(H. Tyus and R. Valdez, pers. comm.). Therefore this occurrence is undoubtedly very rare and probably had little influence on the decline of the Colorado squawfish.

I thank R. Wydoski and C. Reger who participated in the collection. The Utah Cooperative Fishery Research Unit is jointly supported by the U.S. Fish and Wildlife Service, Utah Division of Wildlife Resources, and Utah State University.—CHARLES W. MCADA, *Utah Coop. Fish. Res. Unit, UMC-52, Utah State Univ., Logan, UT 84322.* (Present address: *U.S. Fish and Wildlife Service, 551 25.5 Rd., Suite B113, Grand Junction, CO 81501*).

SOUTHWESTERN CACTI GROWING AS EPIPHYTES.—Humphrey (*The Boojum and Its Home*, Univ. of Arizona Press, Tucson, 1974) found *Opuntia* sp. and *Ferocactus* sp. growing on *Idria columnaris* in Baja California Norte, Mexico. He suggests they grow from bird deposited seed at places on the boojum where soil and debris accumulate. We wish to report here two instances of cacti growing on alligator juniper (*Juniperus deppeana*) in moist canyons of the northern Chihuahuan Desert. *Opuntia phaeacantha* was seen in August 1981 growing on the end of a horizontally fractured branch (ca. 50 cm diameter) of a tree in McKittrick Canyon, Guadalupe Mountain National Park, Culberson Co., TX at an elevation of 1500 m. The cactus is well established with 14 joints, and is 2.5 m above the ground in a thicket of canyon bottom vegetation. A cluster of five 3-6 cm tall *Echinocereus triglochidiatus* was seen in October 1978 and January 1982 on a 151 cm dbh tree in Three Rivers Canyon, Otero Co., NM at 2100 m elevation. Much of this large, old tree is dead, and only 26% of the stem circumference has bark. The cacti ae 3 m above the ground, and appear to have grown little between observations. They are bedded in decaying wood in a place that catches moisture and some leaf litter from nearby oaks. Both were left undisturbed, and consequently our species indentifications are tentative.

Growth of cacti as epiphytes seems the result of an infrequent combination of circumstances. There are few large, old trees in the region, and only a fraction of them have platforms to catch bird or rodent transported seeds, moisture, litter and some sunlight. The first author would appreciate copies of any published or unpublished observations of cacti growing on trees or other unusual places in the deserts of southwestern North America.—WILLIAM REID AND RALPH KRAPPA, *Laboratory for Environmental Biology, Univ. of Texas at El Paso, El Paso, TX 79968.*

MATURITY AND FECUNDITY OF THE BLUEHEAD SUCKER, *CATOSTOMUS DISCOBOLUS* (CATOSTOMIDAE), IN THE UPPER COLORADO RIVER BASIN, 1975-76.—The bluehead sucker, *Catostomus discobolus*, is native to the upper Snake River drainage, Idaho and Wyoming, Weber and Bear River drainages, Utah and Idaho, and the Colorado River system above the mouth of the Grand Canyon (Smith, Univ. Mich. Mus. Zool., Misc. Publ. 129:1-133, 1966; Minckley, *Fishes of Arizona*, Arizona Game and Fish Dept. 293 pp., 1973). Although largely limited to areas of relatively swift water with cobble or gravel bottom, it is distributed throughout these rivers and is considered common to abundant in areas of suitable habitat. Information concerning bluehead sucker is generally limited to distribution (Vanicek et al., Southwestern Nat. 98:193-208, 1970; Holden and Stalnaker, Trans. Amer. Fish. Soc. 104:217-231, 1975; Sigler and Miller, *Fishes of Utah*, Utah Dept. Fish and Game, Salt Lake City, 204 pp., 1963; Minckley 1973) or classification (Smith 1966), although Andreasen and Barnes (Copeia, 1975:645-648, 1975) discussed reproduction of the species in the Weber River, Utah. We studied maturity and fecundity of bluehead sucker in the Upper Colorado River Basin.

Bluehead suckers were collected using electrofishing gear and trammel nets from the Colorado River near Grand Junction, Colorado, in April, May, and June 1975; from the Green and Yampa rivers, near their confluence (Echo Park), in May and June 1975-76; and from the lower Gunnison River in May 1976. Total lengths were measured to the nearest mm; weight was determined to the nearest 20 g for fish weighing >200 g and to the neareast g for fish weighing <200 g. Mature males were identified by presence of tubercles on the anal and caudal fins. Female and immature fish were dissected to determine sex and maturity. Ovaries were removed from mature females, identified with a numbered tag, wrapped in cheesecloth, and preserved in 10% formalin.

In the laboratory, ovaries were soaked in water to remove formalin and blotted to remove excess moisture; eggs were then separated from ovarian tissue. We estimated fecundity gravimetrically, using a triple-beam balance. Samples from anterior, middle, and posterior sections of the ovary, totaling about 10% of the entire ovary weight, were weighed to the nearest 0.1 g and counted. The rest of the ovary was weighed and fecundity estimated by direct proportion. Accuracy of the

TABLE 1.—*Relation of size to sexual maturity for bluehead suckers from the Yampa, Green, Colorado, and Gunnison rivers, 1975-1976.*

Total length (mm)	Colorado and Gunnison rivers				Yampa and Green rivers			
	Female		Male		Female		Male	
	Number of fish	Percent mature	Number of fish	Percent mature	Number of fish	percent mature	Number of fish	Percent mature
301-310			3	33				
311-320	3	66	3	67				
321-330	2	100	5	80			2	100
331-340	6	67	7	57			1	100
341-350	11	82	15	80	1	100	4	100
351-360	5	100	5	80	2	50	5	80
361-370	12	92	6	83	6	83	4	100
371-380	7	86	20	95	5	100	3	100
381-390	18	100	8	100	2	100	8	100
391-400	17	100	5	100	4	100		
401-410	14	100			5	100		
411-420	4	100	1	100	2	100		
421-430	4	100			2	100		
431-440	3	100						

method was estimated by total counts of ova from three fish. Percentage error ranged from an underestimate of 3.9% to an overestimate of 1.5%.

Diameters of preserved, mature ova were measured to 0.01 mm with an ocular micrometer. Ova from anterior, middle, and posterior sections of the ovary were mixed, and 30 chosen from that group. These were measured and the average value was considered the diameter of ova for that fish.

The total length-fecundity relation for bluehead suckers was best described by the logarithmic equation:

$$\text{Log } F = b_1 \text{ Log TL} - b_0$$

where TL = total length in mm, F = fecundity (mature eggs per female), and b_0, b_1 = empirical constants. We fitted regression equations by using 'STAT PAC' programs available at Utah State University.

In spring collections, mature females were recognized by presence of large, yellow eggs. Ova size was variable, and although egg diameter generally increased with increase in fish length, the relation was not significant. Diameters of preserved, mature ova ranged from 1.22 to 2.26 mm (mean, 1.87; n = 79).

In the Colorado or Gunnison rivers, the smallest mature female collected was 313 mm TL and all females > 380 mm were mature (Table 1). The smallest mature female collected from the Yampa or Green rivers was 345 mm TL, and nearly all larger females were mature. The smallest mature males were 305 mm TL in the Colorado or Gunnison river collections and 323 mm in those from the Yampa and Green rivers; all males > 380 mm in the Colorado and Gunnison rivers and > 360 mm in the Yampa and Green rivers were mature.

The relation between fecundity and length for bluehead suckers collected from the Yampa and Green rivers in 1975 was significantly different from that for fish collected in 1976 ($P < 0.05$; Fig. 1). Data on fecundity for bluehead suckers from the Colorado river (1975) and the mouth of the Gunnison River (1976) were combined because there was no significant difference between them (Fig. 2). The difference between fecundity-length relations for fish from the Colorado-Gunnison rivers and the Yampa-Green rivers was highly significant ($P < 0.001$). Bluehead suckers from the Colorado and Gunnison rivers produced more eggs than fish of similar sizes from the Yampa and Green rivers.

Size at maturity varies throughout the range of the bluehead sucker. Fish from small tributaries do not reach the large sizes attained in the main rivers, and mature at a smaller size (Smith, pp. 125-171, *in Fishes in North American Deserts*, [Naiman and Soltz, eds.] John Wiley & Sons, New

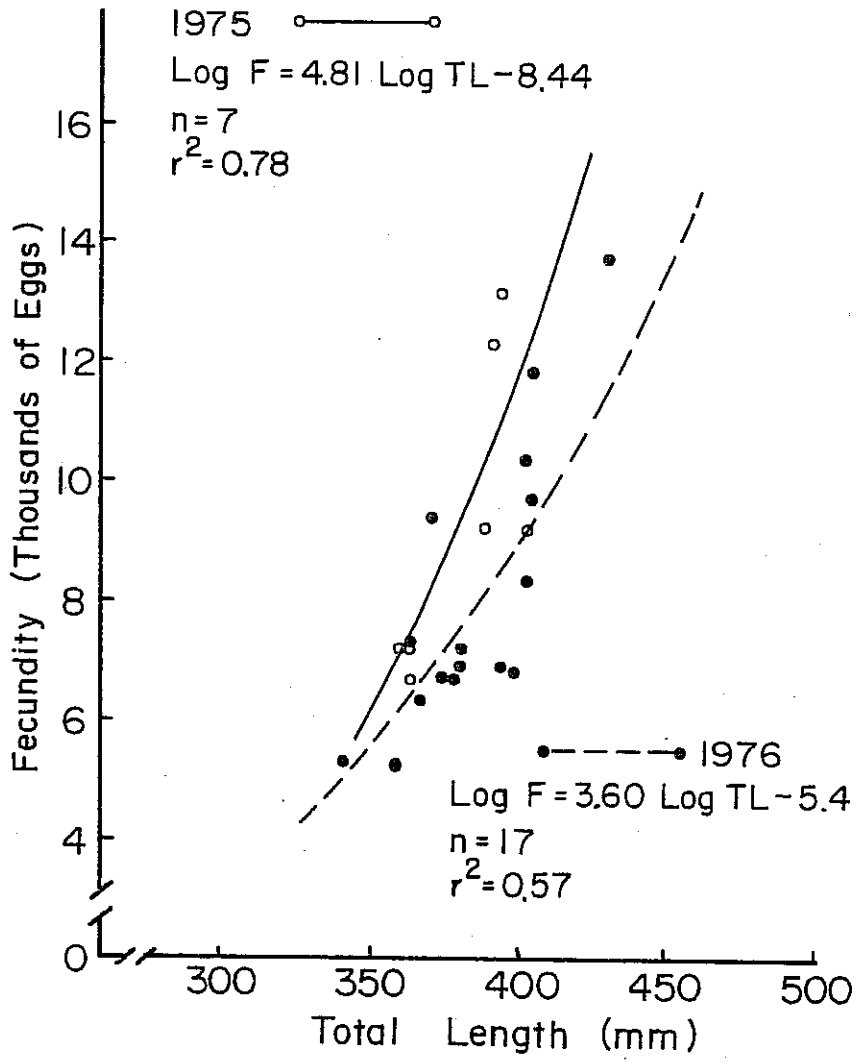

Fig. 1.—Relation between fecundity and total length of bluehead suckers from Echo Park, Yampa-Green rivers, 1975 and 1976.

York, 1981). Fish as short as 79 mm were mature in the San Juan and Little Colorado rivers (Smith 1966).

Data concerning size at maturity are somewhat biased in the present study because of collection methods. Fish from the Yampa and Green rivers were collected primarily with trammel nets and as a result, large individuals comprised most of the collection. Colorado and Gunnison river collections were made with electrofishing gear in addition to trammel nets, and a more representative sample was probably obtained. However, large individuals still dominated the collections.

Fish examined in this study produced fewer eggs than bluehead suckers examined by other investigators. Smith (1966) estimated a 319 mm standard length bluehead sucker from the Green River contained 8,500 eggs. A fish of equal length from the Yampa or Green rivers would have produced 5,450 eggs in 1975 or 5,050 eggs in 1976, based on our regression equations. A fish of equal length from the Colorado or Gunnison rivers would have produced 7,760 eggs. The estimated average fecundity for bluehead suckers from the Weber River, Utah (n = 4, 380 to 440 mm TL; Andreasen and Barnes 1975) was 20,227, which is considerably greater than estimated by us. Diameters of mature ova from fish examined in the present study were similar to those from the Weber River (1.55 to 2.25; Andreasen and Barnes 1975).

Fecundity of flannelmouth suckers (*Catostomus latipinnis*) also is greater in the Colorado River than in the Green and Yampa rivers (McAda, M.S. thesis, Utah State Univ., Logan. 105 pp., 1977). The greater fecundity may be attributable to temperature differences between the two areas. Temperature of the Green River is affected by Flaming Gorge Dam (approximately 105 km upstream from Echo Park), and is 5-15° lower than that of the Colorado in summer (at the two collection sites; U.S. Geological Survey, Water Resour. Div., Salt Lake City, various pagination, 1961-75).

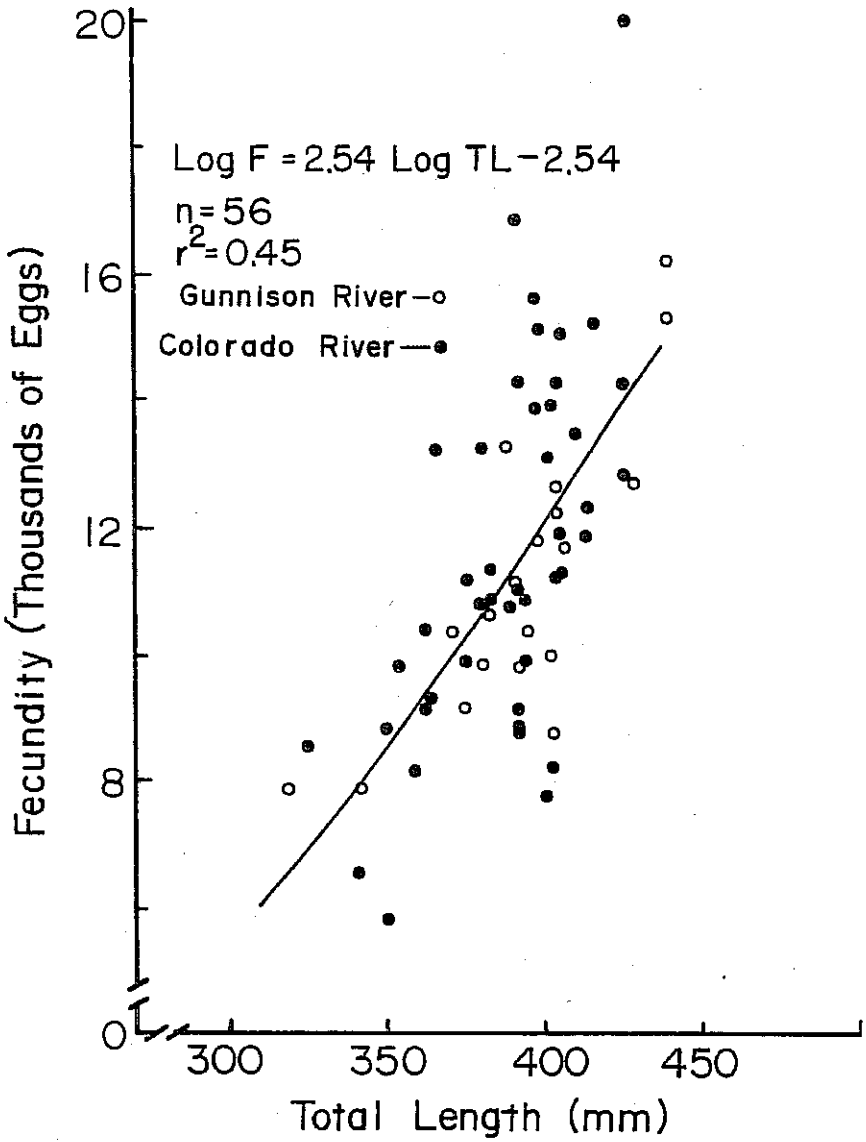

Fig. 2.—Relation between fecundity and total length of bluehead suckers from the Colorado (1975) and Gunnison (1976) rivers.

Closure of Flaming Gorge Dam, which resulted in sharp declines in water temperatures in the Green River downstream, apparently resulted in a decline in growth of Colorado squawfish, *Ptychocheilus lucius*, and roundtail chub, *Gila robusta* (Vanicek and Kramer, Trans. Amer. Fish. Soc., 98;193-208, 1969), and later rainbow trout, *Salmo gairdneri*, (U.S. Bureau of Reclamation, Environmental assessment of proposed penstock intake modifications, Flaming Gorge Dam, Utah. U.S. Dep. Int., Bur. Reclam., Upper Colo. Reg., Salt Lake City, Utah, 50 pp., 1975). Bagenal (J. Fish Biol., 1969:167-182, 1969) indicated that fish with faster growth rates produced more eggs than fish of the same lengths that had grown more slowly. Thus, factors that caused observed differences in growth rates for Colorado squawfish, roundtail chub, and rainbow trout may have had the same effect on fecundity of bluehead and flannelmouth suckers.

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