 117	LC = 5
45	-	SD = 1	-
46	LC = 21	LC = 29	LC = 24
47	-	-	-
48	-	-	-
49	-	-	-
50	-	Water depth < 5 cm	Water depth < 5 cm
51	-	-	-
52	-	Dry	-
53	-	LC = 12, SD = 16	Water depth < 5 cm
54	-	UC = 16, SD = 1	-
55	-	UC = 2	-
56	-	-	-
57	LC = 1	Dry	Dry
58	-	-	-
59	not sampled	-	-
60	-	-	-
<b>Total</b>	<b>LC = 732, UC = 8, SD = 3</b>	<b>LC = 583, UC = 24, SD = 39</b>	<b>LC = 755, UC = 12, SD = 30</b>

LC = least chub, UC = Utah chub, SD = speckled dace



Table 7. Fish species captured at Gandy Salt Marsh complex, Snake Valley, Utah from 1993 to 2001.

Spring	1993	1994	1995	1996	1997	1998	1999	2000	2001
1	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-
4	SD	-	-	-	-	SD	SD	-	-
5	SD	LC	-	LC, SD	-	-	LC	LC, SD	LC, SD
6	LC	LC	LC	LC, SD	SD	LC	LC	LC, SD	-
7	-	water < 5 cm	water < 5 cm	water < 5 cm	water < 5 cm	water < 5 cm	water < 5 cm	water < 5 cm	water < 5 cm
8	LC, SD	LC	LC, SD	LC	LC	LC	LC	LC	LC, SD
9	-	SD	-	LC, UC, SD	LC	-	-	-	-
10	-	-	-	-	-	-	-	-	-
11	LC, SD	UC	-	-	-	-	-	-	-
12	LC, SD	LC	LC	LC	-	LC, UC	-	LC	-
13	-	-	-	-	SD	-	-	-	-
14	LC, SD	LC, SD	LC, UC, SD	LC, UC, SD	LC, SD	LC	LC, UC	LC, UC	LC, UC
15	LC, SD	-	-	-	water < 5 cm	water < 5 cm	LC	-	water < 5 cm
16	LC, UC	LC, UC	UC	UC, SD	UC, SD	UC	LC, UC	LC	LC, UC
17	LC, UC	LC, UC, SD	LC, UC, SD	LC, UC, SD	LC, UC, SD	LC	LC	LC	LC, UC, SD
18	-	-	-	-	-	-	-	water < 5 cm	-
19	-	-	-	-	-	-	-	-	-
20	SD	SD	UC	UC	-	LC, UC	LC	LC, UC	LC
21	-	-	-	-	-	-	-	-	-
22	SD	-	UC	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-
24	LC	-	UC	SD	-	-	-	-	-
25	-	-	water < 5 cm	water < 5 cm	water < 5 cm	-	water < 5 cm	-	water < 5 cm
26	LC, SD	UC	LC, UC	-	UC	UC	LC, UC, SD	SD	UC
27	SD	-	-	SD	-	-	-	-	-

Table 7. (continued)

Spring	1993	1994	1995	1996	1997	1998	1999	2000	2001
28	LC	LC	UC	LC, SD	LC	LC, SD	LC	LC, SD	LC, SD
29	LC, SD	-	LC, SD	LC, SD	LC, SD	LC, SD	LC	LC, SD	-
38	LC, SD	LC, SD	LC, SD	LC	LC	LC	LC	LC	LC, SD
39	LC, SD	LC, SD	UC, SD	SD	LC, SD	LC, SD	SD	LC, SD	LC, SD
40	SD	-	SD	SD	LC, SD	-	-	SD	SD
41	-	-	-	-	-	-	-	-	-
42	LC, UC, SD	LC	LC, UC, SD	SD	-	-	-	-	-
43	LC, SD	LC, UC, SD	LC, SD	LC, SD	-	-	-	-	-
44	LC, UC, SD	LC, UC	LC, UC, SD	LC, UC, SD	LC	LC, UC	LC, UC	LC	LC
45	LC, UC, SD	LC, UC, SD	SD	LC, UC, SD	-	LC, UC	-	SD	-
46	LC, SD	LC, SD	LC, UC, SD	LC, UC, SD	LC, UC	LC	LC	LC	LC
47	SD	SD	SD	-	-	-	-	-	-
48	SD	-	SD	-	SD	-	-	-	-
49	-	-	-	-	-	-	-	-	-
50	-	-	-	-	water < 5 cm	water < 5 cm	-	water < 5 cm	water < 5 cm
51	-	-	-	-	-	LC, UC	-	-	-
52	-	-	-	SD	SD	-	-	Dry	-
53	LC, SD	-	-	SD	LC, SD	LC, SD	-	LC, SD	water < 5 cm
54	-	LC, SD	-	UC	-	UC, SD	-	UC, SD	-
55	UC, SD	LC, UC, SD	LC, UC	LC, UC	UC, SD	UC	-	UC	-
56	LC, SD	LC, SD	LC, SD	SD	LC, SD	SD	-	-	-
57	LC, UC, SD	-	LC	SD	LC	-	LC	Dry	Dry
58	SD	-	-	-	SD	-	-	-	-
59	not sampled	not sampled	not sampled	not sampled	not sampled	not sampled	not sampled	-	-
60	not sampled	not sampled	not sampled	not sampled	not sampled	-	-	-	-

LC = least chub, UC = Utah chub, SD = speckled dace

Table 8. Species and number of fish captured by spring (n = 13) in Bishop Springs , Snake Valley, Utah from 1999 to 2001.

Spring No.	Species/Numbers 1999	Species/Numbers 2000	Species/Numbers 2001
South Twin	-	†	UC = 1
North Twin	-	UC = 7	UC = 30
1	Dry*	Dry*	-
2	Dry*	Dry*	LC = 4
3	LC = 4	LC = 8, UC = 5	LC = 1, UC = 3
4	-	LC = 12, UC = 12	LC = 8, UC = 62
5	LC = 11, UC = 21, SD = 1	LC = 7, UC = 14, SD = 1	UC = 19
6	LC = 4	LC = 6, UC = 1	LC = 7, UC = 5, SD = 3
7	LC = 5, UC = 91	LC = 6, UC = 22	LC = 9, UC = 60, SD = 1
8	LC = 2, UC = 16	LC = 6, UC = 38, SD = 1	LC = 1, UC = 4, SD = 1
9	LC = 7, UC = 13	LC = 1, UC = 39	UC = 15, SD = 1
10	UC = 17, SD = 3	UC = 52	LC = 6, UC = 41
11	LC = 6, UC = 1	LC = 2	LC = 17, UC = 8
<b>Total</b>	<b>LC = 39, UC = 159, SD = 4</b>	<b>LC = 48, UC = 190, SD = 2</b>	<b>LC = 53, UC = 248, SD = 6</b>

LC = least chub, UC = Utah chub, SD = speckled dace

† Largemouth bass and goldfish observed

\* = Area de-watered due to diversion of Foote Reservoir

Table 9. Fish species captured at Bishop Springs, Snake Valley, Utah from 1993 to 2001.

Spring	1993	1994	1995	1996	1997	1998	1999	2000	2001
S Twin	LC, UC	UC, †	UC, †	UC, †	UC, †	-†	-	-†	UC
N Twin	UC, †	UC	UC	UC, †	UC, †	UC	-	UC	UC
1	LC	water < 5 cm	not sampled	LC, UC	Dry*	water < 5 cm	Dry*	Dry*	-
2	LC, SD	-	not sampled	LC	Dry*	water < 5 cm	Dry*	Dry*	LC, UC
3	LC, UC	LC	Dry*	LC, UC	Dry*	LC, UC, SD	LC	LC, UC	LC, UC
4	LC, UC	LC, UC, SD	Dry*	LC, UC	Dry*	LC, UC, LB	-	LC, UC	LC, UC
5	LC, UC, SD	LC, UC	LC, UC, SD	LC, UC	Dry*	LC, UC, SD	LC, UC, SD	LC, UC, SD, LB	UC
6	LC, UC	LC	LC, UC, SD	-	LC	LC	LC	LC, UC	LC, UC, SD
7	LC, UC, SD	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC, SD
8	UC, SD	LC	LC, UC, SD	LC, UC	LC, UC	LC, UC	LC, UC	LC, UC, SD	LC, UC, SD
9	LC, UC	UC	UC	UC	LC, UC	LC, UC	LC, UC	LC, UC	UC, SD
10	LC, UC, SD	LC, UC	UC	-	UC	LC, UC	UC, SD	UC	LC, UC
11	LC	UC, SD	LC, UC	LC	LC	LC, UC	LC, UC	LC	LC, UC

LC = least chub, UC = Utah chub, SD = speckled dace, LB = largemouth bass, GF = goldfish

† Largemouth bass and goldfish were observed at North Twin and South Twin

\* Area de-watered due to diversion of Foote Reservoir.

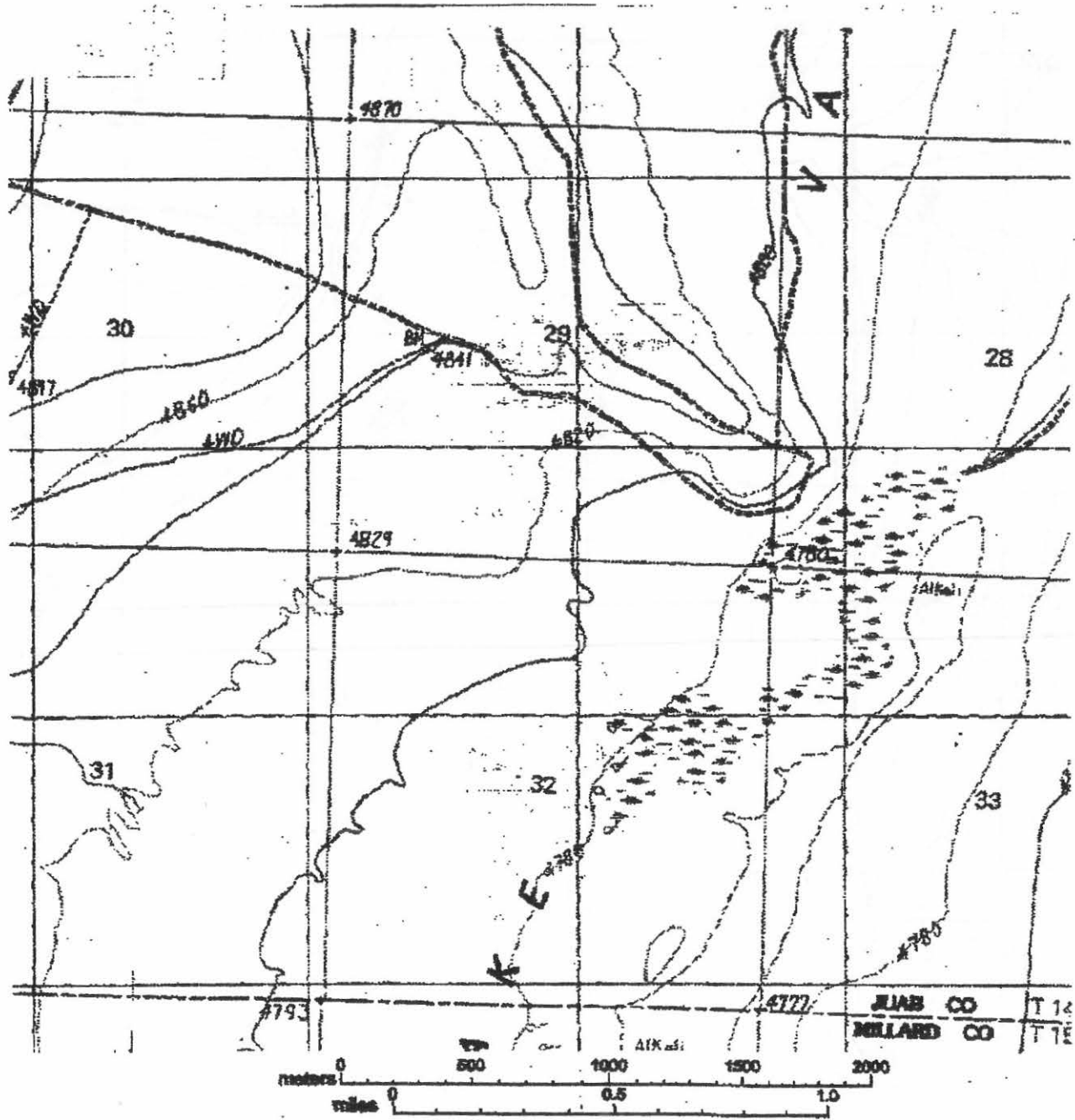


Figure 1. Location of Leland Harris least chub monitoring site. Gandy quadrangle, 7.5 minute series, 1:25,000 Scale, Juab Co., UT.

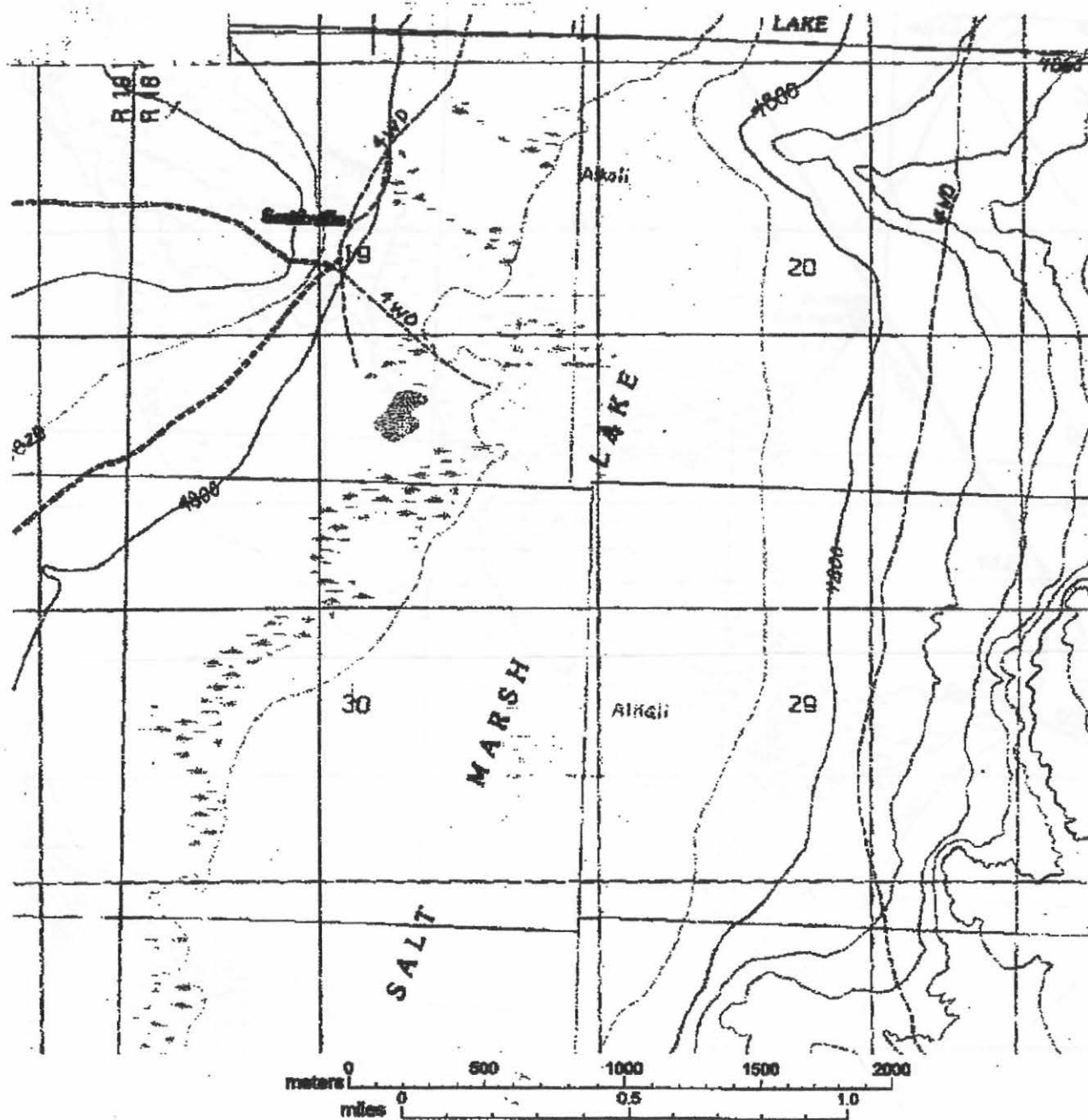


Figure 2. Location of Gandy Salt Marsh least chub monitoring site. Gandy quadrangle, 7.5 minute series, 1:25,000 Scale, Juab Co., UT.

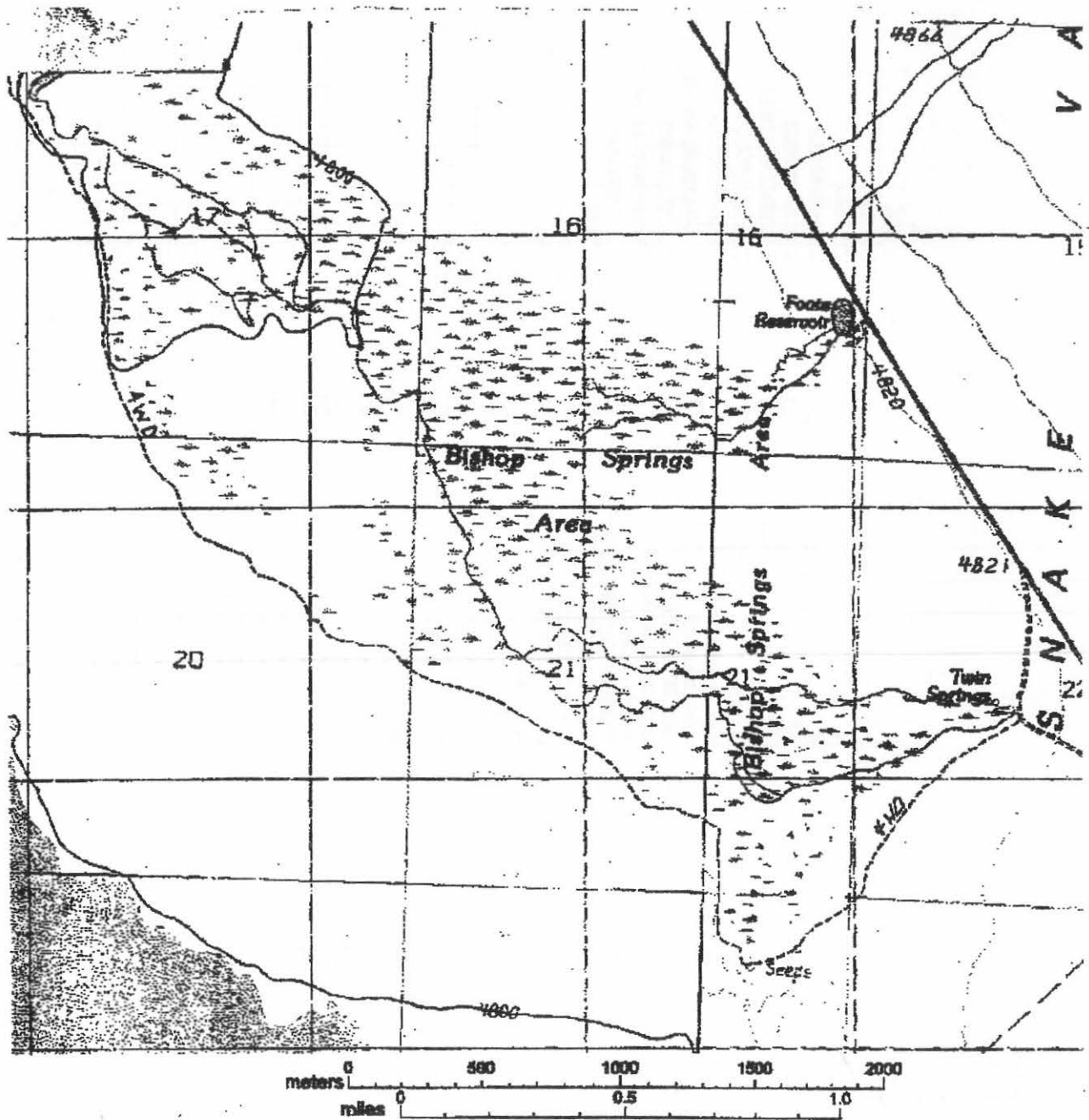


Figure 3. Location of Bishop Springs least chub monitoring site. Gandy quadrangle, 7.5 minute series, 1:25,000 Scale, Juab Co., UT.



## Least Chub Length Frequency

Leland Harris

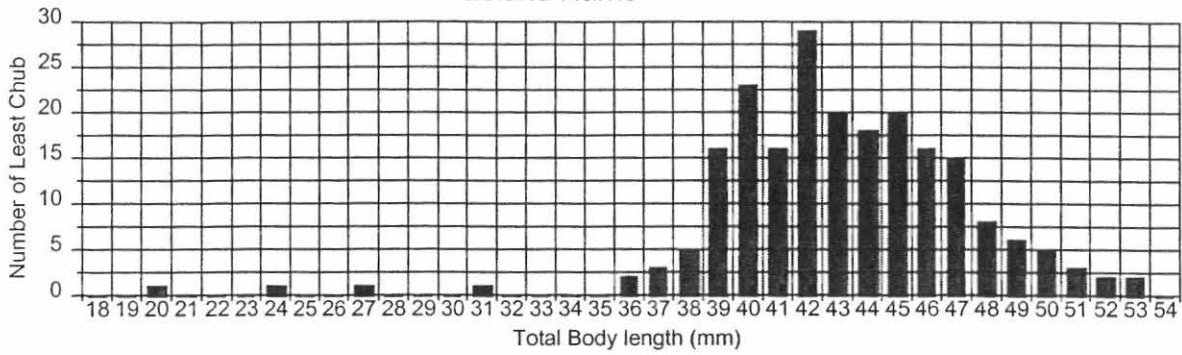


Figure 4. Length frequency distribution of least chub (n = 210) captured at Leland Harris monitoring sites, Snake Valley, Utah, August 2001.

## Least Chub Length Frequency

Gandy Salt Marsh

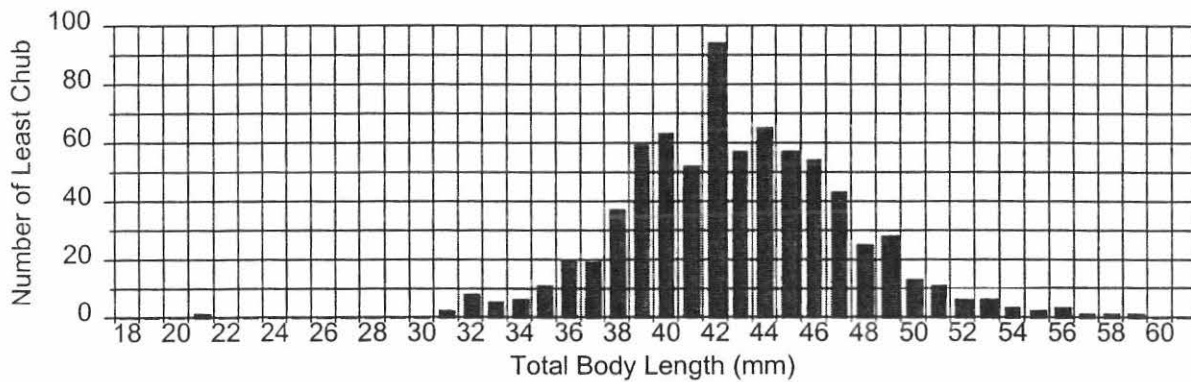


Figure 5. Length frequency distribution of least chub (n = 755) captured at Gandy Salt Marsh complex monitoring sites, Snake Valley, Utah, August 2001.

## Least Chub Length Frequency

Bishop Springs

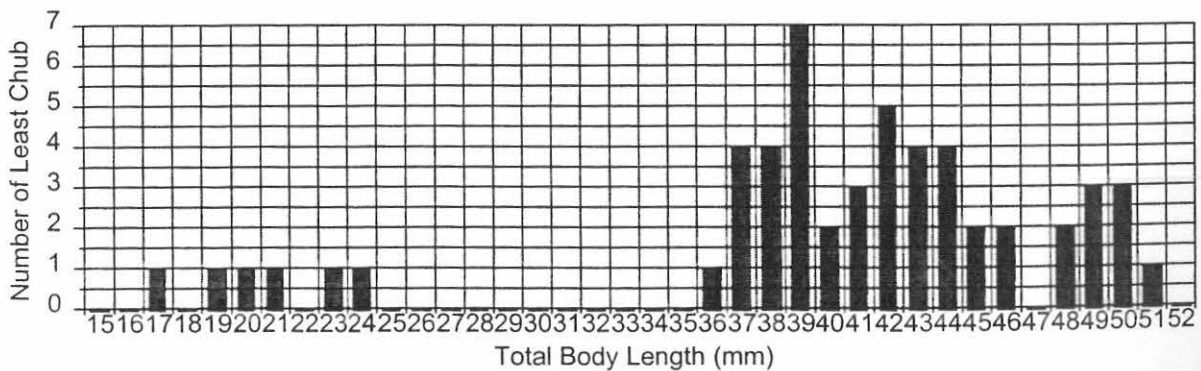


Figure 6. Length frequency distribution of least chub (n = 53) captured at Bishop Springs monitoring sites, Snake Valley, Utah, August 2001.



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