

CONSERVATION AGREEMENT AND STRATEGY

FOR

LEAST CHUB (*Iotichthys phlegethontis*)

in the
State of Utah



Photo by L. Crist

Publication number 98-25

April 1998



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An Equal Opportunity Employer

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Director

April 1998

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Mark Holden	Utah Reclamation Mitigation and Conservation Commission
Ron Bolander	U.S. Bureau of Land Management
Larry Crist	U.S. Bureau of Reclamation
Lynn Decker	U.S. Forest Service
Milton Hooper	Confederated Tribes of the Goshute Reservation
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Paul Thompson	Utah Division of Wildlife Resources
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Harold Sersland	Central Utah Water Conservancy District
Maureen Wilson	Utah Reclamation Mitigation and Conservation Commission
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CONSERVATION AGREEMENT

for
LEAST CHUB, *Iotichthys phlegethontis*

This Conservation Agreement (Agreement) has been developed to expedite implementation of conservation measures for least chub in Utah as a collaborative and cooperative effort among resource agencies and private land owners. Threats that warrant least chub listing as a sensitive species by state and federal agencies and as threatened or endangered under the Endangered Species Act of 1973, as amended (ESA), should be significantly reduced or eliminated through implementation of this Agreement and the accompanying Conservation Strategy (Strategy).

GOAL:

Ensure the long-term conservation of least chub within its historic range and assist in the development of rangewide conservation efforts.

OBJECTIVES:

The following two objectives will be required to attain the goal of this strategy:

Objective 1: To eliminate or significantly reduce threats to least chub and its habitat to the greatest extent possible.

Objective 2: To restore and maintain a minimum number of populations throughout its historic range that will ensure the continued existence of least chub.

These objectives will be reached through implementation of the Strategy. However, the status of least chub will be evaluated annually to assess program progress and amendments will be added to address newly identified least chub recovery issues and to ensure program effectiveness. Failure to implement the Least Chub Conservation Agreement and Strategy, however, will result in replacement of least chub onto appropriate lists.

I. OTHER SPECIES INVOLVED

The primary focus of this agreement is the conservation and enhancement of least chub and the ecosystems upon which they depend; however, other species occurring within or adjacent to least chub habitat may also benefit. Some of these species include spotted frog (*Rana pretiosa*), California floater (*Anodota californiensis*), Utes Ladiestresses (*Spiranthes diluvialis*), etc. By using an ecosystem approach, the accomplishment of actions identified in the Least Chub Conservation Strategy should significantly reduce or eliminate threats for several of these species, and the need for federal listing pursuant to the ESA.

II. INVOLVED PARTIES

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Salt Lake City, Utah 84114

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Central Utah Water Conservancy District
355 West 1300 South
Orem, Utah 84058

III. AUTHORITY

* The signatory parties hereto enter into this Conservation Agreement and the attached Conservation Strategy under federal and state law, as applicable, including, but not limited to Section 2(c)(2) of the ESA, which states that "the policy of Congress is that Federal agencies shall cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species."

* All parties to this Agreement recognize that they each have specific statutory responsibilities that cannot be delegated, particularly with respect to the management and conservation of

wildlife, its habitat and the management, development and allocation of water resources. Nothing in this Agreement or the Strategy is intended to abrogate any of the parties' respective responsibilities.

* This Agreement is subject to and is intended to be consistent with all applicable Federal and State laws and interstate compacts.

IV. STATUS OF LEAST CHUB

A decline in the abundance of least chub has been noted since the 1940's and 1950's (Holden et al. 1974) and studies conducted in the last 20 years indicate a continued decline in their distribution and abundance. In 1972 and again in 1979, least chub was recognized as a threatened species by the Endangered Species Committee of the American Fisheries Society (Miller 1972; Deacon *et al.* 1979). In 1980, the U.S. Fish and Wildlife Service (FWS) reviewed existing information on least chub and determined that there was insufficient data to warrant its listing as endangered or threatened. This finding was based on status reviews conducted by the FWS. On December 30, 1982, the FWS classified this species as a Category 2, Candidate (47 FR 58454). After preparation of a 1989 status report, the FWS reclassified least chub as a Category 1, Candidate species (54 FR 554). In 1995, the FWS determined that listing least chub as an endangered species was warranted and, on September 29, 1995, proposed to list the species as endangered with critical habitat, pursuant to the ESA (60 FR 50520). Currently, this species is classified as a conservation species by the State of Utah.

V. PROBLEMS FACING THE SPECIES

The success of any conservation or recovery program depends on eliminating or reducing the impact of activities that threaten the species existence. The following list is a compilation of threats as perceived by the researchers and managers of least chub populations. For consistency, the general format is based on the five criteria considered for federal listing of a species in Section 4(a)(1) of the ESA.

- A. The present or threatened destruction, modification, or curtailment of its habitat or range.
- B. Disease, predation, competition and hybridization
- C. Over utilization for commercial, recreational, scientific, or educational purposes.
- D. The inadequacy of existing regulatory mechanisms
- E. Other natural (e.g. drought) or human induced (e.g. socio-political) factors affecting its continued existence.

VI. ONGOING CONSERVATION ACTIVITIES

Since the proposal to list least chub as an endangered species was announced in 1995, several conservation and recovery activities have occurred including additional surveys, range expansion activities, habitat enhancement projects and statewide monitoring efforts. It was previously thought that least chub no longer occurred along the Wasatch Front. In September 1995, UDWR initiated surveys along the Wasatch Front. In October of 1995, a population of least chub was

found in a spring complex in Juab County. Further sampling efforts by UDWR in 1996 found a second population of least chub in the Sevier River drainage in Mills Valley. Least chub have not been collected along the Wasatch Front for nearly 30 years. One of the priority actions, as identified in this Agreement and in the Strategy, is to expand least chub populations within historic habitat. In November of 1995, a reintroduction study was initiated at Fish Springs Wildlife Refuge. Nonnative fish were removed and least chub were introduced in two springs. Least chub have successfully reproduced in 1996 and 1997 in one of the reintroduction sites. In an effort to assist in conducting additional surveys and identifying potential sites for range expansion, aerial photographs were taken in April 1997 of most areas where least chub historically and currently occur as well as of areas where least chub may potentially occur.

Habitat enhancement projects and evaluations have been ongoing as well. In October, 1996 several agencies, lead by the Bureau of Land Management, cooperatively completed a cattle enclosure around a large area of the Gandy Spring complex in Snake Valley. These enclosures are being constructed in order to protect spring heads and shore line features as well as to allow native vegetation regeneration.

Coordination with some of the private land owners in Snake Valley has been ongoing to modify current grazing practices and protect additional sensitive springhead areas. It is anticipated that some of these activities might occur prior to the 1998 spawning season.

In addition to the above conservation activities, UDWR, with assistance from the U.S. Fish and Wildlife Service and the Bureau of Land Management, has continued to conduct annual statewide monitoring of the Snake Valley populations and the Wasatch Front population found in 1995. This monitoring program is currently being evaluated as to its effectiveness. It is anticipated that a permanent long term monitoring plan will be completed prior to the 1998 monitoring field season.

VII. REQUIRED CONSERVATION ACTIONS

To meet the goal and objectives of this Agreement, the following conservation actions must be implemented:

- A. Determine baseline least chub population, life history and habitat needs.
- B. Determine and maintain genetic integrity.
- C. Enhance, maintain and protect habitat.
- D. Selectively control nonnative species.
- E. Expand least chub populations and range through introduction or reintroduction from either transplanted (wildstock) or brood stock least chub raised in a designated hatchery.
- F. Monitor populations and habitat.
- G. Develop a mitigation protocol for proposed water development and future habitat alteration, where needed.

VIII. CONSERVATION SCHEDULE AND ASSESSMENT

In addition, four general administrative actions, as outlined below, will be implemented.

Coordinating Conservation Activities

- * Administration of the Agreement will be conducted by the Bonneville Basin Conservation and Recovery Team (BBCRT) in coordination with other involved states. The BBCRT will consist of a designated representative from each signatory to this Agreement and may include technical and legal advisors and other members as deemed necessary by the signatories.
- * Because the areas of concern covered by this Agreement are located in Utah, and because the State of Utah presently has primary jurisdiction over least chub within the State, the designated BBCRT leader will be the Utah Department of Natural Resources, Division of Wildlife Resources (UDWR) representative.
- * Authority of BBCRT shall be limited to making recommendations for the conservation of least chub to the Director of UDWR. The Director will provide copies of comments, recommendations, and actions to the signatories and to other interested parties upon request.
- * The BBCRT will meet annually to develop yearly conservation schedules, review budgets, and review and revise the Strategy as required.
- * The BBCRT will meet on a semiannual basis to report on progress and effectiveness of the Conservation Strategy implementation.
- * BBCRT meetings will be open to the public. Minutes of the meetings and progress reports will be distributed to the BBCRT, the species work groups and to other interested parties, upon request, by the BBCRT leader.

Implementing Conservation Schedule

- * A total of 10 years is anticipated for completion of all actions identified and specified in the Conservation Strategy. Nevertheless, the parties agree that significant actions to benefit least chub will be implemented within the first five (5) years as funds become available. Actions will be determined by the BBCRT.
- * As leader of the BBCRT, the UDWR will coordinate conservation activities and monitor conservation actions conducted by participants of this Agreement to determine if all actions are in accordance with the Conservation Strategy and annual schedule.
- * Conservation actions will be scheduled and reviewed on an annual basis by the signatories on recommendations from the team. Activities that will be conducted during the first year of implementation are listed in Table 1. The Strategy is a flexible document and will be revised annually.

Funding Conservation Actions

* Funding for the Agreement will be provided by a variety of sources. Federal, state and local sources will need to provide or secure funding to initiate procedures of the Agreement and Strategy.

- Federal sources include, but are not limited to, the United States Forest Service (USFS), FWS, Bureau of Land Management (BLM), Utah Reclamation and Mitigation Conservation Commission (URMCC), Bureau of Reclamation (BR), Land and Water Conservation (LWC) funds and the Natural Resource Conservation Service (NRCS).

- State funding sources include, but are not limited to, direct appropriation of funds by the legislature, Community Impact Boards, Water Resources Revolving funds, State Department of Agriculture (ARD), and State Resource Management Agencies.

- Local sources of funding will be provided by water districts, Native American affiliations, cities and towns, counties, local irrigation companies, and other supporting appropriations and may be limited due to factors beyond local control.

* In-kind contributions in the form of personnel, field equipment, supplies etc., will be provided by participating agencies (Table 2). In addition, each agency will have specific tasks, responsibilities and proposed actions/commitments related to their in-kind contributions.

* It is projected that expansion of habitat and population actions will require the greatest expense during the first five years of the agreement.

* It is understood that all funding commitments made under this Agreement are subject to approval by the appropriate local, state or federal appropriations.

Conservation Progress Assessment

* A semiannual assessment of progress towards implementing actions identified in this agreement will be provided to the Director, of UDWR, by BBCRT. This assessment will be based on updates and evaluations by BBCRT members. The Director will provide copies of this assessment to the signatories of this document.

* An annual assessment of conservation accomplishments identified in Table 1 and subsequent yearly schedules will be made by the BBCRT. This assessment will determine the effectiveness of this agreement and whether revisions are warranted. It will be provided to the Director of UDWR by BBCRT. The Director will provide copies of this assessment to the signatories of this document.

* If threats to the survival of the least chub become known that are not or cannot be resolved through this or any Conservation Agreement, the UDWR immediately will notify all signatories. The FWS reserves the right to list the least chub if actions to remove threats are not proceeding according to the established schedules, notwithstanding funding limitations.

IX. DURATION OF AGREEMENT

The initial term of this Agreement shall be 5 years. Prior to the end of each 5 year period, a thorough analysis of actions implemented for the species will be conducted by the BBCRT. If

all signatories agree that sufficient progress has been made towards the conservation and recovery of the least chub, this Agreement shall be extended for an additional five (5) years. Any party may withdraw from this Agreement on sixty (60) days written notice to the other parties.

X. NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) COMPLIANCE

Signing of this agreement is covered under authorities outlined in section III listed above. We anticipate that any survey, collection or non-land disturbing research activities conducted through the Conservation Agreement will not entail significant federal actions under the NEPA and will be given a categorical exclusion designation. However, each signatory agency holds the responsibility to review planned actions for their area of concern to ensure conformance with existing land use plans and to conduct any necessary NEPA procedures for those actions within their area.

XI. FEDERAL AGENCY COMPLIANCE

* During the performance of this agreement, the participants agree to abide by the terms of Executive Order 11246 on non-discrimination and will not discriminate against any person because of race, color, religion, sex or national origin.

* No member or delegate to Congress or resident Commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

XII. SIGNATORIES

Utah Department of Natural Resources
Utah Division of Wildlife Resources
1594 West North Temple
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John Kimball 10/28/97
John Kimball Date
Director

USDI Fish and Wildlife Service
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Ralph O. Morgenweck 10/30/97
Ralph O. Morgenweck Date
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William Lamb 10/28/97
William Lamb Date
State Director

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Charles A. Calhoun 3/18/98
Charles Calhoun Date
Regional Director

Utah Reclamation Mitigation and Conservation Commission
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Michael Weland 10/17/97
Michael Weland Date
Executive Director

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David Pete 4/2/98

David Pete

Date

Chairman

Central Utah Water Conservancy District

355 West 1300 South

Orem, Utah 84058

Don A. Christiansen 3-16-98

Don A. Christiansen

Date

General Manager

Table 1: Conservation Actions to be Implemented in Calendar Year 1997-1998

A). Statewide Actions

LEAD	DATE OF COMPLETION	ACTION
BBCRT	12/97	- Determine number of populations needed for conservation
BBCRT	12/97	- Determine studies needed to obtain additional baseline information on Least chub (population, life history, habitat etc)
UDWR	12/97	- Analyze habitat fragmentation
UDWR/USU	12/98	- Conduct genetic analysis of all populations
BBCRT	12/97	- Establish introduction, reintroduction, and transplant protocols
BBCRT	12/97	- Identify broodstock needs
UDWR	12/97	- Revise population and habitat monitoring protocols
UDWR	Ongoing	- Maintain least chub database
BBCRT	12/97	- Develop mitigation protocols
UDWR	Completed	- Prioritize areas and conduct aerial photography

B) Geographic Management Unit Actions

SUBUNIT	ACTIONS
WEST DESERT GMU	
Snake Valley	* Conduct surveys of potential habitat and historic least chub sites * Protect habitat where least chub occur (acquire, fence etc.) * Determine areas where detrimental interactions occur * Monitor existing populations of least chub
Tule Valley	* Conduct surveys of potential least chub habitat * Determine areas where detrimental interactions occur
Tooele Valley	* Conduct surveys of potential habitat and historical least chub sites * Determine areas where detrimental interactions occur
Skull Valley	* Conduct surveys of potential habitat and historical least chub sites * Determine areas where detrimental interactions occur
West Desert	* Conduct surveys of potential habitat and historical least chub sites * Determine areas where detrimental interactions occur
W. Great Salt Lake	* Conduct surveys of potential habitat and historical least chub sites * Determine areas where detrimental interactions occur

B) Geographic Management Unit Actions (Cont.)

SUBUNIT	ACTIONS
WASATCH FRONT GMU	
Utah Lake	<ul style="list-style-type: none"> * Conduct surveys of potential habitat and historic least chub sites * Protect habitat where least chub occur (acquire, fence etc.) * Determine areas where detrimental interactions occur * Monitor existing populations
Spanish Fork River Subunit	<ul style="list-style-type: none"> * Conduct surveys of potential least chub habitat * Determine areas where detrimental interactions occur
Provo River Subunit	<ul style="list-style-type: none"> * Conduct surveys of potential least chub habitat * Determine areas where detrimental interactions occur
Jordan River Subunit	<ul style="list-style-type: none"> * Conduct surveys of potential least chub habitat * Determine areas where detrimental interactions occur
Lower Weber Subunit	<ul style="list-style-type: none"> * Conduct surveys of potential least chub habitat * Determine areas where detrimental interactions occur
Lower Bear River Subunit	<ul style="list-style-type: none"> * Conduct surveys of potential least chub habitat * Determine areas where detrimental interactions occur
SEVIER RIVER GMU	
Lower Sevier River Subunit	<ul style="list-style-type: none"> * Conduct surveys of potential least chub habitat * Protect habitat where least chub occur (acquire, fence etc.) * Determine areas where detrimental interactions occur * Monitor existing populations
Upper Sevier River Subunit	<ul style="list-style-type: none"> * Conduct surveys of potential least chub habitat * Determine areas where detrimental interactions occur
Upper Beaver River Subunit	<ul style="list-style-type: none"> * Conduct surveys of potential least chub habitat * Determine areas where detrimental interactions occur
Sevier Lake Subunit	<ul style="list-style-type: none"> * Conduct surveys of potential least chub habitat * Determine areas where detrimental interactions occur
Escalante Desert Subunit	<ul style="list-style-type: none"> * Conduct surveys of potential least chub habitat * Determine areas where detrimental interactions occur

Table 2: Estimated agency in-kind contributions, actions, and responsibilities for implementation of the Least Chub Conservation Agreement.

Agency	Brief Description of Tasks and Responsibilities *
Utah Department of Natural Resources, Utah Division of Wildlife Resources	Serve as Bonneville Basin Conservation and Recovery Team leader and coordinator for least chub (e.g.: oversee administrative responsibilities of agencies, reports, meetings etc.). Consult on water protection issues. Assist in obtaining and/or securing water rights and land within least chub suitable and potential habitat. Assist in funding enhancement projects. Plan and implement eradication/control projects of non-indigenous species. Serve as lead agency for population, propagation and habitat enhancements, re-introductions and monitoring projects in Utah. Maintain data base.
U.S. Fish and Wildlife Service	Advise and assist implementation of conservation agreement in regard to existing laws (e.g.: ESA, NEPA regulations etc.). Cooperate and assist in eradication/control projects of non-indigenous species, cooperate and assist in habitat enhancement and population monitoring projects. Assist in funding conservation and recovery projects.
U.S. Bureau of Land Management	Cooperate and assist in habitat enhancement, population monitoring, and land management projects. Assist in funding conservation and recovery projects. Cooperate and assist in eradication/control projects of non-indigenous species.
Utah Reclamation Mitigation and Conservation Commission	Cooperate and assist in developing mitigation protocols and activities. Cooperate and assist in habitat enhancement and population monitoring projects. Assist in funding conservation and recovery projects. Cooperate and assist in eradication/control projects of non-indigenous species.
U.S. Bureau of Reclamation	Cooperate and assist in habitat enhancement and population monitoring projects. Assist in funding conservation and recovery projects. Cooperate and assist in eradication/control projects of non-indigenous species.
Confederated Tribes of Goshute Indian Reservation	Cooperate and assist in habitat enhancement and population monitoring projects. Assist in funding conservation and recovery projects. Cooperate and assist in eradication/control projects of non-indigenous species
Central Utah Water Conservancy District	Cooperate and assist in habitat enhancement and population monitoring projects. Assist in funding conservation and recovery projects. Cooperate and assist in eradication/control projects of non-indigenous species

* All agencies will participate in, and provide technical and administrative assistance to the Bonneville Basin Conservation and Recovery Team. Tasks and responsibilities will only apply to activities and locations where appropriate.

CONSERVATION STRATEGY

for

Least Chub, *Iotichthys phlegethontis*

INTRODUCTION

The purpose of this document is to describe specific actions and strategies required to expedite implementation of conservation measures for least chub as a cooperative effort among resource agencies and private land owners. The goal of these actions is to ensure the long-term conservation of this species within its historic range. The general conservation approach focuses on two main objectives. The first objective is to eliminate or significantly reduce threats to least chub and its habitat to the greatest extent possible. The second is to restore and maintain a minimum number of least chub populations throughout its historic range within three Geographic Management Units (GMU) that will ensure its continued existence. Though the primary focus of the Least Chub Conservation Strategy (Strategy) is conservation and enhancement of least chub, it may also significantly reduce or eliminate threats and improve habitat for many other species that would warrant Federal listing pursuant to the Endangered Species Act of 1973, as amended (ESA).

DEFINITIONS

For the purpose of this Strategy, the following terms are defined as follows:

Geographic Management Unit (GMU) - A distinct area, primarily within Utah, defined by the historic least chub range and hydrologic and geographic boundaries.

Historic Range - The area that least chub is perceived to have inhabited at the time of modern exploration and settlement of Utah (Approximately 1850)

Introduction - Release of wild or cultured least chub into historically unoccupied sites for aiding conservation.

Nonnative - A species that historically did not occur in a specific area or habitat and that now inhabits as a result of human actions.

Reintroduction - Release of wild or cultured least chub into historically occupied sites for the purpose of reestablishing populations.

Threat - Any action or activity, past or present, that currently or in the future may prevent the continued existence of least chub.

Transplant/Translocate - Removal of least chub individuals from a naturally occurring population and subsequent release of these individuals into other waters for the purposes of establishing new or augmenting populations.

BACKGROUND

The Bonneville Basin within Utah encompasses the area that was covered by ancient Lake Bonneville and which, today, lies within the Great Basin province. The entire Great Basin province is distinguished geologically by its characteristically parallel north-south mountain ranges that are separated by broad, alluviated desert basins (Christiansen 1951) and valleys. The steep, gravelly slopes of these ranges are prominently marked by benches and other shore features of Lake Bonneville. Numerous springs are present at the base of the mountains (Bick 1966) and in the valley floors. Several aquatic species have maintained an existence as relict populations in these springs, including the least chub (*Iotichthys phlegethontis*), spotted frog (*Rana pretiosa*), and several species of mollusks. Populations of these species are, however, rare and in some areas declining. The rapid deterioration of these aquatic environments, primarily from water development and/or agricultural practices, has caused other unique Bonneville Basin species, such as *Rhinichthys osculus relictus* (Hubbs and Miller) a subspecies of dace, to become extinct (Hubbs et al. 1974).

DISTRIBUTION AND STATUS

Historic Distribution

The least chub are endemic to the Bonneville Basin of Utah where it was formerly widely distributed (Figure 1). The species occupied a variety of habitats including rivers, streams, creeks, springs, ponds, marshes and swamps (Sigler and Miller 1963). Historically, least chub were found in streams near Salt Lake City, in freshwater ponds, swamps and tributaries around the Great Salt Lake, in Utah Lake, in and around the Provo River, Beaver River, Parowan Creek, and Clear Creek, in tributaries of Sevier Lake, and in springs in Snake Valley and in Utah Valley.

The earliest records for least chub were by Dr. H.C. Yarrow and H.W. Henshaw in 1872 from the Beaver River, Utah (Cope and Yarrow 1875). They noted that this species was abundant in the areas where they made their collections. In 1889, Jordan collected least chub from the Provo River drainage and noted that they were “extremely common in the pools of water about the mouth of the Provo River and in the carp ponds next to Utah Lake” (Jordan 1891). Jordan and Evermann (1896) stated that the least chub occurred in “tributaries of Great Salt Lake and Sevier Lake” and that they were “excessively common in ponds and warm pools”. Tanner (1936) noted that the distribution of least chub included the Beaver River, Parowan Creek and Clear Creek. He also stated that it was “found in the Provo River and fresh water ponds around the Great Salt Lake. V.M. Tanner collected several specimens from the Provo River in 1931 as well.

Least chub have also been collected from the northeastern edge of the Bonneville Basin in Salt Lake and Davis counties. The Michigan Museum of Zoology contains specimens that were in a small brook outside of Salt Lake City in 1871 and again in 1933. Pendleton and Smart (1954) collected least chub in 1953 from Big Cottonwood Creek, in Salt Lake County and George Smith collected least chub near Centerville and in Farmington Bay, Davis County, in 1964 and 1965, respectively.

The first recorded collection of least chub in Snake Valley was thought to be by Hubbs in the Gandy Salt Marsh complex in 1964. Barbour collected least chub in 1970 from this same location. A large survey for least chub was conducted in 1979 by Workman et al. in the Bonneville Basin. The only least chub populations located were from Snake Valley including the Gandy Salt Marsh complex, Leland Harris Spring complex, Callao Spring complex, and in Twin Springs and Redden Springs. No least chub were recorded in the lower reaches of the Ogden River, Big and Little Cottonwood Creeks, Provo River, or from numerous springs and ponds in Juab, Millard and Tooele counties. Osmundson (1985) surveyed the same sites as Workman et al. did in 1977 and only found least chub in the Gandy Salt Marsh complex and Leland Harris Spring complex. He did, however, find least chub in Miller and Central Spring. Shirley (1989) surveyed the same springs in Callao but did not collect any least chub in these springs. Dr. Rosenfeld found a few least chub in Redden Springs during 1984 and indicated that they were not very abundant (Hickman 1989).

Current Distribution

The current distribution of least chub is restricted almost exclusively to Snake Valley in northwestern Utah where they are found in Gandy Salt Marsh, Bishop Springs (Twin Spring, Central Spring, Foote Spring/Reservoir), Leland Harris Springs, and Miller Spring (Figure 1). Recently, some least chub have been found in Snake Creek, south of Gandy Salt Marsh, however, surveys have not been conducted to determine the distribution, abundance, or status of the Snake Creek population. Further surveys have confirmed that least chub have been extirpated from the Callao springs on the Bagley ranch and the Redden Springs complex (Crist 1990). Recent data suggest that least chub numbers may be declining within the Gandy Salt Marsh (UDWR unpublished data). For example, during the 1993, 1994, 1995, 1996, and 1997 monitoring activities, least chub were found in 21 of 50 sites, 18 of 50 sites, 15 of 51 sites, 14 of 50 sites, and 13 of 50 sites respectively in Gandy Salt Marsh monitoring area. Least chub have recently been transplanted to Walter Spring and Deadman Spring located at Fish Springs National Wildlife Refuge (Figure 1) as an effort to establish additional populations and expand its range. Monitoring efforts conducted in August 1997 have confirmed that the populations are persisting, particularly in Walter Spring.

Surveys were also conducted in 53 springs located in Box Elder county from 1985 to 1986 (Paul and Bich, 1987), however, no least chub were collected.

The last collection of least chub along the Wasatch Front was made by Smith in 1965. In October of 1995, a population of least chub was discovered by UDWR in a small spring complex near the town of Mona in Juab County (Keleher pers. comm., unpubl data) (Figure 1). Monitoring efforts in 1996 confirmed that least chub were still present, though fewer numbers were observed. Monitoring efforts for 1997 will occur in November. Further sampling efforts by UDWR in 1996 found a second population of least chub in the Sevier River drainage in the Mills Valley marsh complex (Keleher pers. comm., unpubl data) (Figure 1). More extensive presence/absence surveys were conducted in this area in September, 1997. Results of these surveys found that least chub were distributed throughout the Mills Valley marsh complex.

Status

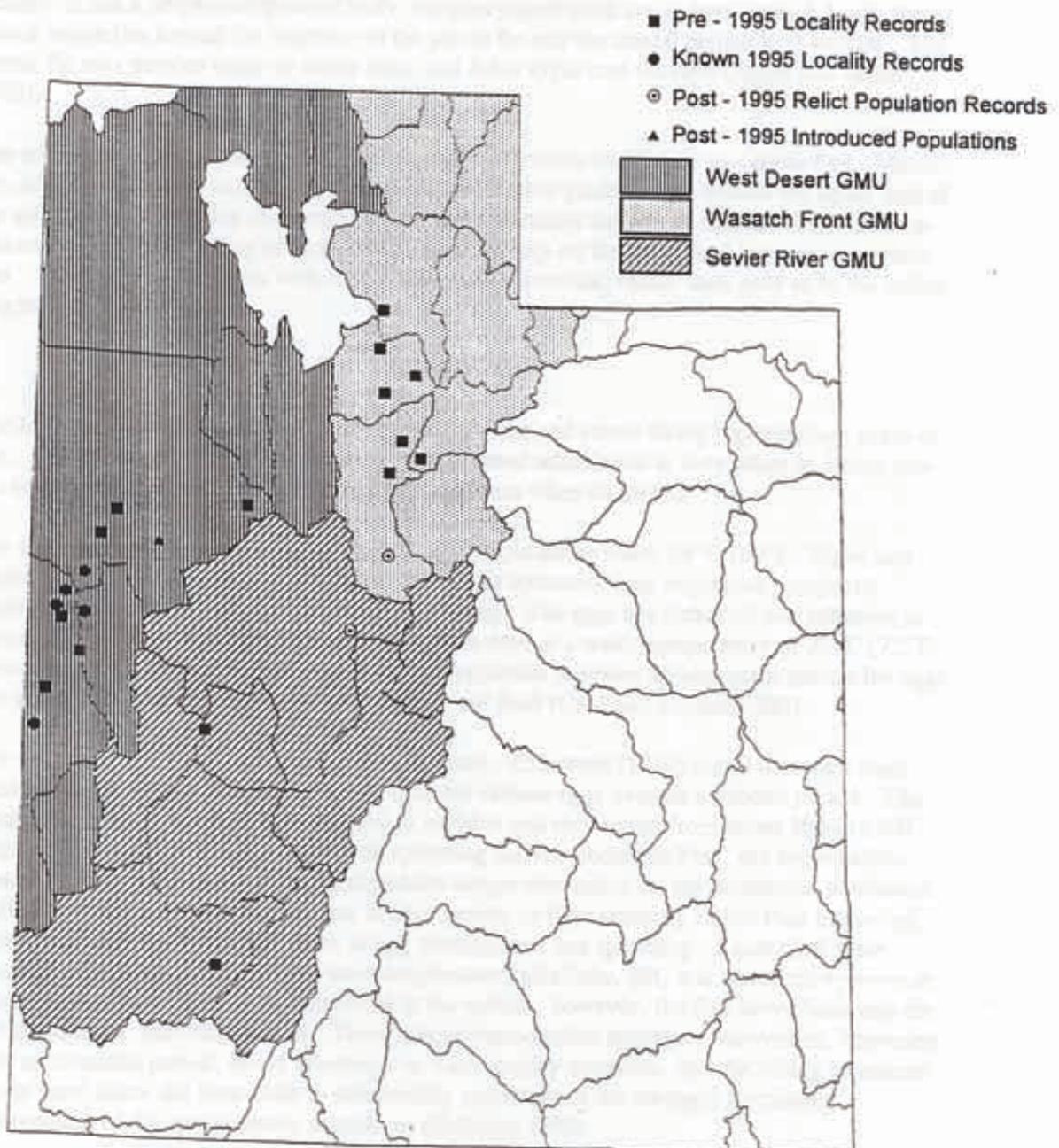
This species has been declining since the 1940's (Holden et al. 1974; Workman 1977; Crist 1990). Least chub were recognized in 1972, and again in 1979, as a threatened species by the Endangered Species Committee of the American Fisheries Society (Miller 1972; Deacon *et al.* 1979). In 1980, the U.S. Fish and Wildlife Service (FWS) reviewed existing information on least chub and determined that there was insufficient data to warrant its listing as endangered or threatened. This finding was based on status reviews conducted by the FWS. On December 30, 1982, the FWS classified this species as a Category 2 Candidate (47 FR 58454). After preparation of a 1989 status report, the FWS reclassified the least chub as a Category 1 Candidate species (54 FR 554). In 1995, the FWS determined that listing the least chub as an endangered species was warranted and, on September 29, 1995, proposed to list the species as endangered with critical habitat, pursuant to the ESA (60 FR 50520). This species is currently classified as a conservation species of special concern by the State of Utah.

SYSTEMATICS AND TAXONOMY

The least chub is a small monotypic minnow endemic to the Bonneville Basin of Utah, which is located in the Great Basin of southwestern North America. The least chub is the sole representative of the genus *Iotichthys*. It was described by E.D. Cope (*Clinostomus phlegethontis*) from specimens collected in the Beaver River, southeastern Bonneville Basin, in 1872 by Dr. H.C. Yarrow and H.W. Henshaw (Cope and Yarrow 1875 in *Hickman 1989*). The genus was revised several times from *Clinostomus*, to *Gila* (Cope and Yarrow 1875), to *Phoxinus* (Jordan and Gilbert 1883), to *Hemitremia* (Jordan 1891), to *Leuciscus* (Jordan and Evermann 1896, who also listed it in the subgenus *Iotichthys*), and finally to *Iotichthys* (Jordan et al. 1930) (*Hickman 1989*).

Figure 1

Locality Information of Least Chub



SPECIES DESCRIPTION

The least chub is a small cyprinid less than 2.5 inches, characterized by a very oblique mouth, large scales (34 to 38 along the side) and absence of a lateral line (rarely with one or two pored scales). It has a deeply compressed body, the pharyngeal teeth are in two rows, 2,5-4,2, the dorsal origin lies behind the insertion of the pelvic fin and the caudal peduncle is slender. The dorsal fin rays number eight or rarely nine, and it has eight anal fin rays (Sigler and Miller 1963).

The colorful least chub has a gold stripe along its blue sides with white-to-yellow fins. Males are olive-green above, steel blue on the sides, and have a golden stripe behind the upper end of the gill opening. The fins are lemon-amber, and sometimes the paired fins are bright golden-amber. Females and young are pale olive above, silvery on the sides, and have watery-white fins. They have silvery eyes with only a little gold coloration, rather than gold as in the males (Sigler and Miller 1963).

LIFE HISTORY

The least chub is short lived, maturing within one year and rarely living beyond three years of age. This species swims in rather dense, well-ordered schools but is very adept at diving into the bottom vegetation or retreating rapidly into rushes when disturbed.

The least chub spawns in the spring when water temperatures reach 16°C (60°F; Sigler and Sigler 1987). Least chub are polyandrous broadcast spawners over vegetation, primarily algae. They do not build nests or guard their young. The eggs are demersal and adhesive to the vegetation. Fertilized eggs hatch in about two days at a water temperature of 22°C (72°F; Crawford 1979). The presence of submerged vegetation provides an important habitat for eggs and young larvae by furnishing needed oxygen and food (Crist and Holden 1980).

The least chub is a partial and intermittent spawner. Crawford (1979) found that least chub females produced only a few eggs at any time but release eggs over an extended period. The number of eggs produced at any one time is variable and may range from about 300 to 2700 (Sigler and Sigler 1987). Although peak spawning activity occurs in May, the reproductive season lasts from April to August, and perhaps longer depending on environmental conditions. Field studies have shown that changes in photoperiod or light intensity rather than increasing water temperature initiated the onset of egg development and spawning. Least chub were found to reproduce in the marshes when temperature, alkalinity, pH, and conductivity were at a maximum. Spawning was not observed in the springs, however, the fish move back into the springs after the spawning period. These unique reproductive strategies (movement, spawning over an extended period, broad tolerances to water quality extremes, and the ability to mature in one year) allow the least chub to successfully reproduce in the strongly fluctuating environment of the spring/marsh complexes (Hickman 1989).

Least chub are thought to be opportunistic feeders, their diets being related to the abundance or availability of food items during different seasons and from different habitat types (Crist and Holden 1980; Lamarra 1982). Common food items include algae, diatomaceous material, and midge adults, larvae, and pupae (Sigler and Sigler 1987). They also eat copepods, ostracods, and

whatever invertebrates are available (Hickman 1989). Workman *et al.* (1979) found that the diet of 121 least chub collected from various areas consisted of approximately 50% insects, 30% crustaceans, and 20% algae. They observed a reduced selection of algae during the winter and spring months. The least chub is of value as a natural predator of mosquito larvae (Rees 1945, Smart 1954), although mosquito larvae appears to be a seasonal food item.

Historically, least chub inhabited a variety of habitat types in different environments, including both lotic and lentic (Lamarra 1982; Sigler and Sigler 1987). The species was typically found in association with moderate to dense vegetation and in areas with moderate to no current (Sigler and Miller 1963).

Least chub is a generalist and has broad tolerance limits to many water quality parameters which allows it to exist in the severe environment of the springs and marshes in Snake Valley (Lamarra 1982). In general, the springs where least chub are still found exhibit cool stable temperatures, relatively low, stable dissolved oxygen values, and low conductivities. The marshes display higher temperatures, conductivity, pH and dissolved oxygen than the spring areas (Hickman 1989). The marshes also exhibit wide diurnal fluctuations in dissolved oxygen due to higher productivity. The daily temperatures in the marshes can fluctuate between 15 and 32°C (59-90°F; Crist and Holden 1980). Seasonal water quality changes in the marshes and stream segments result in fish movement back and forth between different habitat types, especially between springs and marshes (Crist and Holden 1980). The presence of vegetation is an important habitat component for least chub, while substrate type appears to be insignificant (Crist and Holden 1980). Habitat usually consists of a small spring, pond or slough with a variety of herbaceous emergent, floating, and submergent vegetation. Vegetation most commonly associated with least chub includes: bullrush (*Scirpus sp.*), sedges (*Carex spp*), cattails (*Typha sp.*), duckweed (Iemnaceae), rushes (*Juncus spp.*), watercress (*Nasturtium officinale*), grasses (Graminae) and algae. Additional species of vegetation found associated with the Snake Valley populations include saltgrass (*Distichilis spicata*), Elodea (*Elodia*), pondweed (*Xanthium spinosum* and *strumarium*), giant reed (*Phragmites*) and sandbar willow (*Salix sp.*). The occurrence of least chub populations in Snake Valley is ecologically intriguing because it has evolved life history traits that enable them to survive in isolated springs of high salinity and temperature.

STATE-WIDE CONSERVATION

Least chub historically and currently occur in two major geographically isolated areas in the Utah portion of the Bonneville Basin; in the West Desert and along the Wasatch Front. These areas have been separated into three geographic management units (GMU's) (Figure 1) that are based on hydrologic subregions (USGS 1974). These units include the West Desert Management Unit, Sevier River Management Unit, and Wasatch Front Management Unit. For the purpose of this document and to facilitate prioritization and implementation of necessary actions for the conservation of least chub, details of threats, goals, objectives and actions have been described separately within these GMU's. This section describes the general problems and threats facing least chub, and at the statewide level, how these threats will be eliminated and/or reduced as well as other actions that are required to conserve least chub in Utah.

PROBLEMS FACING THE SPECIES

The success of any conservation or recovery program depends on eliminating or reducing the impact of activities that threaten the species existence. In the proposed rule to list the least chub as an endangered species (60 FR 50518), the FWS identified and described pertinent problems and threats facing the least chub. These threats were identified based on the criteria for Federal listing as required by Section 4(a)(1) of the ESA. The following discussion summarizes the significant threats to least chub that will be addressed by conservation actions as described in this Strategy.

(1) *Present or Threatened Destruction, Modification, or Curtailment of its Habitat or Range*

Habitat loss and degradation have been indicated as major causes of the declines in least chub populations and distribution (Holden *et al.* 1974; Hickman 1989; Crist 1990). Although no studies have been made of the springs occupied by least chub, numerous other reports link livestock trampling and grazing with fish habitat degradation (water quality, vegetation type, habitat morphology, etc.) in streams and springs (Duff 1977; Fleischner 1994; May and Somes 1981; Taylor *et al.* 1989). The majority of occupied and unoccupied habitats are currently not protected against grazing practices, and those that are have only recently been fenced.

Water levels have been identified as important in the life history of least chub (Lamarra 1981; Crist and Holden 1990). Interest has been expressed in water development and mining activities within Snake valley. These activities could significantly lower the water table, possibly drying up or lowering the water level in springs and marshes populated by least chub. These springs are dependent on underground water sources which flow from the Deep Creek Mountains to the west side of the Valley. Several water development activities (e.g. irrigation practices) have also altered the habitat of least chub along the Wasatch Front. Most springs along the Wasatch Front have been significantly altered as a result of diversion, capping and pumping activities.

(2) *Predation, Competition, and Disease*

Hickman (1989) considered least chub to be "constantly threatened" by the introduction and presence of nonnative species. Surveys of spring complexes indicate that where nonnative fishes were introduced, few if any least chub remain (Osmundson 1985). Introduced game fishes, including largemouth bass (*Micropterus salmoides*), rainbow trout (*Oncorhynchus mykiss*), common carp (*Cyprinus carpio*), and brook trout (*Salvelinus fontinalis*) are predators on least chub, and these species have been regularly stocked into least chub habitat (Workman *et al.* 1979; Sigler and Sigler 1987; Osmundson 1985; Crist 1990). In addition to game fish, other nonnative fishes also have been released into least chub habitat. The mosquitofish (*Gambusia affinis*), rainwater killifish (*Lucania parva*), and plains killifish (*Fundulus zebrinus*) have been introduced into least chub habitats, have similar diets to the least chub and are considered potential competitors. The mosquitofish poses a direct threat to the least chub because of its known aggressive predation on eggs and young of other fishes (Meffe 1985; Sigler and Sigler 1987).

Other potential predators on least chub include frogs, ducks, gulls, herons, and egrets

(Osmundson 1985; Sigler and Sigler 1987). Under normal situations, predation from these sources would not negatively affect healthy populations of least chub. However, the effects of predation from the above combined sources could result in further depletions of already fragile populations.

Disease or incidence of parasitism are not presently major factors affecting least chub. However, a single parasite called blackspot (*Neascus cuticola*) is known to infest least chub, although all infested least chub examined appeared to be robust and in good condition (Workman *et al.* 1979).

(3) *Over utilization for Commercial, Recreational, Scientific, or Educational Purposes*

Over utilization for commercial, recreational, scientific or educational purposes does not pose a threat to least chub.

(4) *Other Natural or Human Induced Factors Affecting the Continued Existence of Least Chub*

Hybrid introgression between least chub and the Utah chub (*Gila atraria*) and speckled dace (*Rhinichthys osculus*) has been reported (Behnke 1985). Reproductive isolating mechanisms have apparently broken down in some areas due to habitat alteration and degradation. This has resulted in overlaps of reproductive niches and breakdowns of behavior due to overcrowding (Crawford 1979; Lamarra 1981). Least chub hybrids have been reported from springs near Callao, Utah, where they once existed (Behnke 1985).

Another potential threat to the least chub is a proposed mosquito abatement program for Juab County. The Bureau of Land Management has rejected the County's request to implement a mosquito control spraying program in marsh and spring areas on BLM administered lands. The rejection does not prevent the county from spraying on privately owned lands. The effect of a mosquito control spraying program on least chub is uncertain. Past studies (Workman *et al.* 1979) indicate that much of the least chub diet is composed of insects, including mosquito larvae. To date, no studies have been undertaken to determine the effects of chemical toxins on the least chub or its environment.

STATE-WIDE GOAL AND OBJECTIVES

It is the goal of this strategy to ensure the continued persistence and genetic integrity of least chub within its natural range in Utah by describing specific actions and strategies required to expedite implementation of conservation measures. Objectives to meet the goal of this program are based on the historic range of the species. This format ensures that conservation actions are not limited to areas where least chub currently exist that may reflect habitat refugia rather than habitat preference.

The following two objectives will be required to attain the goal of this strategy.

Objective 1: To eliminate or significantly reduce threats to least chub and its habitat to the

greatest extent possible.

Objective 2: To restore and maintain a minimum number of least chub populations throughout its historic range within the three GMUs that would ensure its continued existence.

STATE-WIDE ACTIONS

The following section outlines a general list of actions that will eliminate or reduce threats to least chub. Each general action includes a list of specific activities which may be implemented, either at a statewide level or site specific within a GMU. Because the potential for least chub restoration varies between least chub populations, most actions will be prioritized and implemented within the GMUs as described in the next section.

(1) *Determine baseline least chub population, life history, and habitat requirement data (Additional Surveys)*

a. Locate and assess additional least chub populations and confirm known population status.

Specific Statewide Actions

➤ Identify potential habitat of least chub using aerial videography.

Areas of priority include:

Snake Valley Subunit	Tule Valley Subunit
Lower Sevier River Subunit	Weber River Subunit
Goshen Valley Subunit	Skull Valley Subunit
West Desert Subunit	Tooele Valley Subunit

b. Analyze habitat fragmentation to determine the degree of connectivity required for metapopulation persistence.

c. Identify additional habitat and life-history requirements and conditions through surveys and studies of hydrologic, hydraulic, biological and watershed features.

- * wetland/spring condition, water quality
- * flow quantity, water levels
- * sympatry and macro invertebrate/micro invertebrate community composition and ecology

d. Determine the number of individuals and habitat requirements needed to maintain a

viable population.

(2) *Determine and maintain genetic integrity (Genetic Analysis)*

This action will be implemented as a statewide action.

- a) Conduct genetic surveys to determine relatedness of least chub populations

Specific Statewide Actions:

- Collect genetic samples from all known populations of least chub
- Genetically analyze all samples to determine relatedness within and between least chub populations

- b) Establish introduction, reintroduction, and transplant protocols based on criteria of maintaining genetic integrity and maximizing genetic variability.

- c) Conduct genetic surveys to determine if any hybridization has occurred between least chub and other species of fish (e.g. speckled dace).

(3) *Enhance, maintain, and protect habitat (Habitat Enhancement)*

- a) Enhance and/or restore habitat conditions in designated areas throughout the historic range of least chub. Actions may include bank stabilization, riparian/spring fencing and sustainable grazing practices.

- b) Maintain and restore where possible the natural hydrologic characteristics and water quality.

- c) Protect and enhance (via land use changes) habitat using land acquisition, conservation easements or regulatory mechanisms (e.g. memorandums of understanding).

(4) *Selectively control nonnative species (Nonnative Control)*

- a) Determine where detrimental interactions, such as predation, competition, hybridization, or disease occur or could occur.

- b) Control or modify stocking, introductions, and spread of nonnative aquatic species where appropriate.

- c) Eradicate or control detrimental nonnative fish where feasible. Targeted species may include mosquitofish, some species of trout, carp, and other piscivorous warmwater fish species.

(5) *Expand least chub populations and distribution through introduction or reintroduction from either transplanted least chub or least chub raised in a designated hatchery facility (Reintroduction)*

- a) Establish additional populations through reintroduction and introductions as per protocols established under 2b .
 - b) Identify and develop brood stock sources including identification and taking of wild sources, and hatching and rearing facilities.
 - c) Restore least chub populations to minimum viable sizes in appropriate areas.
- (6) *Monitor populations and habitat (Monitoring)*
- a) Revise and implement population and habitat monitoring protocol to determine program effectiveness.
 - b) Evaluate conditions of populations and habitat using baseline data (See 1a)
 - c) Maintain least chub database
- (7) *Develop a mitigation protocol for proposed water development and future habitat alteration, where needed (Mitigation)*
- a) Impacts from existing and proposed watershed development that affects least chub habitat will be assessed and mitigation will be determined on a case-by case basis. In some areas, habitat restoration will offset negative affects of grazing, road construction and water development projects.

CONSERVATION WITHIN GEOGRAPHIC MANAGEMENT UNITS

Three GMU's have been identified for describing threats and actions for least chub; West Desert GMU, the Wasatch Front GMU, and the Sevier River Basin GMU (Figure 1). These units have been further divided into subunits consistent with the United States Geographic Services hydrological description of Utah (USGS 1974) to assist in describing threats and prioritizing conservation measures to be implemented. These subunits have been assigned a name by UDWR with a corresponding USGS accounting code as shown in Table 2.

WEST DESERT GEOGRAPHIC MANAGEMENT UNIT

This unit comprises nine hydrologic subunits (Table 1), six of which have been prioritized for conservation actions (Table 2). Known populations of least chub that currently exist in this GMU are described below.

Snake Valley Subunit is located between the Deep Creek Mountains and the Confusion Range. High priority areas within Snake Valley where least chub currently occur include Bishop Spring Complex (Central Spring, and West and East Twin Springs), Foote Reservoir, Gandy Salt Marsh spring complex, Leland Harris spring complex, and Miller Spring. Historic records of least chub have also been recorded in the Callao Spring and the Redden Spring complexes.

Tule Valley Subunit is located between the House Range and the Confusion Range in Juab County. Tule Valley consists of several spring complexes that have been designated as high priority areas. These include South and North Tule Spring, Willow Spring and Coyote Spring.

In the West Desert Subunit, least chub is only known to occur in Ibapah Valley. Ibapah Valley is located northwest of the Deep Creek Mountains in Tooele County and extends into Nevada. This area consists of Ibapah Spring complex and springs in the vicinity of Blue Lake. Ibapah Springs are also associated with several stream reaches including Deep Creek, West Creek, East Creek, and Middle Creek. Blue Lake springs include East Spring, West Spring, North Radio Tower Spring, and South Radio Tower Spring.

Threats

(1) Habitat Degradation:

The major threat in this GMU is loss of habitat due to livestock grazing, the threat of oil and gas exploration, alteration of wetland/spring complexes, and accelerated succession of spring complexes. Livestock grazing specifically impacts the habitat by trampling shorelines, reducing vegetation, and decreasing water quality. Oil and gas exploration may lead to decrease in water quality and water contamination. Alterations to wetland/spring habitat that include diversions for agricultural or municipal purposes is currently a significant threat, particularly in the Bishop Springs complex.

(2) Detrimental Interactions:

Several nonnative fish species (mosquitofish, largemouth bass, carp, and rainbow trout) have been introduced into some of the subunits for purposes ranging from mosquito abatement to sportfishing. Competition and predation by nonnative species has significantly impacted least chub populations and continues to present a threat.

Actions

(1) Additional Surveys:

Actions will include identification of areas with available suitable least chub habitat. Areas with suitable habitat will be surveyed for the presence or absence of least chub.

General Actions:

- Identify and survey areas of suitable least chub habitat

(2) Habitat Enhancement:

Actions will include identification of public and private lands available for land acquisition, conservation easements, exclosures, wetland re-vegetation and water quality improvements.

General Actions:

- Identify other areas where habitat enhancement actions are needed

(3) Nonnative Control:

Priority actions will consist of determining where, if any, detrimental interactions occur. If any are identified, actions will focus on eradication of detrimental nonnative fish; where feasible, and control nonnative fish to the maximum extent possible where eradication is not possible.

General Actions:

- Identify areas where detrimental interactions occur
- Implement nonnative control activities

(4) Reintroduction:

Identification of suitable reintroduction sites for least chub will be the primary focus of actions.

General Actions:

- Identify possible reintroduction sites

(5) Monitoring:

Monitoring protocols are currently being evaluated and revised for the West Desert populations of least chub. Any new populations or reintroduced populations will be incorporated into the revised monitoring program.

WASATCH FRONT GEOGRAPHIC MANAGEMENT UNIT

This unit comprises eleven hydrologic subunits (Table 1), six of which have been prioritized for

conservation actions (Table 2). Subunits where historic records of least chub and in some cases where empirical evidence suggests that least chub historically occurred include: Utah Lake, Spanish Fork, Provo River, Jordan River, and in the Lower Weber River. The only known population of least chub in this GMU is in the Utah Lake Subunit near the town of Mona.

Threats

(1) Habitat Degradation:

The major threat in this area is loss of habitat due to human growth and water development for municipal and agricultural purposes. Agricultural areas and mountain foothills have been converted into neighborhoods and wetland areas in the valleys have been drained and diked. Water development projects have caused a reduction in habitat due to decreased water levels.

(2) Detrimental Interactions:

Several nonnative fish species have been introduced into these areas for purposes of mosquito abatement and sportfishing. Competition and predation by nonnative species have significantly impacted least chub populations and will continue to present a threat.

Actions

(1) Additional Surveys:

Currently, it is not known how much suitable least chub habitat is available within the historic range in this GMU. Actions will initially focus on identification of areas with available least chub habitat. Areas with suitable habitat will be surveyed for the presence or absence of least chub and other fish species.

General Actions:

- Identify additional areas with suitable least chub habitat
- Survey areas that are suitable least chub habitat
- Survey all areas where historic locality information exists

(2) Habitat Enhancement:

Once suitable least chub habitat has been identified, actions will focus on identification of public and private lands available for land acquisition, conservation easements, or enclosures, wetland revegetation and water quality improvements.

General Actions:

- Identify areas where habitat enhancement actions are needed
- Implement acquisition or conservation easement of known habitat

(3) Nonnative Control:

Eradication of detrimental nonnative fish will be implemented where feasible and controlled to the maximum extent possible where eradication is not possible. Several species have already been targeted for control and/or eradication including mosquitofish, killifish and in some cases nonnative sportfish and forage fish. Also, public education on

the benefits of ecosystem integrity, detrimental effects of nonnative introductions and disease transmission may reduce these threats.

General Actions:

- Determine other areas where detrimental interactions occur
- Plan and Implement other nonnative control activities

(4) *Reintroduction:*

Once suitable habitat has been identified and actions have been taken to secure an area, least chub will be reintroduced. Fish stocked will be provided either by appropriate brood stock from wild sources or from designated rearing facilities.

General Actions:

- Identify possible reintroduction sites

(5) *Monitoring:*

Monitoring protocols are currently being evaluated and revised for the West Desert populations of least chub. Any new populations identified or reintroduced will be incorporated into the revised monitoring program.

General Actions:

- Incorporate new populations into the revised monitoring program

(6) *Mitigation:*

Impacts from existing and proposed development activities that affect least chub habitat will be assessed and mitigation will be determined on a case-by case basis. In some areas, habitat restoration will offset negative affects of grazing, road construction and water development projects.

SEVIER RIVER GEOGRAPHIC MANAGEMENT UNIT

This unit is comprised of nine hydrologically distinct subunits (Table 1), five of which have been prioritized for conservation actions (Table 2). Water in the Sevier River Basin historically flowed into pluvial Sevier Lake, but for the most part is currently diverted for agricultural purposes. The only population known to occur in this GMU occurs in the Lower Sevier River subunit north of Sevier Bridge Reservoir (Yuba Reservoir).

Threats

(1) *Habitat Degradation:*

The major threat in this area is loss of habitat due to livestock grazing and water development for municipal and agricultural purposes. Livestock grazing specifically impacts the habitat by trampling banks, reducing vegetation, and decreasing water quality. Habitat alteration has caused significant losses in habitat due to wetlands being filled or drained to create additional land for agriculture and development. Water development projects have caused a reduction in habitat due to decreased water levels, capping and drying of spring complexes.

(2) *Detrimental Interactions:*

Several nonnative fish species have been introduced into these areas for purposes ranging from mosquito abatement to sportfishing. Competition and predation by nonnative species has significantly impacted least chub populations and continues to present a threat in this unit.

Actions

(1) *Additional Surveys:*

Actions will include identification of areas with available least chub habitat. Areas with suitable habitat will be surveyed for the presence or absence of least chub.

General Actions:

- Identify and conduct surveys of potential least chub habitat

(2) *Habitat Enhancement and Protection:*

Actions will include identification of public and private lands available for conservation easements and enclosures, acquisition, wetland re-vegetation and water quality improvements.

General Actions:

- Acquisition of property where least chub population(s) exist or
- Establish conservation easements to protect vital areas of habitat or
- Construct enclosures to protect vital areas of habitat
- Conduct habitat and water quality improvement projects

(3) *Nonnative Control:*

Eradication of detrimental nonnative fish will be implemented where feasible and controlled to the maximum extent possible where eradication is not possible from suitable habitat where least chub could be reintroduced. Several species have already been targeted for control and/or eradication including mosquitofish, killifish and in some cases nonnative sportfish and forage fish. Also, public education on the benefits of ecosystem integrity and detrimental effects of nonnative introductions and disease transmission may reduce these threats.

General Actions:

- Determine areas where detrimental interactions occur
- Implement nonnative control activities

(4) *Reintroduction:*

Identification of suitable reintroduction sites for least chub are ongoing. No sites have been targeted for population enhancement of least chub. It is anticipated that once additional surveys have been completed, suitable sites for reintroduction will be identified. UDWR is currently evaluating the feasibility of developing brood stock from wild sources in rearing facilities. Once brood stock needs have been identified, a source will be established.

(5) *Monitoring:*

Monitoring protocols are currently being evaluated and revised for the West Desert populations of least chub. The current population in the Sevier River Drainage as well as any new populations or reintroduced populations will be incorporated into the revised monitoring program.

(6) *Mitigation:*

Impacts from existing and proposed development activities that affect least chub habitat will be assessed and mitigation will be determined on a case-by-case basis. In some areas, habitat restoration will offset negative affects of grazing, road construction and water development projects.

Table 1: Summary of GMU Subunits

GMU	SUBUNIT	SUBUNIT CODE (USGS 1974)	PRESENCE OF LC POPULATIONS	
			CURRENT	HISTORIC
West Desert	Snake Valley	16020301	X	X
	Pine Valley Wash	16020302		
	Tule Valley	16020303		
	Tooele Valley	16020304		X
	Skull Valley	16020305		
	West Desert	16020306	X	
	W. Great Salt Lake	16020308		
	N. Great Salt Lake	16020309		
	Great Salt Lake	16020310		
	Wasatch Front	Upper Bear River	16010101	
Bear Lake		16010203		
Middle Bear River		16010202		
Logan River		16010203		
Lower Bear River		16010204		X
Upper Weber River		16020101		
Lower Weber River		16020102		X
Utah Lake		16020201	X	X
Spanish Fork River		16020202		
Provo River		16020203		X
Jordan River		16020204		?
Sevier River	Upper Sevier River	16030001		
	East Fork Sevier River	16030002		
	Middle Sevier River	16030003		
	San Pitch	16030004		
	Lower Sevier River	16030005	X	
	Escalante Desert	16030006		
	Upper Beaver River	16030007		
	Lower Beaver River	16030008		X
	Sevier Lake	16030009		?

Table 2: Summary of Conservation Actions* to be Implemented by Geographic Management Unit priority subunits.

Subunit	Additional Surveys	Genetic Analysis	Habitat Enhancement	Nonnative Control	Reintroduction	Monitoring
WEST DESERT GMU						
Snake Valley	X	X	X	X	X	X
Tule Valley	X					
Tooele Valley	X					
Skull Valley	X					
West Desert	X	X	X	X	X	X
W. Great Salt Lake	X					
WASATCH FRONT GMU						
Utah Lake	X	X	X	X	X	X
Spanish Fork River	X					
Provo River	X					
Jordan River	X					
Lower Weber	X					
Lower Bear River	X					
SEVIER RIVER GMU						
Lower Sevier River	X	X	X	X	X	X
Lower Beaver River	X					
Upper Beaver River	X					
Sevier Lake	X					
Escalante Desert	X					

* As new populations are identified through additional surveys or created through reintroductions or translocation, other conservation actions will be identified for each subunit.

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