

A PRELIMINARY STUDY OF THE
LARGER AQUATIC PLANTS OF OKLAHOMA WITH
SPECIAL REFERENCE TO THEIR VALUE IN FISH CULTURE

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PREFACE

The main object for the presentation of this paper is to make available practical general knowledge relative to the larger aquatic plants--knowledge based upon notes gathered through the author's personal observations. The desirable and undesirable qualities, with the relative values for each plant, are given with the hope that they may be of some aid in selecting plants with which to stock a pond.

Owing to the limited time and extra expense involved, it was impossible to visit distant localities more than once. On these trips it was necessary to cover several localities each day. Thus the author has been obliged to ignore seasonal and weather changes. At times, the collecting of these plants was seriously handicapped by high water. No doubt, under these circumstances, some plants have been overlooked. This observational work was carried on chiefly during the summer and fall of both 1935 and 1936. However, the results of previous observations, extending over a period of years, have also been included.

The writer wishes to express his grateful appreciation to those who have helped him in various ways during the preparation of this paper. He is particularly indebted to Professor C. E. Sanborn for his valuable suggestions and advice; to Dr. G. W. Prescott of the Albion College, Albion, Michigan; Dr. J. M. Greenman, Curator of the Herbarium, Missouri Botanical Garden, St. Louis, Missouri; Dr. C. A. Weatherby, Assistant Curator, Gray Herbarium, Harvard

University, Cambridge, Massachusetts; Mr. C. E. Ogden of the Gray Herbarium, Harvard University, Cambridge, Massachusetts; Dr. E. J. Alexander, Assistant Curator, the New York Botanical Garden, New York City, New York; and Professor Robert Stratton of the Botany Department, Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma, for aid on the identification of plant specimens and for valuable criticism.

Most of the photographs were made from specimens collected by the writer; however, some were made from material previously collected by other workers. The writer is indebted to the botany departments of the University of Oklahoma at Norman and the Agricultural and Mechanical College at Stillwater, for the use of their herbarium specimens and for the privilege of photographing them. He is especially grateful to his wife, Lillian Marie, for her aid in developing and printing these photographs, to his father and to his late sister, Mary Adelaide Spicer, for the assistance which they gave him in gathering the plants. To the memory of his sister this work is dedicated.

CONTENTS	PAGE
DISCUSSION OF ECONOMIC VALUES, INTRODUCTION . . .	I
DISTRIBUTION AND ECONOMIC IMPORTANCE	9
SUMMARY OF SPECIES WITH OUTSTANDING VALUES . .	129
PLATES	134
LIST OF PLANTS USED TO DETERMINE DISTRIBUTION	154
BIBLIOGRAPHY	193
INDEX, SCIENTIFIC NAMES	195

DISCUSSION OF ECONOMIC VALUES

INTRODUCTION

In order to understand fully the part played by the larger plants in fish life, a thorough study should be made of the long chain of relations which connects aquatic plants and animals. In this chain larger aquatic plants constitute an important link. The latter form a link in the line of food relations that extends from the water and the soil to the higher fishes. Directly or indirectly plant life is necessary to the support of fish. As long as a good food supply is maintained the fish will continue to increase. It is to all of the aquatic plants that one must turn for the upkeep of this food supply.¹

Since the larger aquatic plants are so important for their food value as well as for other functions, the following discussion is devoted to them. To simplify matters and to enlighten the reader, a description of each plant has been placed upon a separate page accompanied by a photograph of the plant and a map showing its distribution in Oklahoma. In determining this distribution, plants collected by others and placed in the herbaria located at the Oklahoma Agricultural and Mechanical College at Stillwater, and at the University of Oklahoma at Norman, are designated by the letter 'O'; plants in the author's personal collection, by the letter 'P'; plants observed by the author together with

1 R. J. Pieters, *The Plants of Western Lake Erie with Observations on Their Distribution*, pp. 483-526.

others, by the letter 'X'.

In the study of each plant the following properties have been considered:

General habitat---The fluctuating water conditions found in Oklahoma make it difficult to classify aquatic plants according to their relative positions in respect to the water line. However, a rough grouping as to their places of growth will give some idea as to the particular situation of each plant. These groups interlap, especially when competition is low, making a sharp line of demarcation impossible. The following groupings give approximate locations: (1) Water's edge---Water-soaked soil to soil covered with water to a depth of eighteen inches. (2) Shallow water---Soil covered with water from a film to a depth of three feet. (3) Deep water---Soil covered with water from two feet to ten feet in depth.

Growth type---In considering the different growth types five general classifications were used. (1) Floating---The major portion of the plant, including vegetative and reproductive structures, floats freely on top of the water. (2) Wholly submersed---Vegetative and reproductive structures all appear under water. (3) Partially submersed with floating leaves---Vegetative structures are found below water, leaves floating on water, and reproductive structures either above or below water. (4) Partially submersed with aerial leafy stems---Vegetative structures are found below or above water in an upright position with reproductive struc-

tures above water. (5) Sometimes submerged with aerial leafy stems---The plant generally grows on land at the water's edge but sometimes is submerged during times of high water.

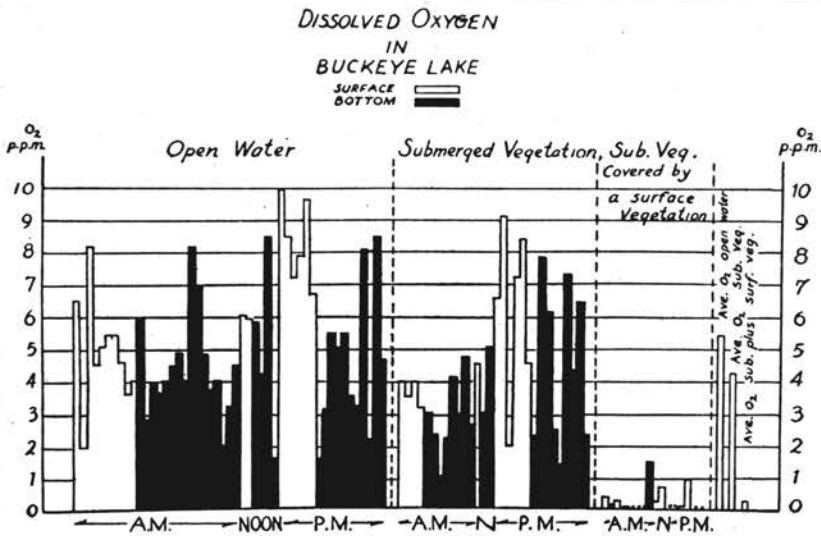
Shade---Values for shade are given the plant according to the manner in which it shields the water, and the life therein, from the rays of the sun. It should be understood that plants whose foliage completely shades the water are undesirable since they seriously lower the oxygen content of the water.

Food---Since most of the food of the game fish consists chiefly of the smaller fish and aquatic animals we cannot classify the larger aquatic plants directly as food for desirable pond fish. However, there are some fish such as the blackhead or fathead minnow, (Pimephales promelas), and the golden shiner or roach, (Notemigonus crysoleucas), that feed directly on the lower forms of plant life² and possibly on the fragments and tender shoots of the larger aquatics. This is also true of the lower forms of aquatic animal life such as the insects and entomostraca. Food ratings are given on observed relative tenderness of the plant with consideration given also to animal life found on it.

Ornamental properties---These ratings are based on the appeal which the color, fragrance, and other aesthetic qualities of the plant made to the author.

² H. S. Davis and A. H. Wiebe, *Experiments in Black Bass and Other Pondfish*, p. 185.

Oxygenator---For ratings on value as oxygenators the following graphs by L. S. Roach and E. L. Wickliff are inserted.



In the accompanying graphs, showing the dissolved oxygen in Buckeye Lake, the oxygen has been plotted in three time groups. All oxygen samples taken between 6:30 and 10:30 A.M. are placed in the A.M. groups, all samples taken between 10:30 A.M. and 1:30 P.M. are placed in the Noon group, and all samples taken between 1:30 and 6:30 P.M. are placed in the P.M. group.

The oxygen has been plotted for both surface and the bottom water in (1) open water, where no coarse vegetation was in evidence, (2) water with abundant (choked) submerged vegetation (mostly *Ceratophyllum*) and (3) water with abundant submerged vegetation and covered with a surface vegetation (mostly *Wolffia punctata*). It has been estimated by Dr. Lawrence E. Hicks of the United States Soil Erosion Service that over a million of these small *Wolffias* cover a square yard of water.

Examination of the graph giving the dissolved oxygen in the open water shows the tremendous variation in the quantity of oxygen in the same lake on different days during the same month. It also indicates that the amount of oxygen in the surface water is greater than that in the bottom water and tends to show that the average amount of oxygen is

greater in the P.M. samples than during any other time of the day.

Examination of the graphs illustrating the amount of oxygen in water choked with submerged vegetation shows the same marked variations in the daily samples. These graphs also show the increase in oxygen during the noon and P.M. samples over the A.M. samples. The bottom oxygen, of course generally falls below that of the surface.

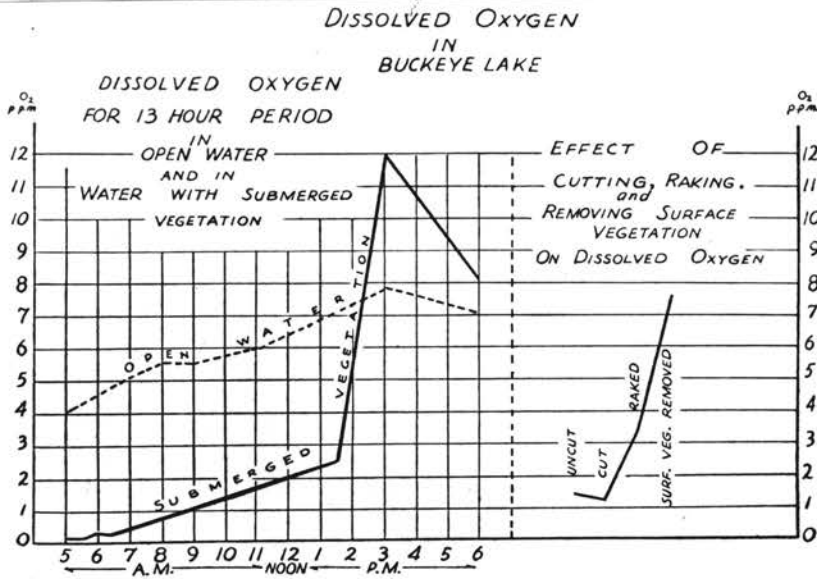
The graphs indicating the dissolved oxygen in water choked with submerged vegetation and covered with the surface vegetation are scanty but interesting. The same general rise in amount of oxygen is noticeable in the P.M. over the A.M. and Noon samples. In every case but one, the surface oxygen is higher than that of the bottom. The average of all samples taken under the surface vegetation in protected areas however, was only 0.2 ppm.

In a few areas where the breezes had a chance to ripple the water, samples were taken to determine the amount of oxygen under surface vegetation which was not so protected from the wind action. The average oxygen mounted to slightly over 2 ppm. This is another point in favor of removing the embankments thrown up by the dredge whereon cat-tails and rushes now abound.

Averages have been made of all dissolved oxygen in these three situations and the data are presented graphically. The average quantity of dissolved oxygen in the open water amounted to 5.5 ppm., as opposed to about 4.3 ppm. in water choked with submerged vegetation and 0.2 ppm. in water choked with submerged vegetation and covered with surface vegetation.

The graph showing the amount of dissolved oxygen for a thirteen hour period in open water as compared to water with submerged vegetation presents some interesting information.

The fundamental similarities in the rise and fall of oxygen in both situations are to be noted, a low point being noticeable at daybreak (about 5 A.M.) and a high point at 3 P.M. The difference in the minimum and maximum quantities of oxygen in the vegetation are extreme. At daybreak the oxygen ranged between one tenth to fifteen hundredth parts per million. In the middle of the afternoon the dissolved oxygen had risen to twelve parts per million



The effect of the night on dissolved oxygen in the vegetated areas is evident. If the conditions of the night were to be continued by a dark cloudy day the results on fish life are obvious. As it were, many fish were observed swimming at the surface of the water during the time these morning samples were taken. It so happened that some open water was available for them at the surface.³

The plant's value as an oxygenator has been determined more or less by its growth type, assuming that plants which grow wholly submersed or nearly so, are the best oxygenators; those partly submersed with few floating leaves, fair; and those with floating leaves as poor oxygenators.

Ability to increase fertility of water---Since most of the fish food is derived indirectly from the vegetable plankton that float in the water and since these organisms can receive the necessary elements only from their surroundings, it is of the utmost importance that these elements be

³ L. S. Roach and E. L. Wickliff, Relationship of Aquatic Plants to Oxygen Supply, and Their Bearing on Fish Life, pp. 372-374.

present in the water. The larger rooted aquatic plants probably play their most important role in this manner. The following quotation bears out this statement:

These rooted aquatics are important contributors to the plankton food supply, because when living they organize matter that may be used as food and in death they yield important salts and organic substances to the water. Artari (1901) finds that certain algae prefer organic nourishment, and it is quite possible that many of the forms so abundant on wounded and decaying portions of the larger plants derive considerable nourishment therefrom.⁴

The plant's rankness of growth, and the fact that it is a rooted or unrooted plant is used to determine its importance.

Ability to prevent silting and erosive wave action--- This value is based upon the following qualities: sturdiness of stem, place of growth, relative height, presence and position of matted rhizomes and the soil binding qualities of the roots. In general, the ability of the plant to retard the movement of the water determines its importance.

Protection---Large fish eat the small fish, the small fish eat the fingerlings and the fingerlings eat the fry. These smaller fish are also attacked by other animals, such as the turtle and snake. The protective value of the plant varies somewhat with the size of the plant and the size of the fish. Small fry need a plant growth that is more or less closely matted. More open vegetation of a sturdy nature is desirable as the fish grow older. This gives the

⁴ R. H. Pond, The Biological Relation of Aquatic Plants to the Substratum, p. 522.

small fish more freedom of movement and still keeps it from being an easy prey of the larger fish.

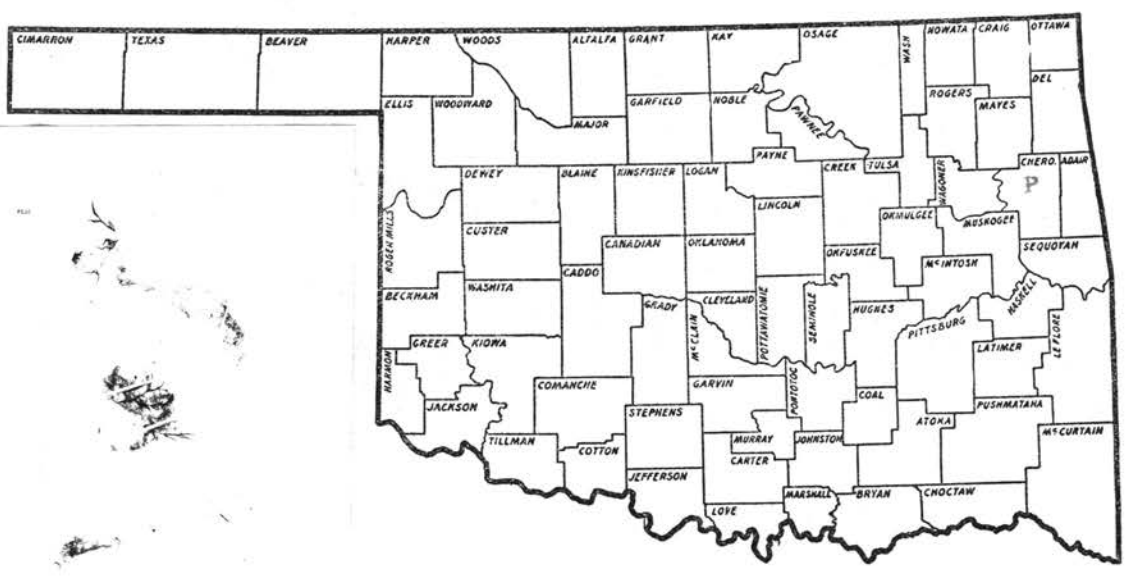
Drouth resistance---The spring and summer of 1936 offered an excellent opportunity to determine the ability of a plant to withstand drouth conditions since this period was the most severe of any on record. Ratings on drouth resistance are based on the plant's ability to remain alive at low water during the dry weather and to resume normal activity when conditions permit.

Water clarifying qualities---These qualities are determined by the rapidity with which water in ponds containing the plant clarifies as compared with ponds in the same locality that do not contain the plant.

Tolerance for turbidity---Ratings are founded upon the ability of the plant to withstand the muddying action of our lakes and streams.

The families are listed in natural sequence according to their genetic relationships with generic and specific names respectively arranged in alphabetic order.

DISTRIBUTION AND ECONOMIC IMPORTANCE



SCALE: 1:100,000
DATE: 10/1/50

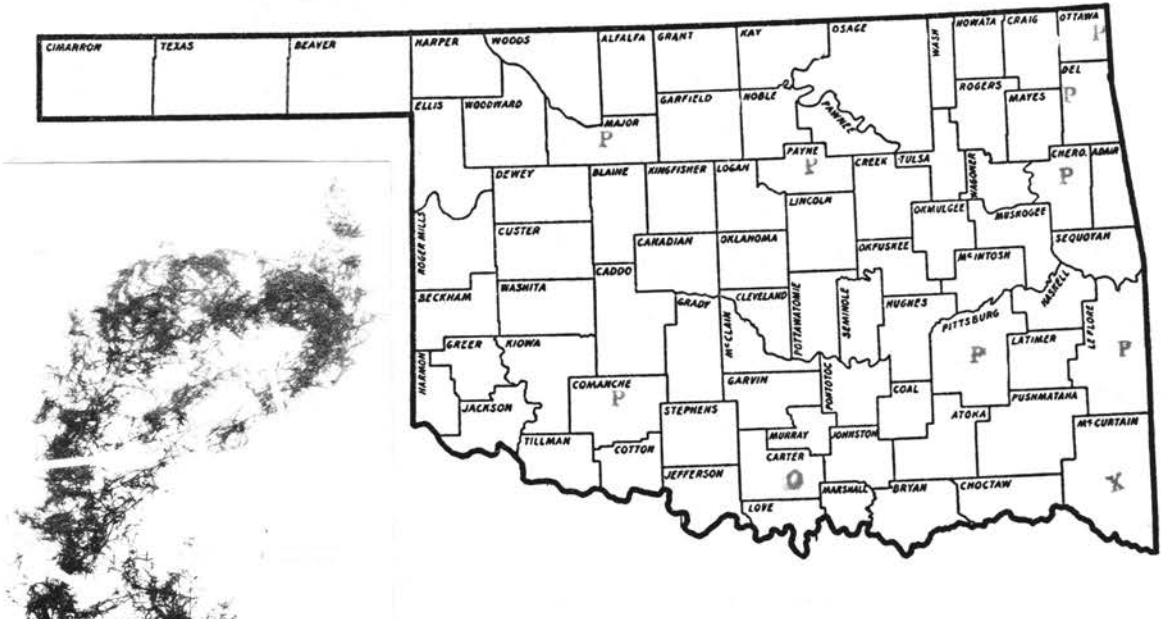
Hydrodictyaceae
Hydrodictyon
Hydrodictyon reticulatum (L.) Lagerheim

General habitat shallow water
 Growth type wholly submersed

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food. good
 Ornamental properties fair
 Value as an oxygenator. good
 Ability to increase fertility of water. poor
 Ability to prevent silting and erosive wave action. . . poor
 Protection for fry. none
 Protection for fingerlings and growing fish none
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



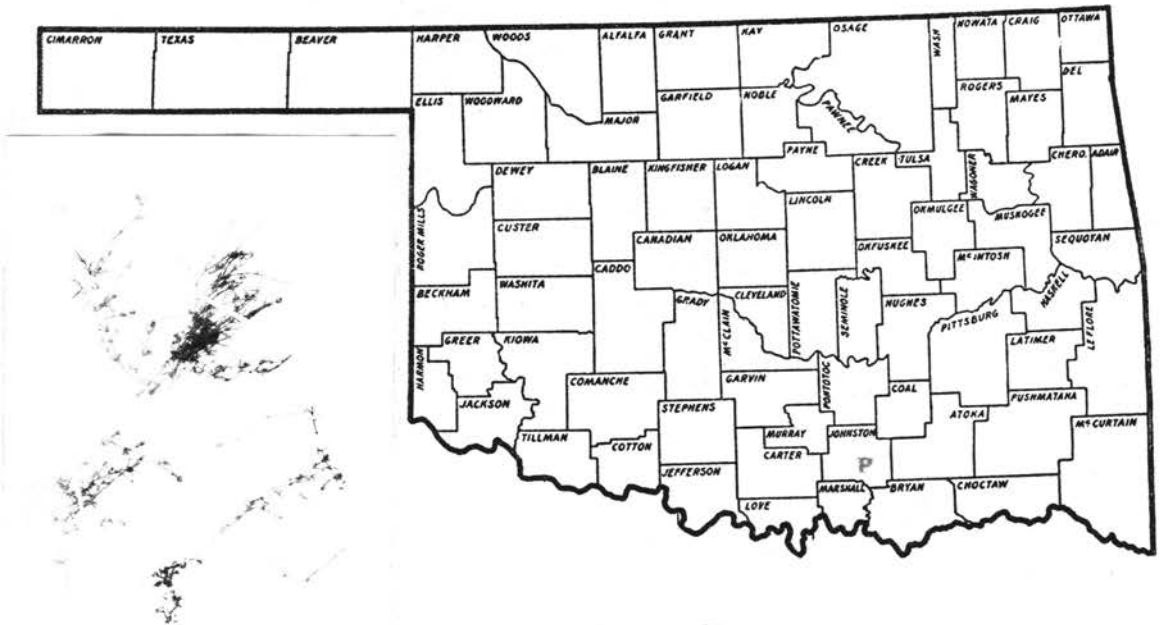
Characeae
Chara (Stonewort Family)
Chara fragilis Deavaux.

General habitat shallow water and deep water
 Growth type wholly submersed

RELATIVE VALUES IN FISH CULTURE

- Shade poor
- Food. good
- Ornamental properties poor
- Value as an oxygenator. good
- Ability to increase fertility of water. fair
- Ability to prevent silting and erosive wave action. poor
- Protection for fry. fair
- Protection for fingerlings and growing fish poor
- Drouth resistance unknown
- Water clarifying qualities. unknown
- Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



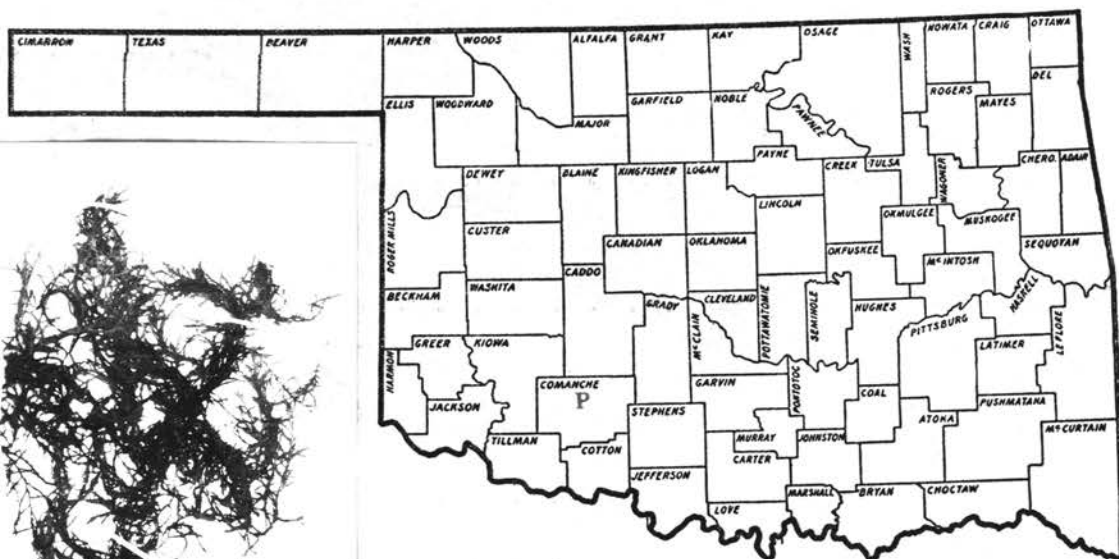
Characeae
Chara (Stonewort Family)
Chara vulgaris L.

General habitat shallow water and deep water
 Growth type wholly submersed

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food. good
 Ornamental properties poor
 Value as an oxygenator. good
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. poor
 Protection for fry. fair
 Protection for fingerlings and growing fish poor
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



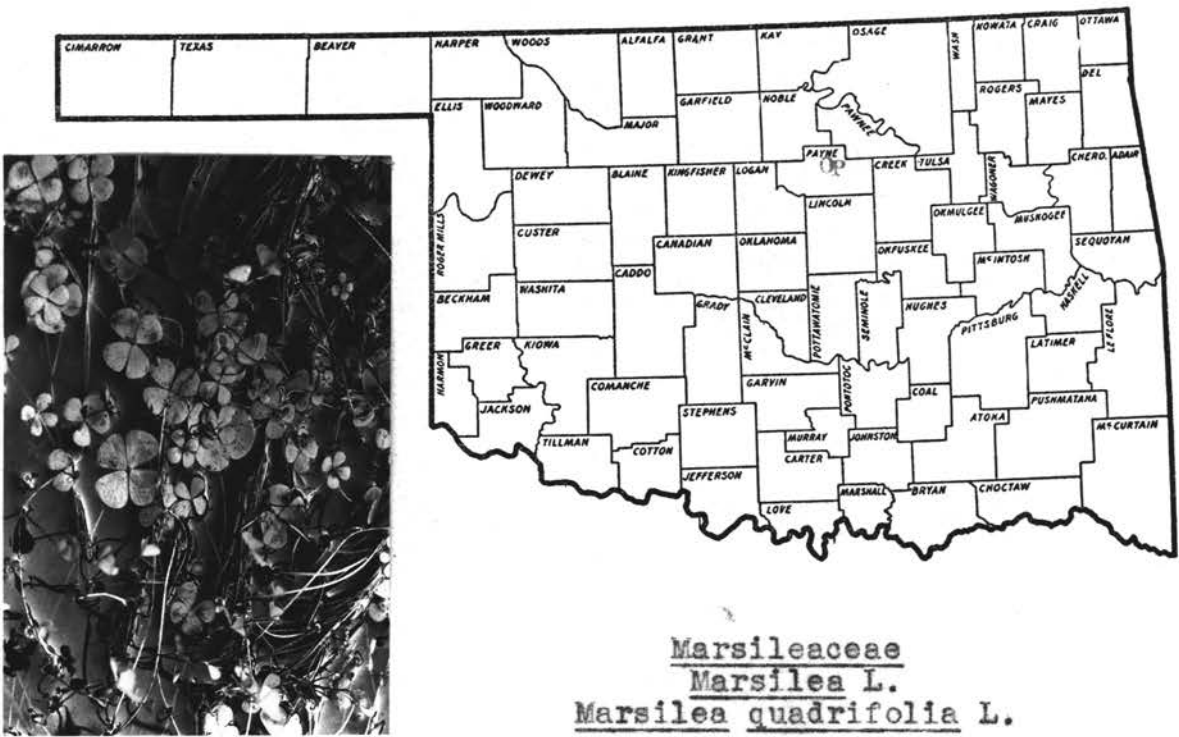
Fontinalaceae
Fontinalis (Long-stemmed water moss)
Fontinalis novae-angliae Sulliv.

General habitat shallow water
 Growth type.. . . . wholly submersed

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food. fair
 Ornamental properties fair
 Value as an oxygenator. fair
 Ability to increase fertility of water. poor
 Ability to prevent silting and erosive wave action. . . poor
 Protection for fry. poor
 Protection for fingerlings and growing fish poor
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



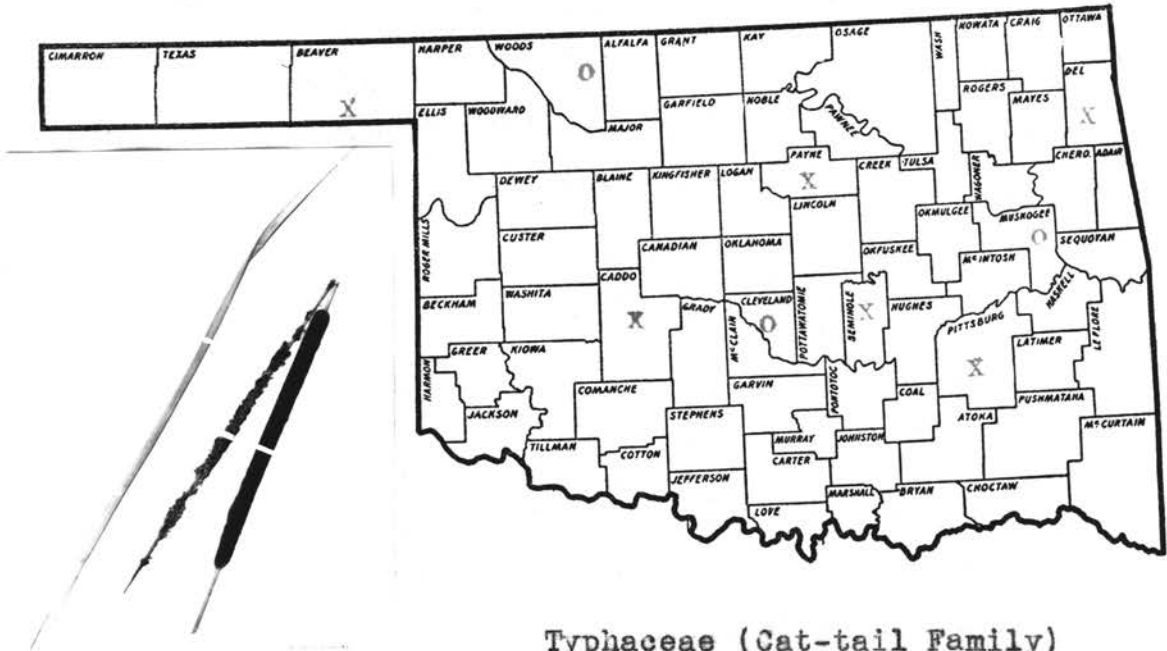
Marsileaceae
Marsilea L.
Marsilea quadrifolia L.

General habitatshallow water
 Growth type partially submersed with floating leaves

RELATIVE VALUES IN FISH CULTURE

Shade	fair
Food.	fair
Ornamental properties	fair
Value as an oxygenator.	poor
Ability to increase fertility of water.	fair
Ability to prevent silting and erosive wave action.	fair
Protection for fry.	fair
Protection for fingerlings and growing fish	poor
Drouth resistance	unknown
Water clarifying qualities.	unknown
Tolerance for turbidity	unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



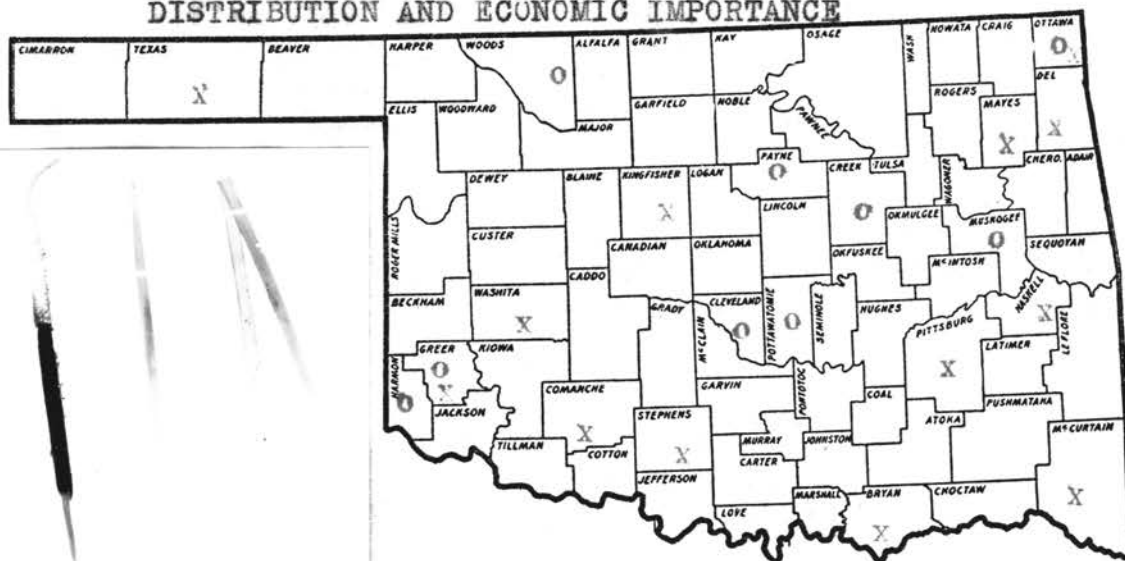
Typhaceae (Cat-tail Family)
Typha (Tourn.) L. Cat-tail Flag
Typha angustifolia L.

General habitat water's edge and shallow water
 Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade	fair
Food.	poor
Ornamental properties	fair
Value as an oxygenator.	poor
Ability to increase fertility of water.	fair
Ability to prevent silting and erosive wave action.	good
Protection for fry.	fair
Protection for fingerlings and growing fish	fair
Drouth resistance	good
Water clarifying qualities.	unknown
Tolerance for turbidity	unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



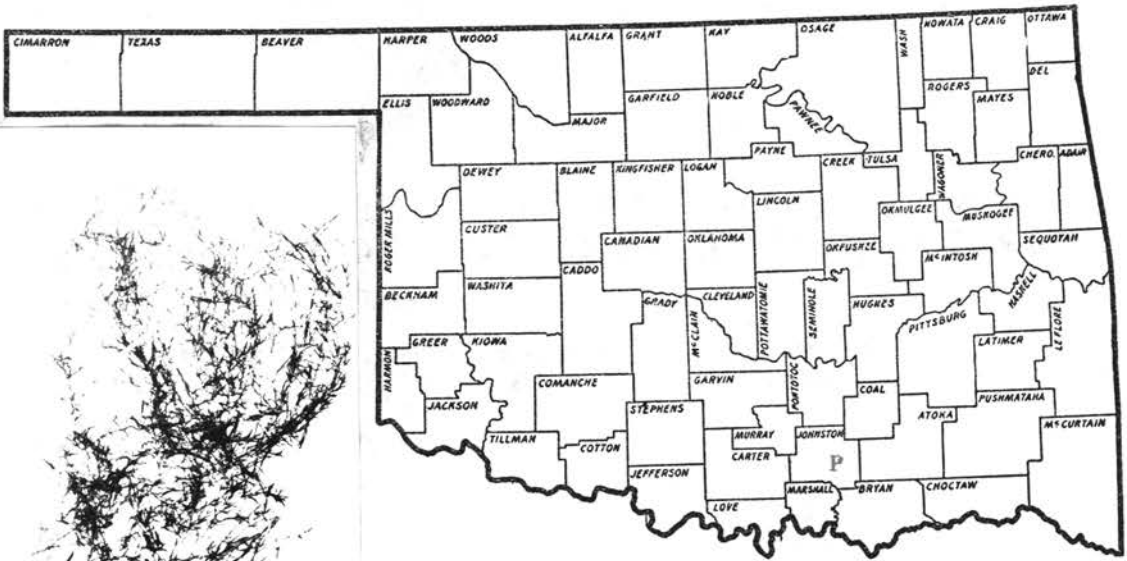
Typhaceae (Cat-tail Family)
***Typha* (Tourn.) L. Cat-tail Flag**
***Typha latifolia* L. (Common Cat-tail)**

General habitat water's edge and shallow water
 Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

- Shade fair
- Food. poor
- Ornamental properties fair
- Value as an oxygenator. poor
- Ability to increase fertility of water. fair
- Ability to prevent silting and erosive wave action. . . good
- Protection for fry. fair
- Protection for fingerlings and growing fish fair
- Drouth resistance good
- Water clarifying qualities. unknown
- Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



Naiadaceae (Pondweed Family)

Naias L. Naiad

N. flexilis (Willd.) Rostk. & Schmidt

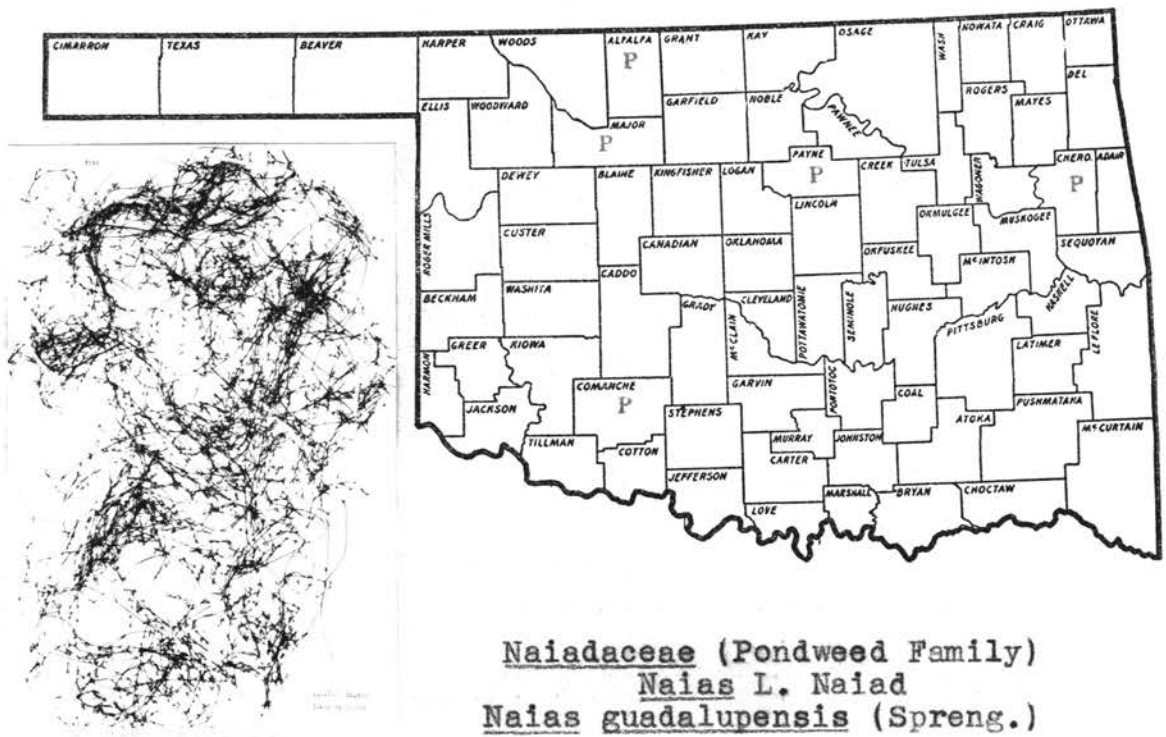
General habitat shallow water and deep water

Growth type wholly submersed

RELATIVE VALUES IN FISH CULTURE

Shade	fair
Food.	good
Ornamental properties	fair
Value as an oxygenator.	good
Ability to increase fertility of water.	good
Ability to prevent silting and erosive wave action.	fair
Protection for fry.	good
Protection for fingerlings and growing fish	fair
Drouth resistance	unknown
Water clarifying qualities.	unknown
Tolerance for turbidity	unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE

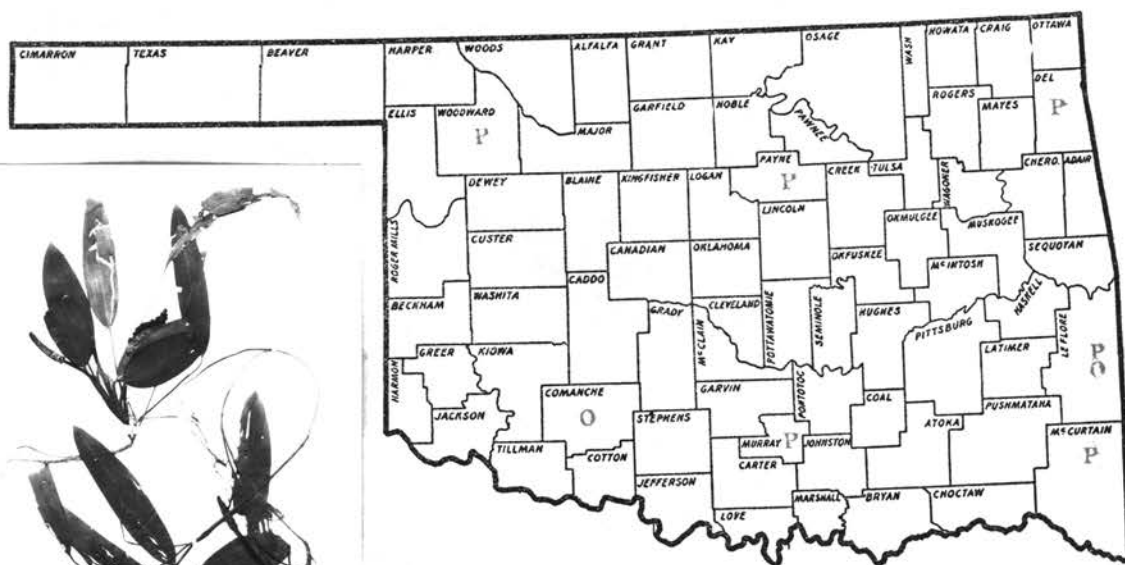


General habitat shallow water and deep water
 Growth type wholly submersed

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. good
 Ornamental properties fair
 Value as an oxygenator. good
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. fair
 Protection for fry. good
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



Naiadaceae (Pondweed Family)
Potamogeton (Tourn.) L. Pondweed
Potamogeton americanus C. & S.

General habitat shallow water and deep water

Growth type partially submersed with floating leaves

RELATIVE VALUES IN FISH CULTURE

Shade good

Food. poor

Ornamental properties fair

Value as an oxygenator. poor

Ability to increase fertility of water. good

Ability to prevent silting and erosive wave action. fair

Protection for fry. good

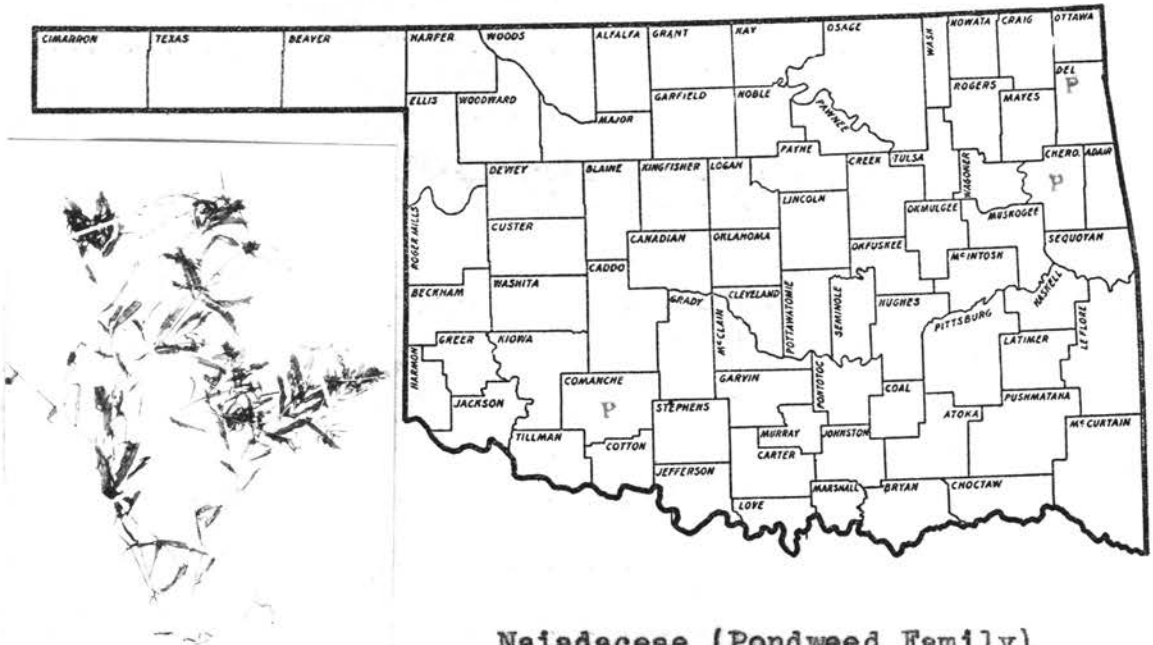
Protection for fingerlings and growing fish fair

Drouth resistance unknown

Water clarifying qualities. unknown

Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



Naiadaceae (Pondweed Family)
Potamogeton (Tourn.) L. Pondweed
Potamogeton crispus L.

General habitat shallow water and deep water
 Growth type wholly submersed

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. good
 Ornamental properties fair
 Value as an oxygenator. good
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. fair
 Protection for fry. good
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



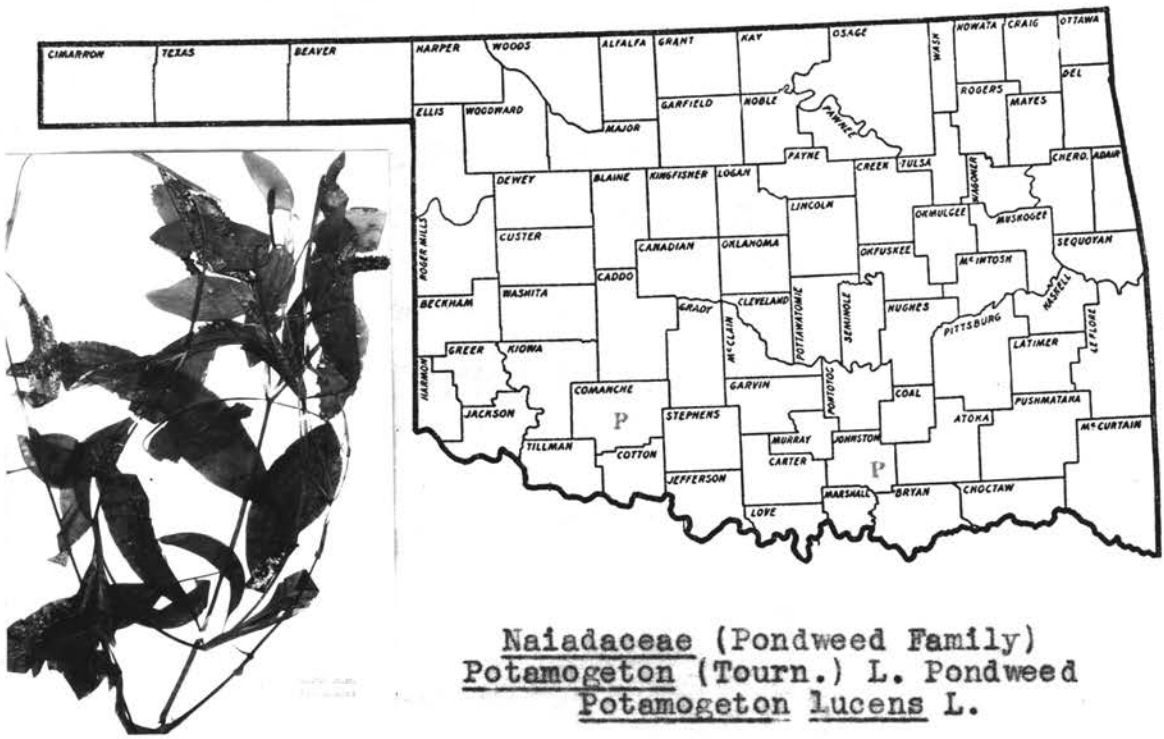
Naiadaceae (Pondweed Family)
Potamogeton (Tourn.) L. Pondweed
Potamogeton dimorphus Raf.

General habitat shallow water and deep water
 Growth type partially submersed with floating leaves

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. good
 Ornamental properties fair
 Value as an oxygenator. fair
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. fair
 Protection for fry. good
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



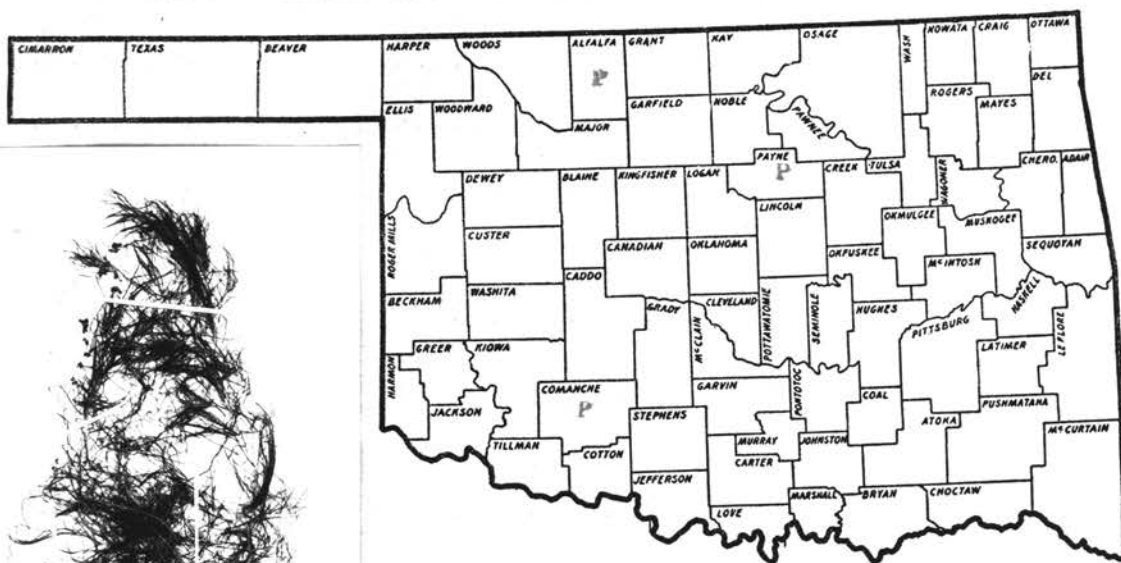
Naiadaceae (Pondweed Family)
Potamogeton (Tourn.) L. Pondweed
Potamogeton lucens L.

General habitat shallow water and deep water
 Growth type wholly submersed

RELATIVE VALUES IN FISH CULTURE

Shade	fair
Food.	fair
Ornamental properties	fair
Value as an oxygenator.	good
Ability to increase fertility of water.	good
Ability to prevent silting and erosive wave action.	fair
Protection for fry.	fair
Protection for fingerlings and growing fish	fair
Drouth resistance	good
Water clarifying qualities.	unknown
Tolerance for turbidity	unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



WATER PLANT
FAM. POTAMOGETONACEAE

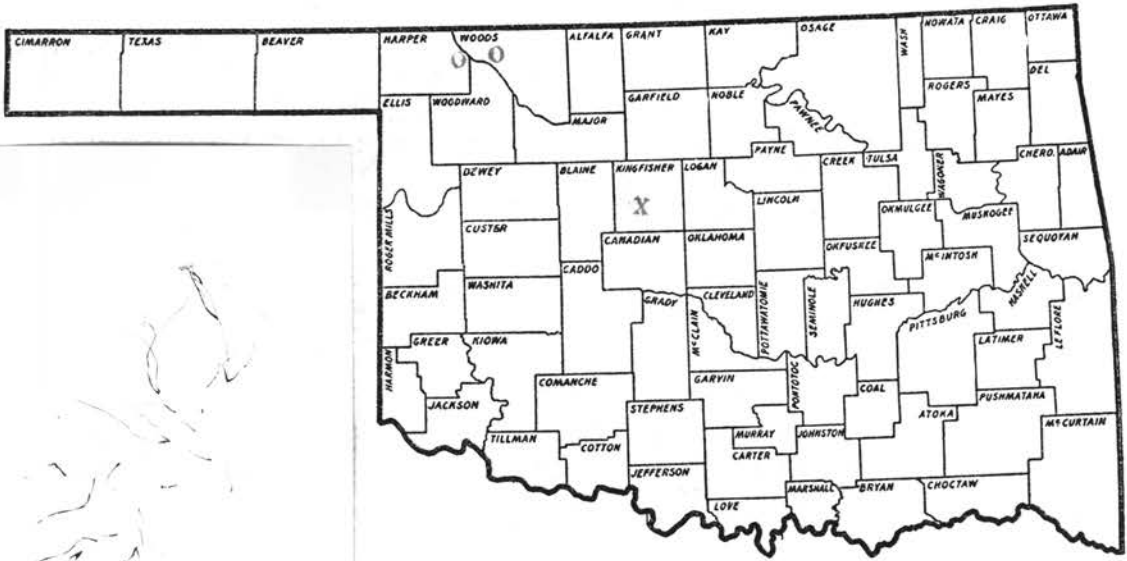
Naiadaceae (Pondweed Family)
Potamogeton (Tourn.) L. Pondweed
Potamogeton pectinatus L.

General habitat shallow water and deep water
Growth type wholly submersed

RELATIVE VALUES IN FISH CULTURE

Shade fair
Food. good
Ornamental properties fair
Value as an oxygenator. good
Ability to increase fertility of water. good
Ability to prevent silting and erosive wave action. fair
Protection for fry. good
Protection for fingerlings and growing fish fair
Drouth resistance unknown
Water clarifying qualities. unknown
Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



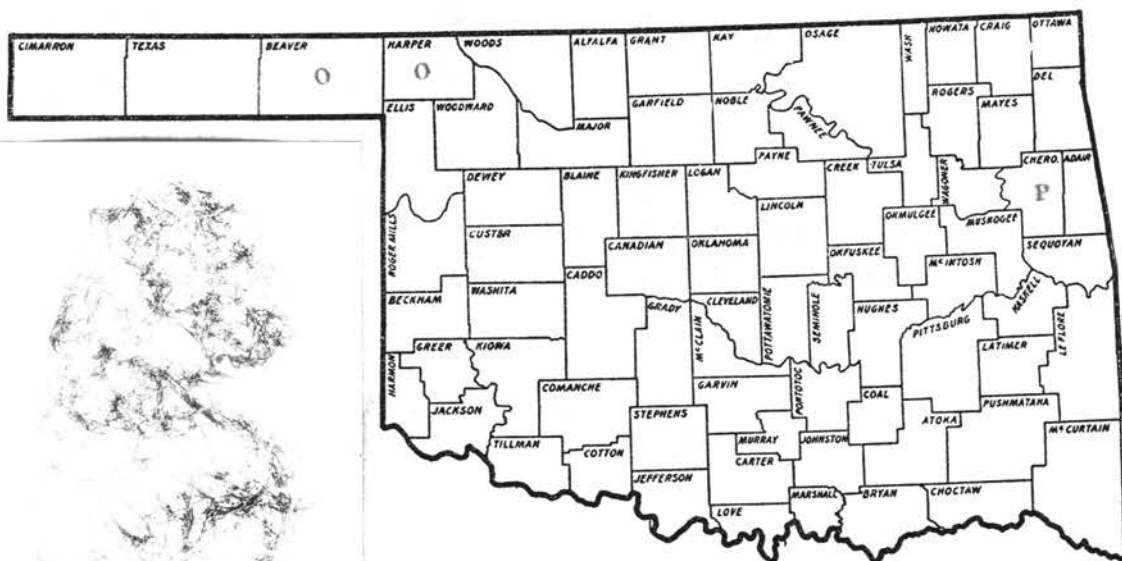
Naiadaceae (Pondweed Family)
Ruppia L. Ditch Grass
Ruppia maritima L.

General habitat shallow water and deep water
 Growth type wholly submersed

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food good
 Ornamental properties fair
 Value as an oxygenator good
 Ability to increase fertility of water fair
 Ability to prevent silting and erosive wave action poor
 Protection for fry fair
 Protection for fingerlings and growing fish poor
 Drouth resistance unknown
 Water clarifying qualities unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



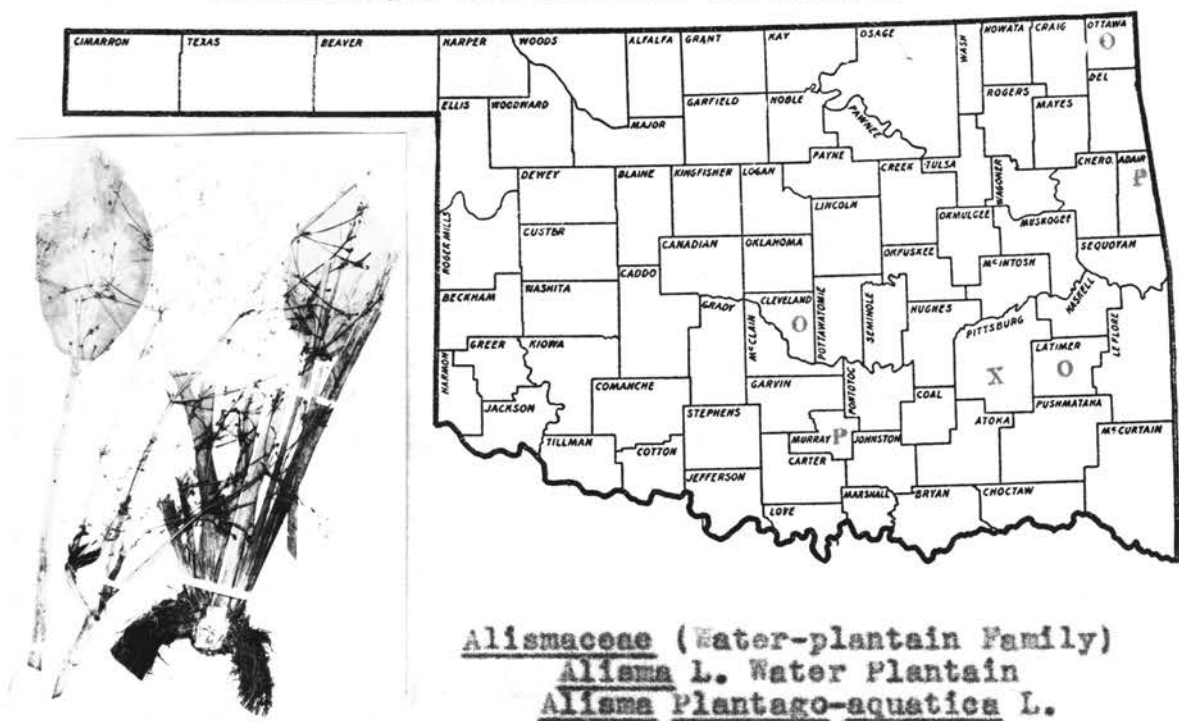
Naiadaceae (Pondweed Family)
Zannichellia (Mich.) L. Horned Pondweed
Zannichellia palustris L.

General habitatshallow water
 Growth type wholly submersed

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. fair
 Ornamental properties fair
 Value as an oxygenator. good
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . poor
 Protection for fry. good
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE

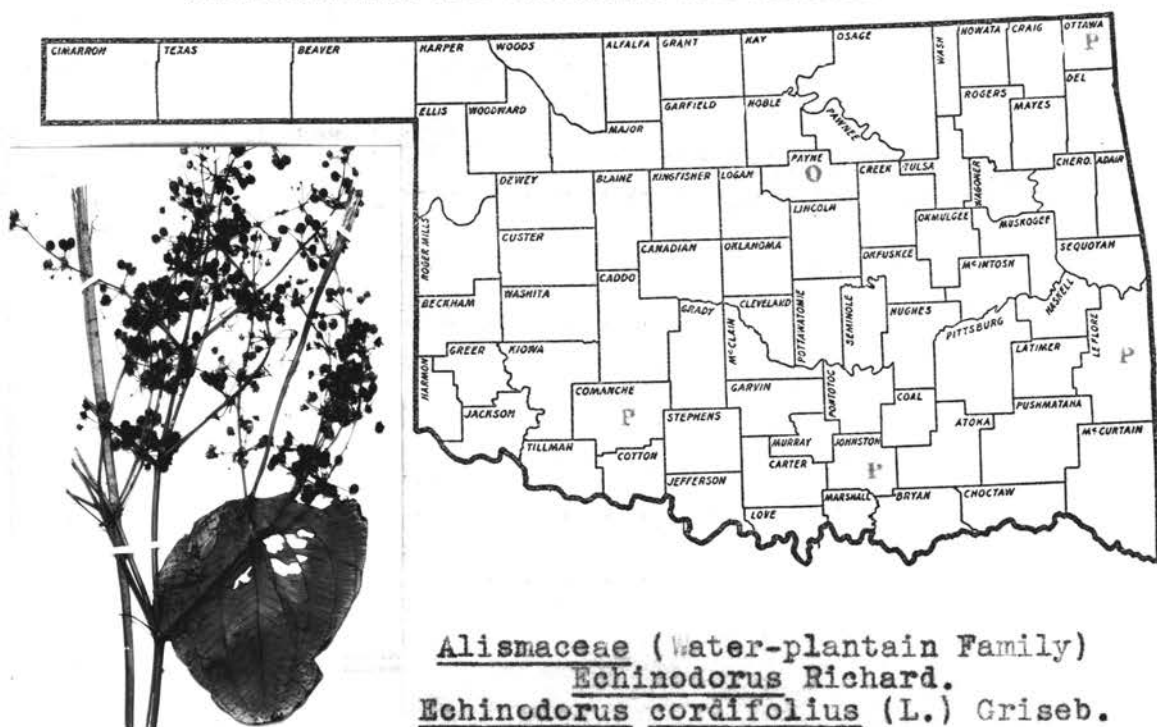


General habitat water's edge
 Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. . . good
 Protection for fry. fair
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



General habitat water's edge

Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair

Food. poor

Ornamental properties fair

Value as an oxygenator. poor

Ability to increase fertility of water. good

Ability to prevent silting and erosive wave action. . . good

Protection for fry. fair

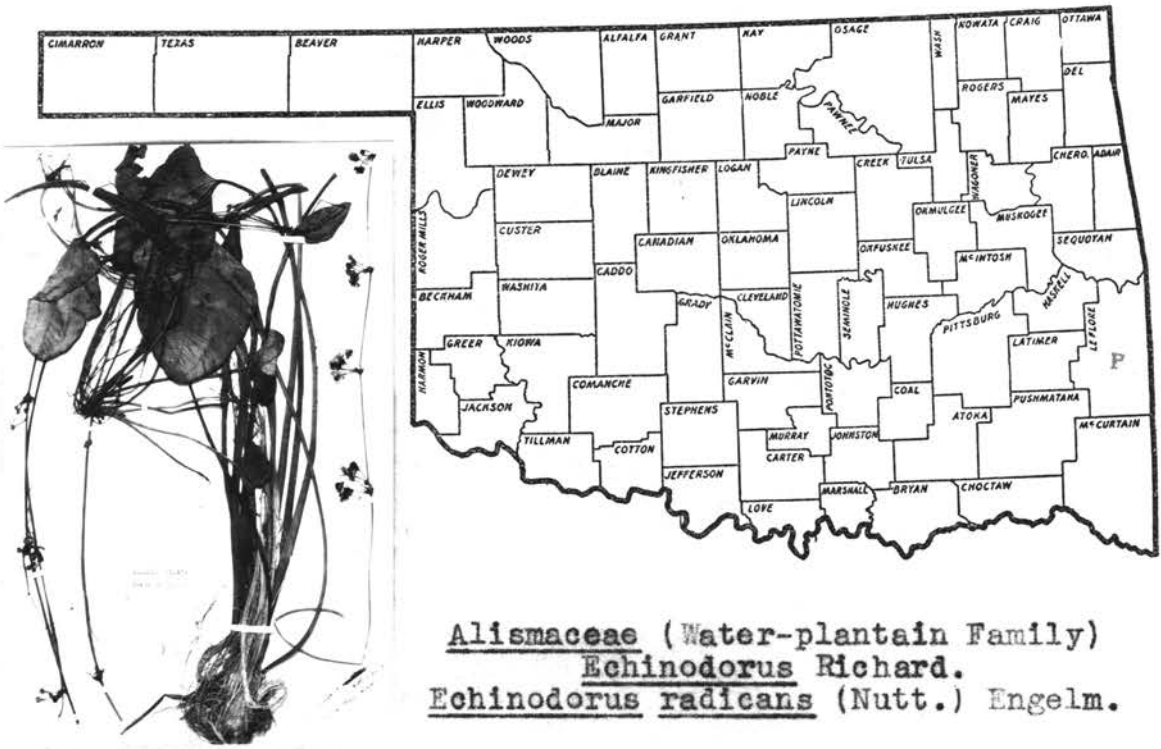
Protection for fingerlings and growing fish fair

Drouth resistance unknown

Water clarifying qualities. unknown

Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



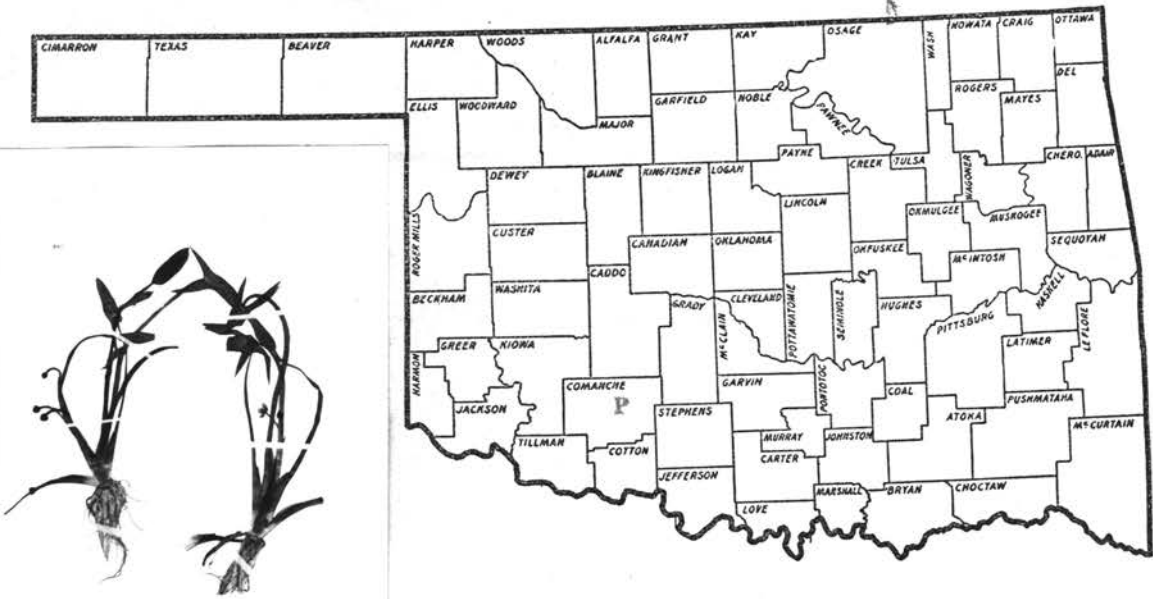
Alismaceae (Water-plantain Family)
Echinodorus Richard.
Echinodorus radicans (Nutt.) Engelm.

General habitat water's edge
 Growth type . . .partially submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade	fair
Food.	poor
Ornamental properties	fair
Value as an oxygenator.	poor
Ability to increase fertility of water.	good
Ability to prevent silting and erosive wave action.	good
Protection for fry.	fair
Protection for fingerlings and growing fish	fair
Drouth resistance	unknown
Water clarifying qualities.	unknown
Tolerance for turbidity	unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



WATER PLANTAIN
 L. CALYCINUS

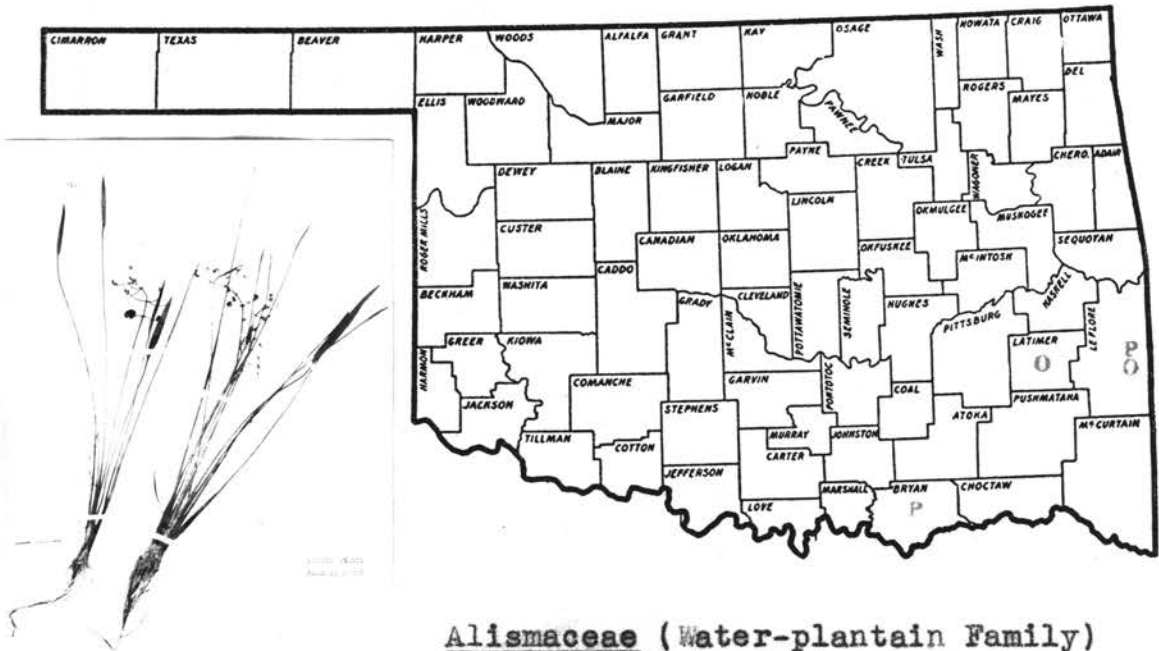
Alismaceae (Water-plantain Family)
Lophotocarpus Th. Durand
L. calycinus (Engelm.) J.G. Sm.

General habitat water's edge
 Growth type . . . partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food poor
 Ornamental properties fair
 Value as an oxygenator poor
 Ability to increase fertility of water good
 Ability to prevent silting and erosive wave action . . . good
 Protection for fry fair
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



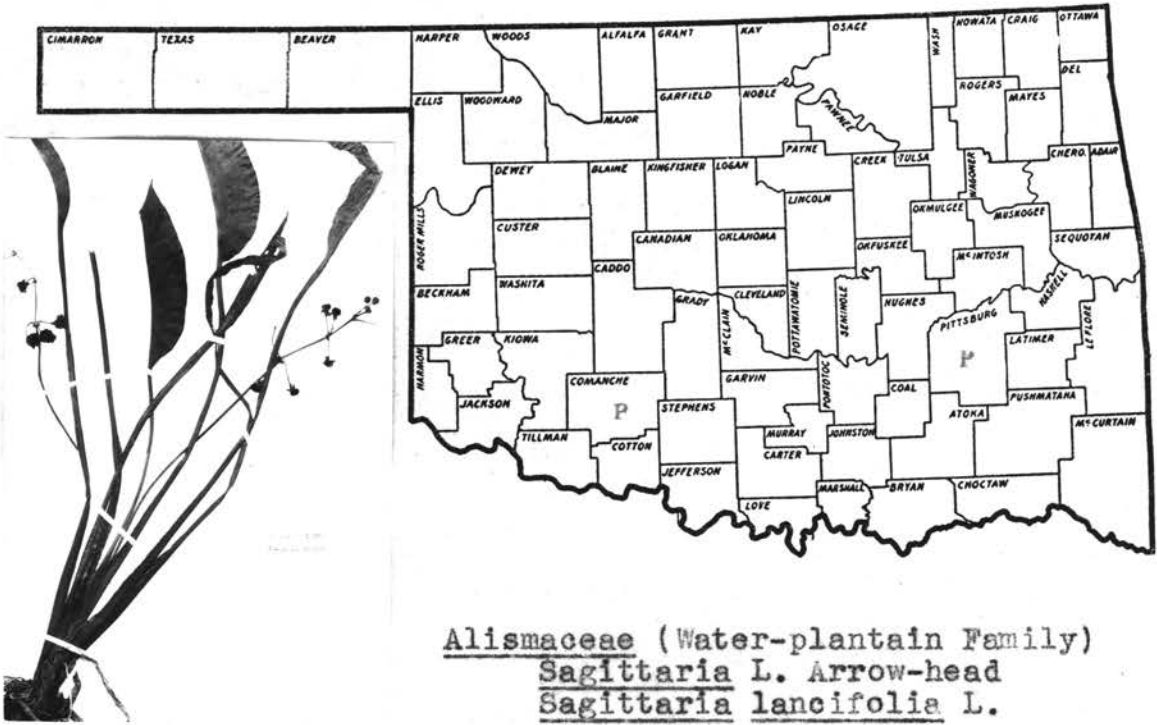
Alismaceae (Water-plantain Family)
Sagittaria L. Arrow-head
Sagittaria graminea Michx.

General habitat water's edge
 Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. . . . good
 Protection for fry. fair
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



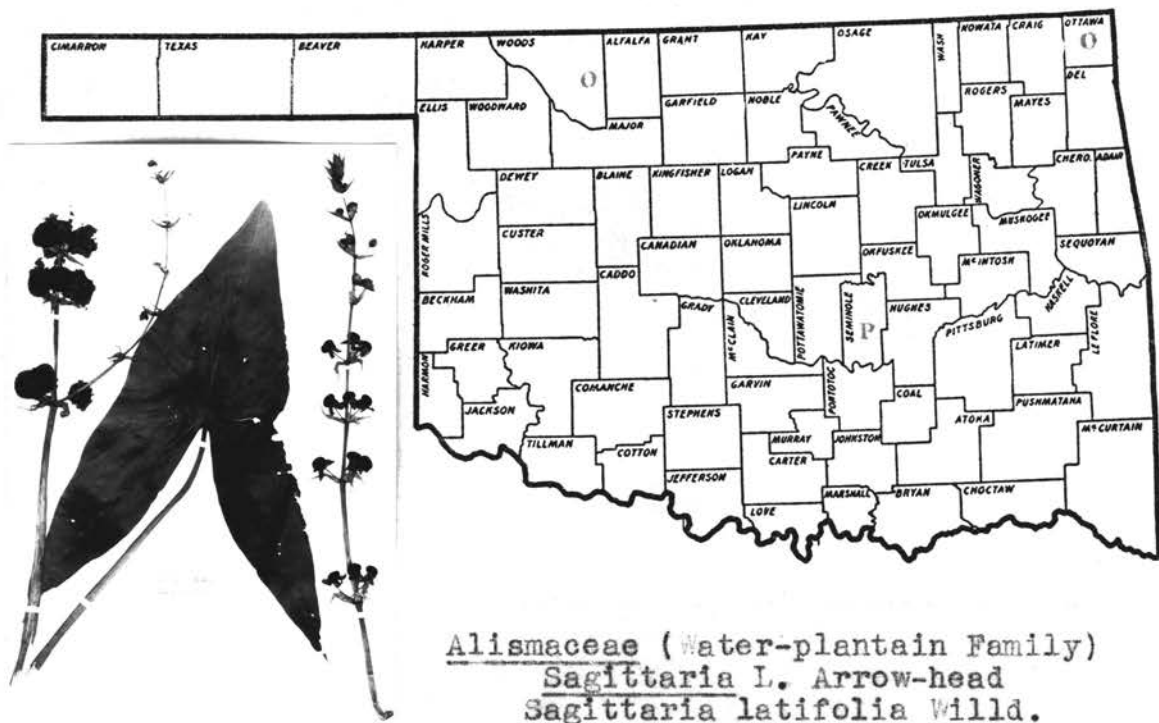
Alismaceae (Water-plantain Family)
Sagittaria L. Arrow-head
Sagittaria lancifolia L.

General habitat water's edge
 Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. . . good
 Protection for fry. fair
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE

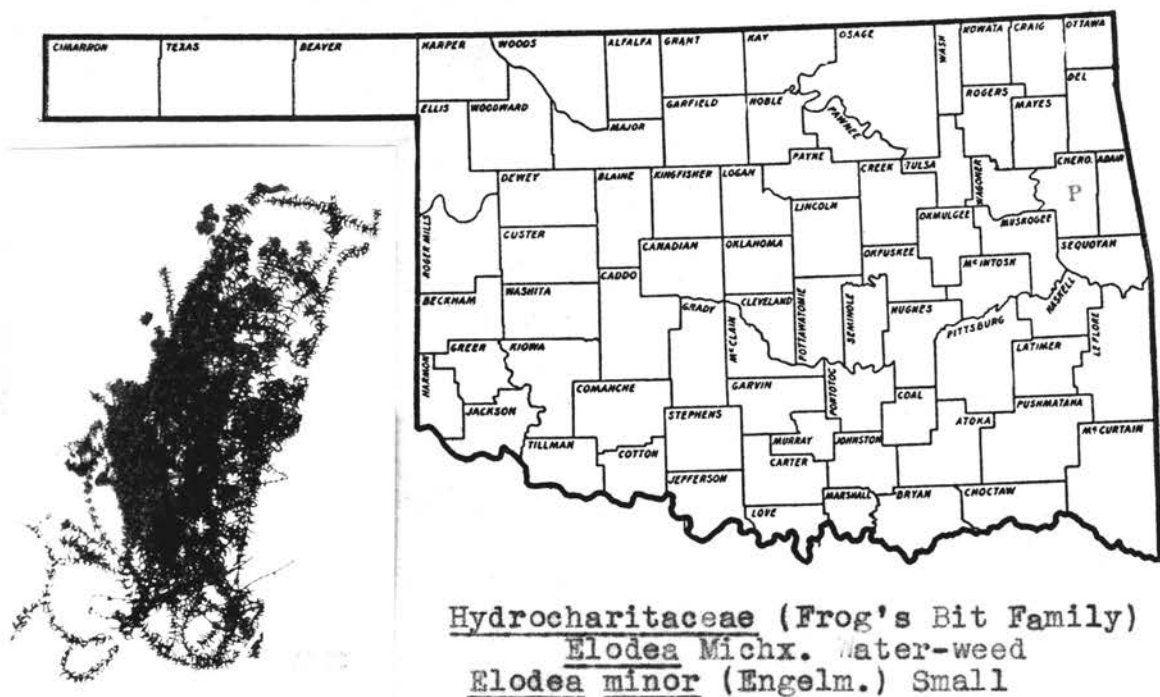


General habitat water's edge
 Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade good
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. . . good
 Protection for fry. fair
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE

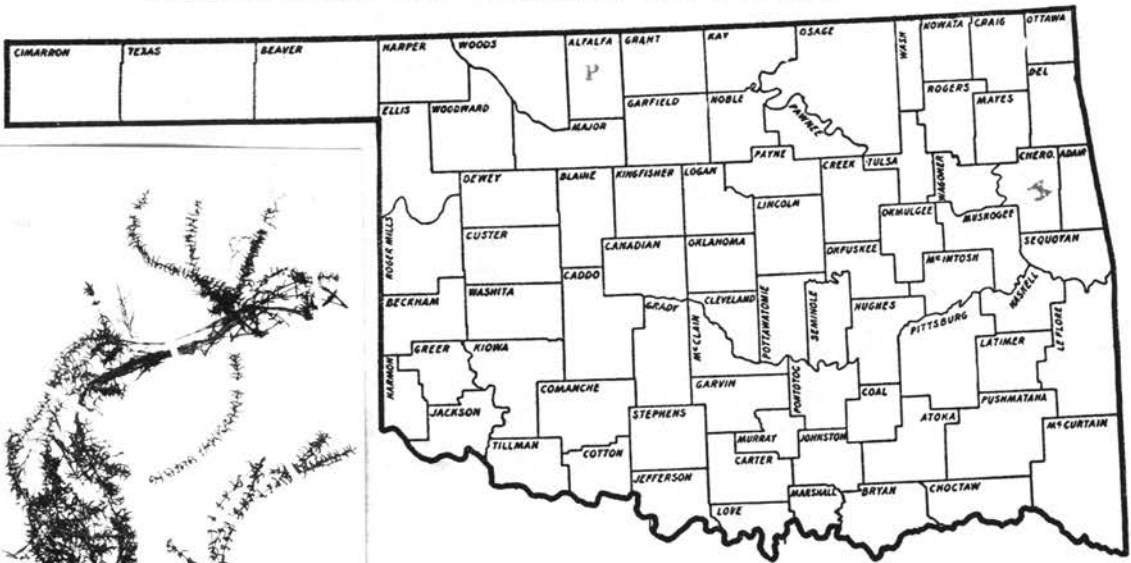


General habitat shallow water and deep water
 Growth type wholly submersed

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. good
 Ornamental properties fair
 Value as an oxygenator. good
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. fair
 Protection for fry. good
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. good
 Tolerance for turbidity fair

DISTRIBUTION AND ECONOMIC IMPORTANCE



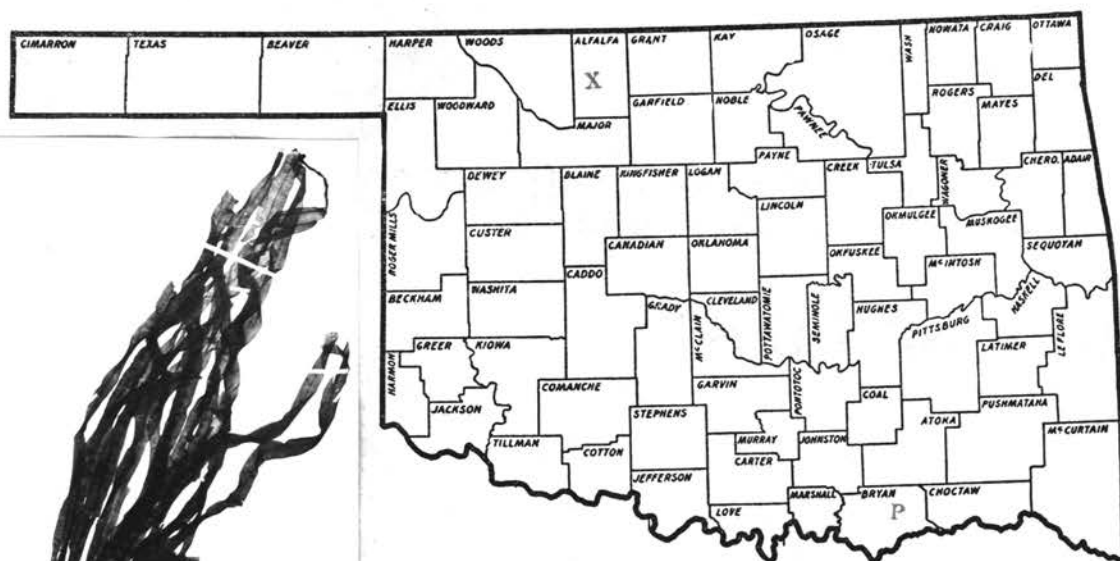
Hydrocharitaceae (Frog's Bit Family)
Elodea Michx. Water-weed
Elodea occidentalis (Pursh) St. John

General habitat shallow water and deep water
 Growth type wholly submersed

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. good
 Ornamental properties fair
 Value as an oxygenator. good
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. fair
 Protection for fry. good
 Protection for fingerlings and growing fish fair
 Drouth resistance.. . . . unknown
 Water clarifying qualities. good
 Tolerance for turbidity fair

DISTRIBUTION AND ECONOMIC IMPORTANCE



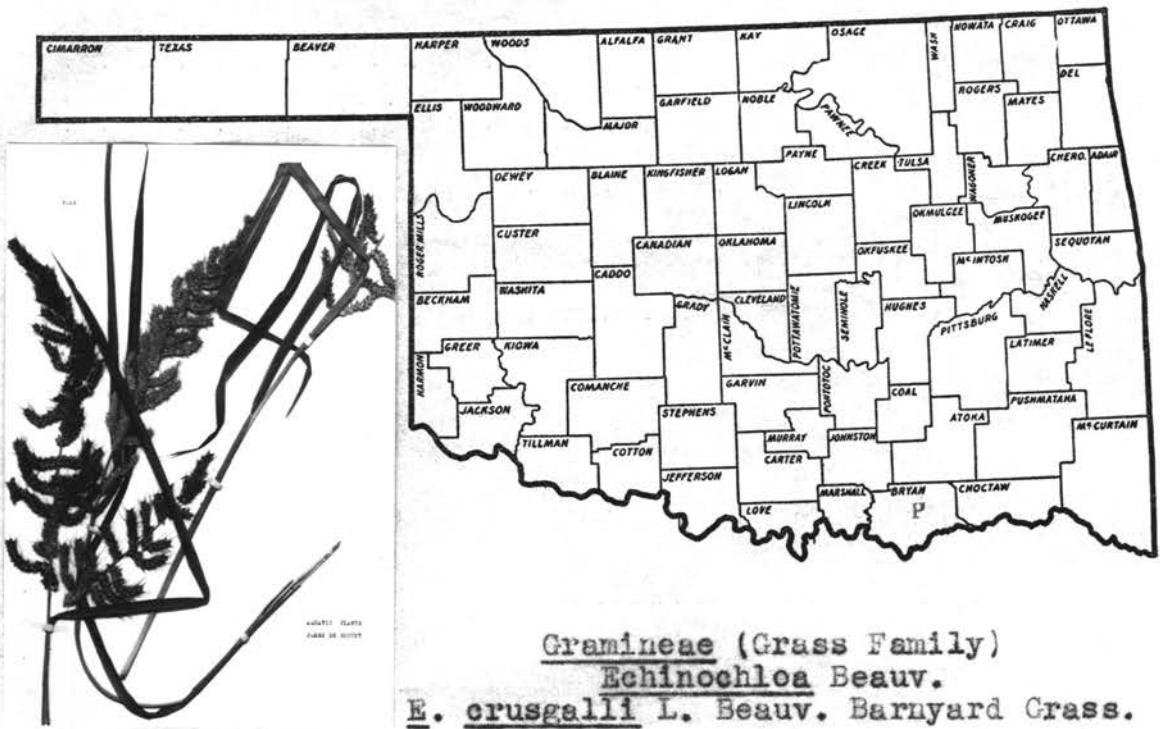
Hydrocharitaceae (Frog's Bit Family)
Vallisneria (Mich.) Tape Grass
Vallisneria spiralis L.

General habitat shallow water and deep water
 Growth type wholly submersed

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. fair
 Ornamental properties good
 Value as an oxygenator. good
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. fair
 Protection for fry. fair
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE

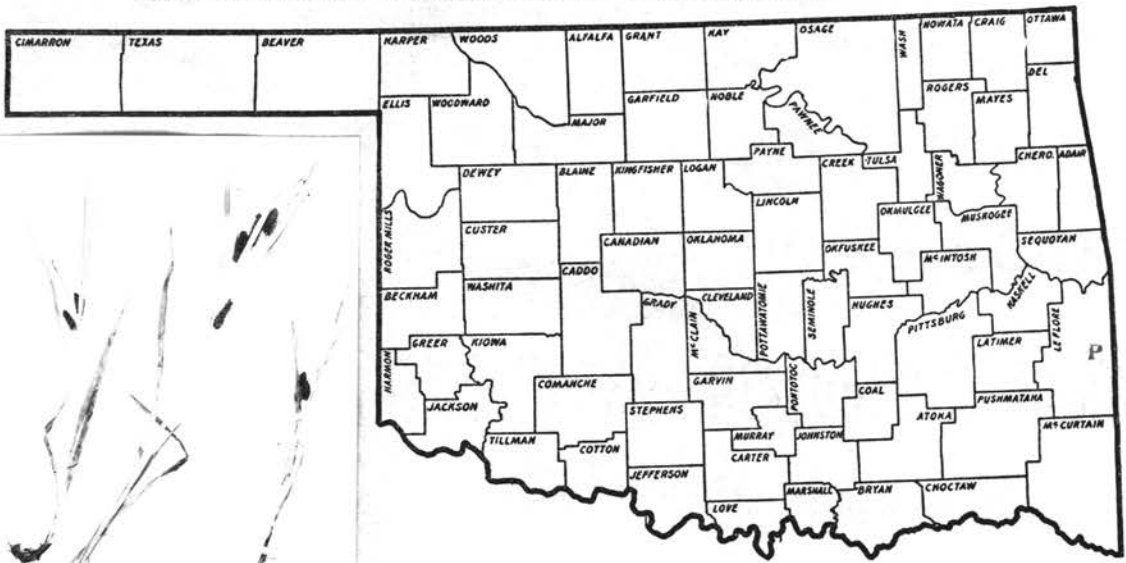


General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. none
 Protection for fingerlings and growing fish none
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



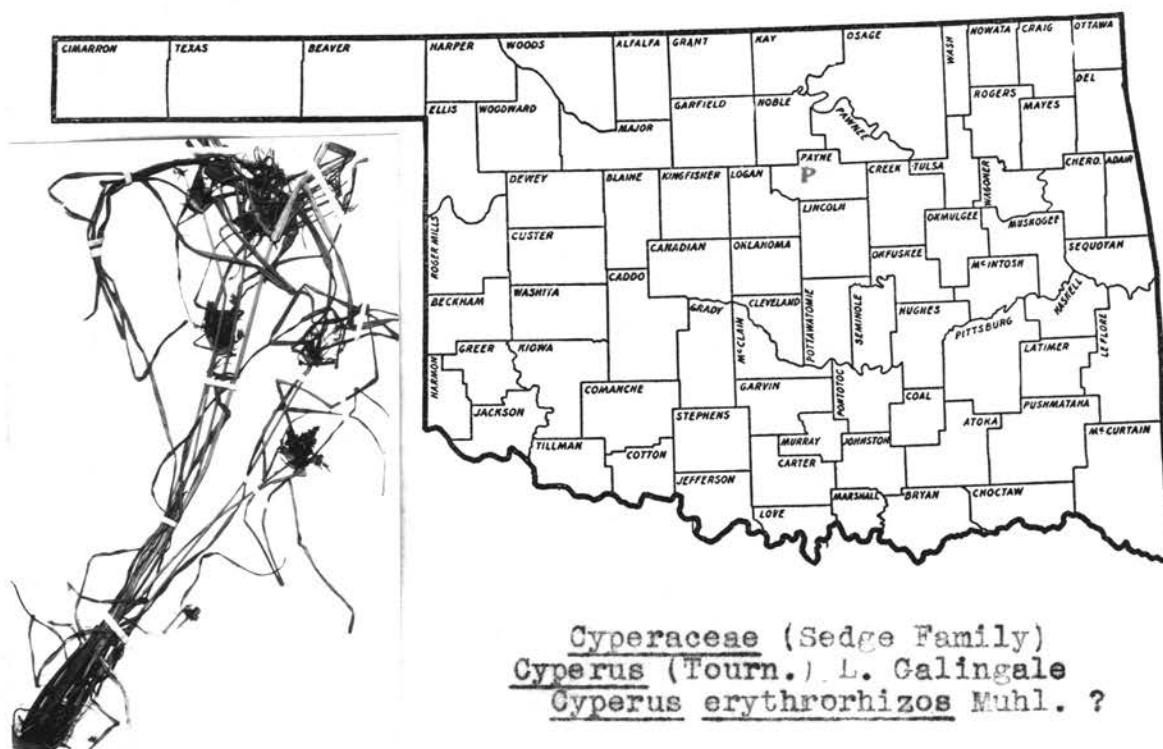
Cyperaceae (Sedge Family)
Carex (Ruppius) L. Sedge
Carex Frankii Kunth.

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. poor
 Protection for fingerlings and growing fish poor
 Drouth resistance fair
 water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE

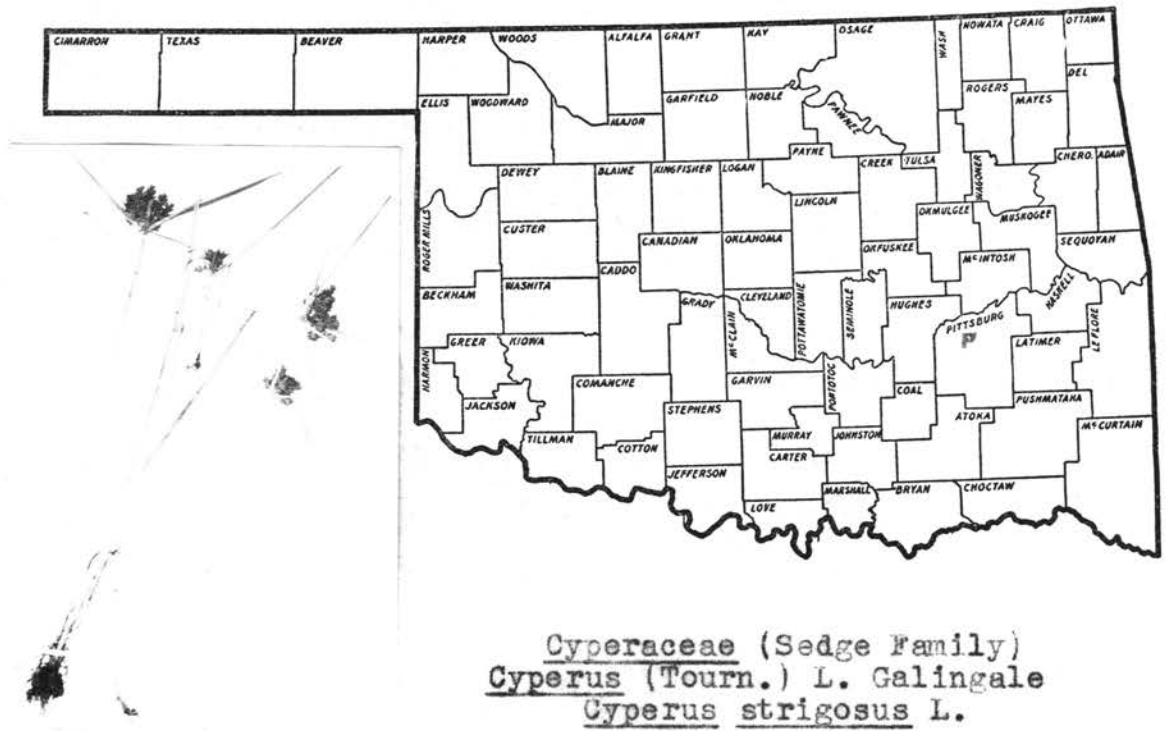


General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . good
 Protection for fry. none
 Protection for fingerlings and growing fish. none
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



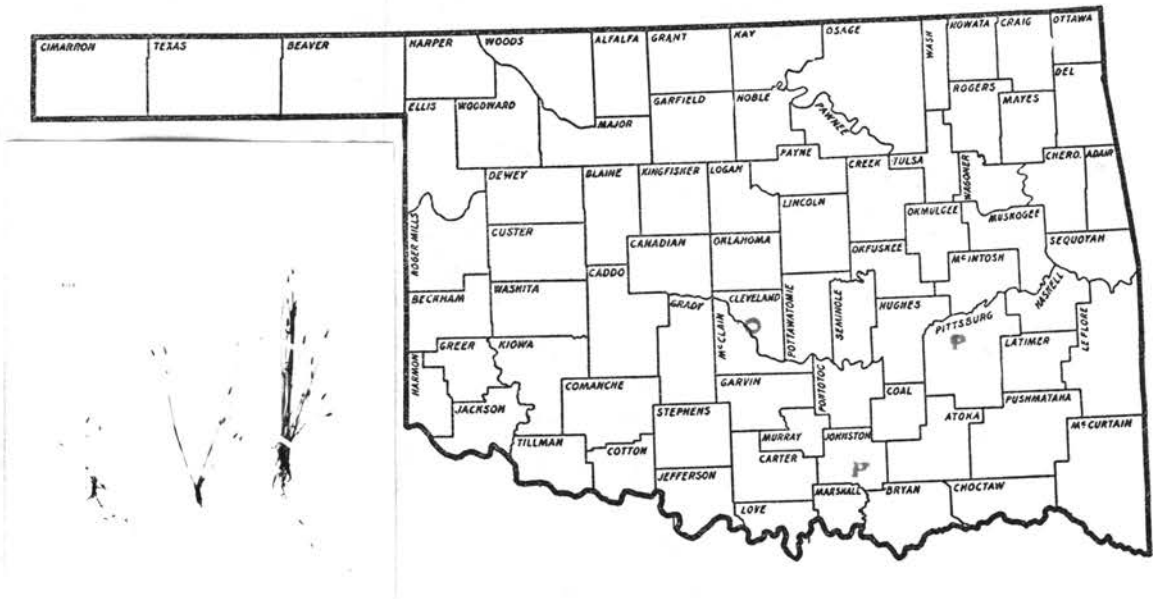
Cyperaceae (Sedge Family)
Cyperus (Tourn.) L. Galingale
Cyperus strigosus L.

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade	fair
Food.	poor
Ornamental properties	fair
Value as an oxygenator.	poor
Ability to increase fertility of water.	fair
Ability to prevent silting and erosive wave action.	good
Protection for fry.	fair
Protection for fingerlings and growing fish	fair
Drouth resistance	unknown
Water clarifying qualities.	unknown
Tolerance for turbidity	unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



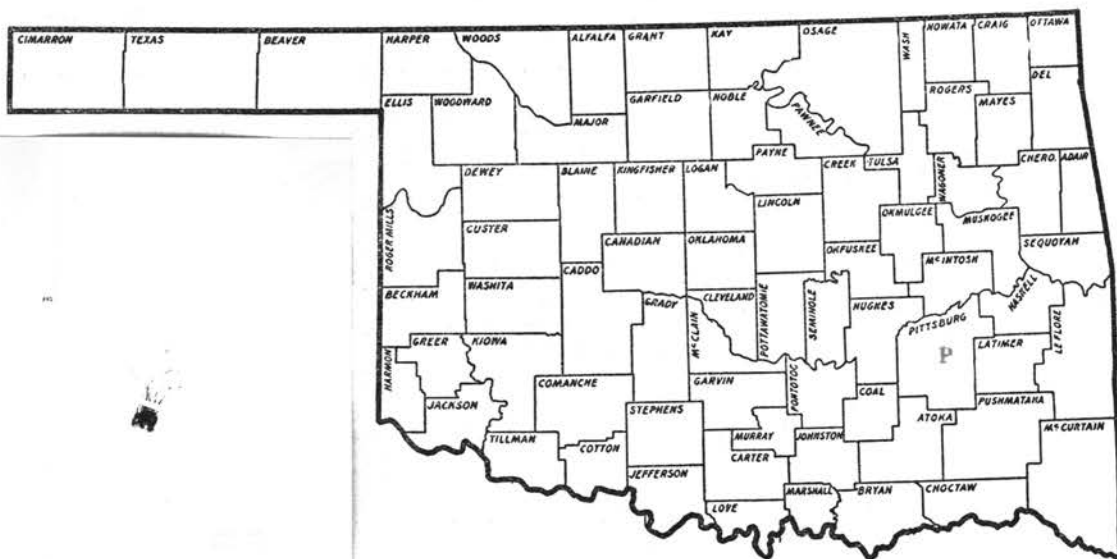
Cyperaceae (Sedge Family)
Eleocharis R. Br. Spike Rush
Eleocharis albidia Torr.

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

- Shade poor
- Food. poor
- Ornamental properties poor
- Value as an oxygenator. poor
- Ability to increase fertility of water. fair
- Ability to prevent silting and erosive wave action. . . fair
- Protection for fry. poor
- Protection for fingerlings and growing fish poor
- Drouth resistance fair
- Water clarifying qualities. unknown
- Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



Cyperaceae (Sedge Family)
Eleocharis R. Br. Spike Rush
Eleocharis leptos (Steud.) Sven.

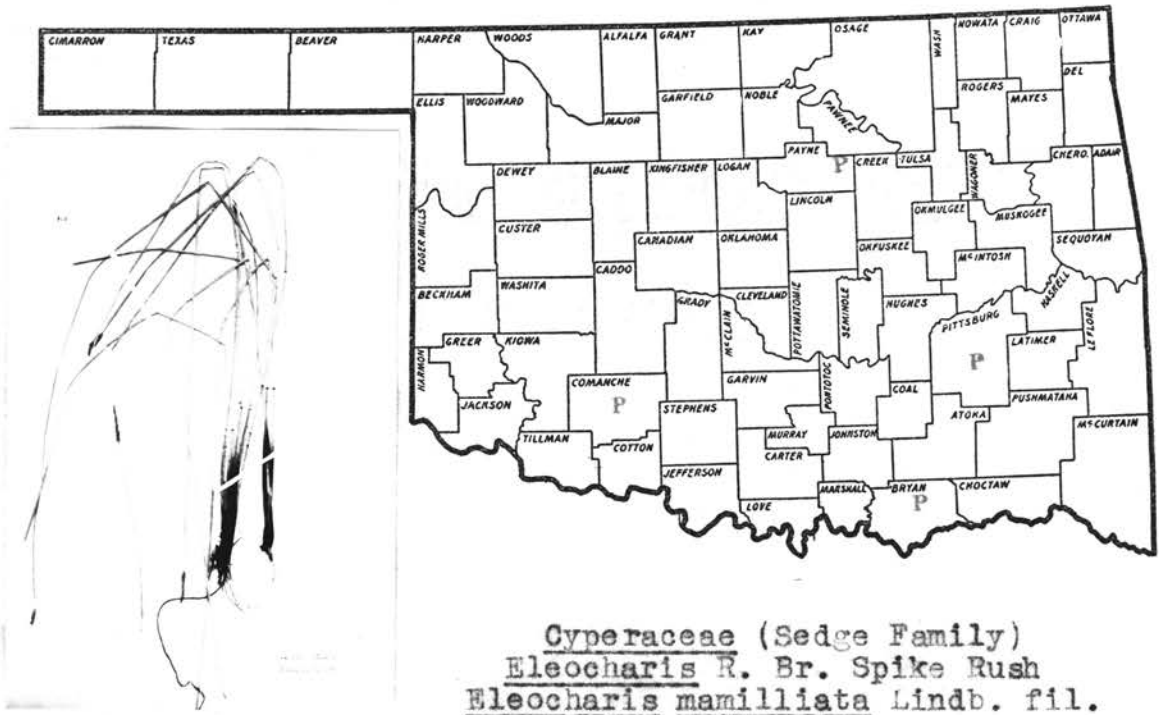
General habitat water's edge

Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

- Shade poor
- Food poor
- Ornamental properties poor
- Value as an oxygenator. poor
- Ability to increase fertility of water. fair
- Ability to prevent silting and erosive wave action. . . fair
- Protection for fry. poor
- Protection for fingerlings and growing fish poor
- Drouth resistance fair
- Water clarifying qualities. unknown
- Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



Cyperaceae (Sedge Family)
Eleocharis R. Br. Spike Rush
Eleocharis mamilliata Lindb. fil.

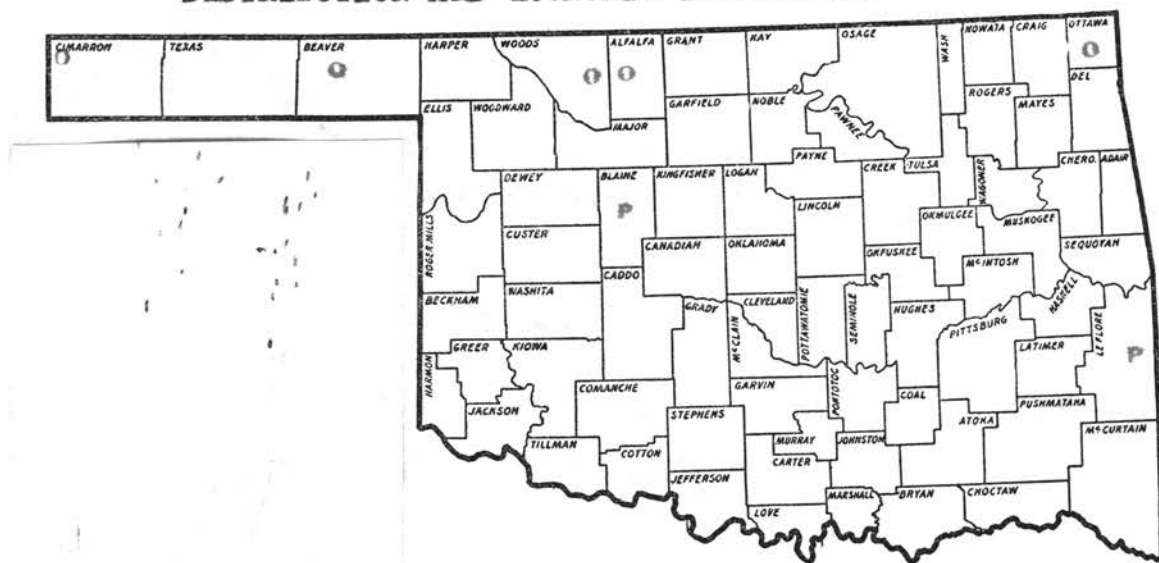
General habitat water's edge

Growth type . . . partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

- Shade fair
- Food poor
- Ornamental properties fair
- Value as an oxygenator poor
- Ability to increase fertility of water fair
- Ability to prevent silting and erosive wave action . . . good
- Protection for fry fair
- Protection for fingerlings and growing fish fair
- Drouth resistance fair
- Water clarifying qualities unknown
- Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



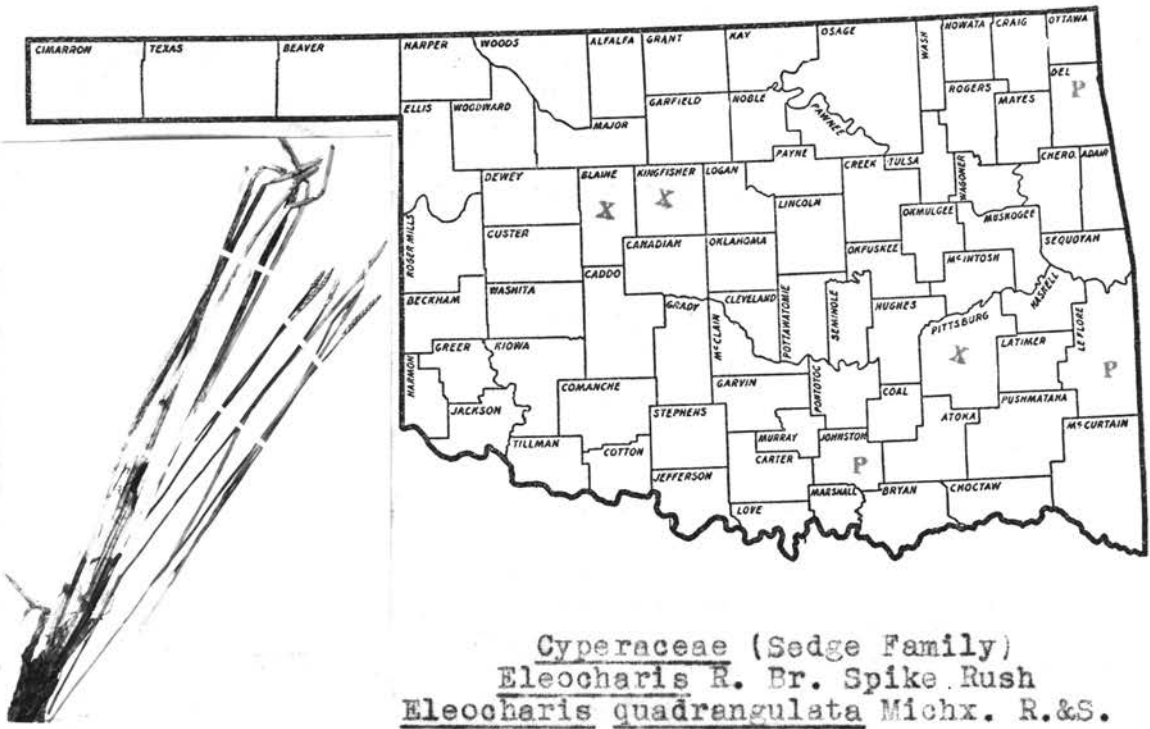
Cyperaceae (Sedge Family)
Eleocharis R. Br. Spike Rush
Eleocharis palustris (L.) R. & S.

General habitat water's edge
 Growth type . . . partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade	fair
Food.	poor
Ornamental properties	fair
Value as an oxygenator.	poor
Ability to increase fertility of water.	fair
Ability to prevent silting and erosive wave action.	good
Protection for fry.	fair
Protection for fingerlings and growing fish	fair
Drouth resistance	fair
Water clarifying qualities.	unknown
Tolerance for turbidity	unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE

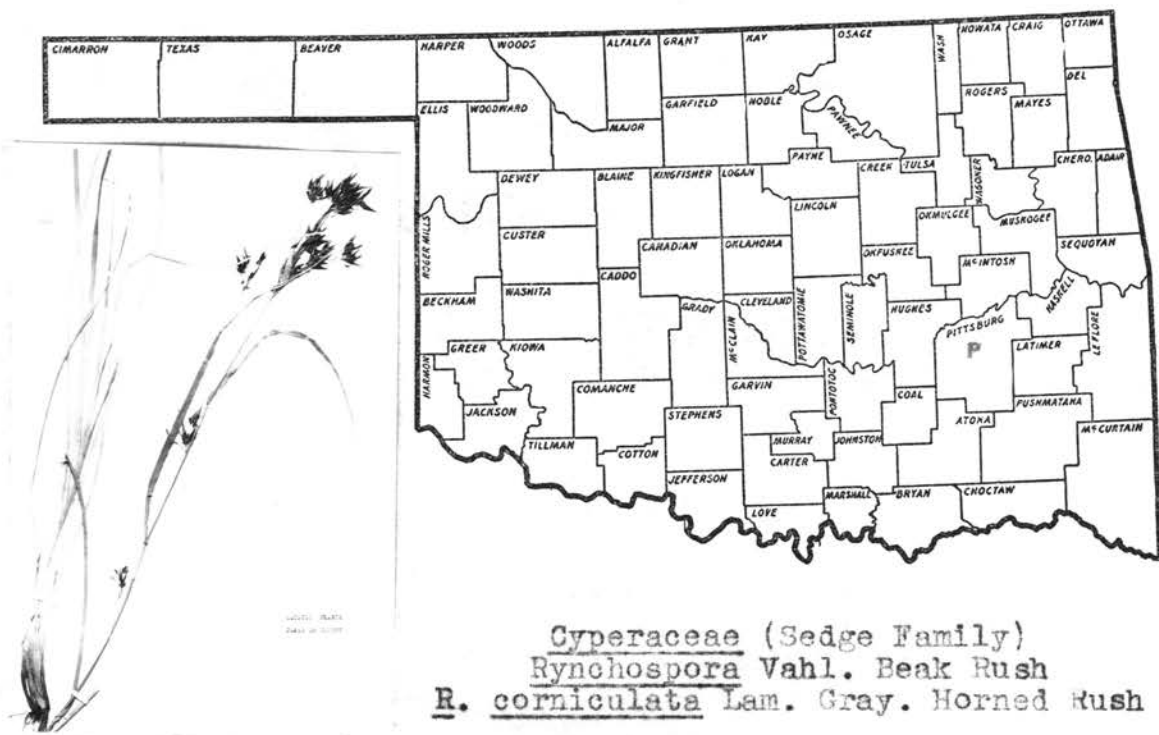


General habitat water's edge
 Growth type . . .partially summersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . good
 Protection for fry. fair
 Protection for fingerlings and growing fish fair
 Drouth resistance fair
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE

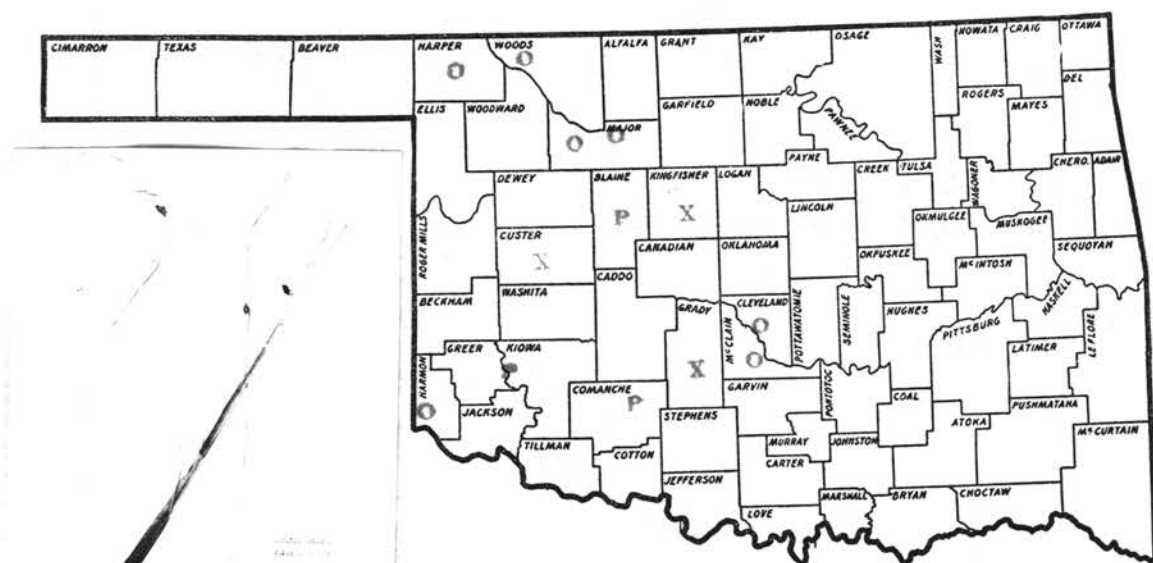


General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . poor
 Protection for fry. poor
 Protection for fingerlings and frowing fish poor
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



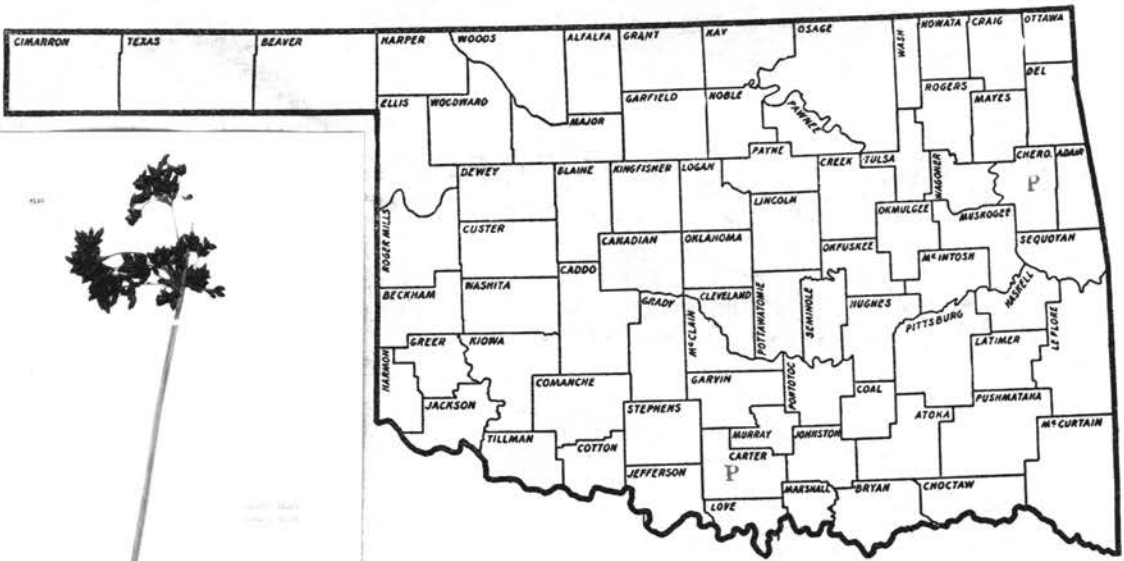
Cyperaceae (Sedge Family)
Scirpus (Tourn.) L. Bulrush
Scirpus americanus Pers.

General habitat shallow water
 Growth type . . . partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade	fair
Food	poor
Ornamental properties	fair
Value as an oxygenator	poor
Ability to increase fertility of water	good
Ability to prevent silting and erosive wave action	fair
Protection for fry	fair
Protection for fingerlings and growing fish	fair
Drouth resistance	unknown
Water clarifying qualities	unknown
Tolerance for turbidity	unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



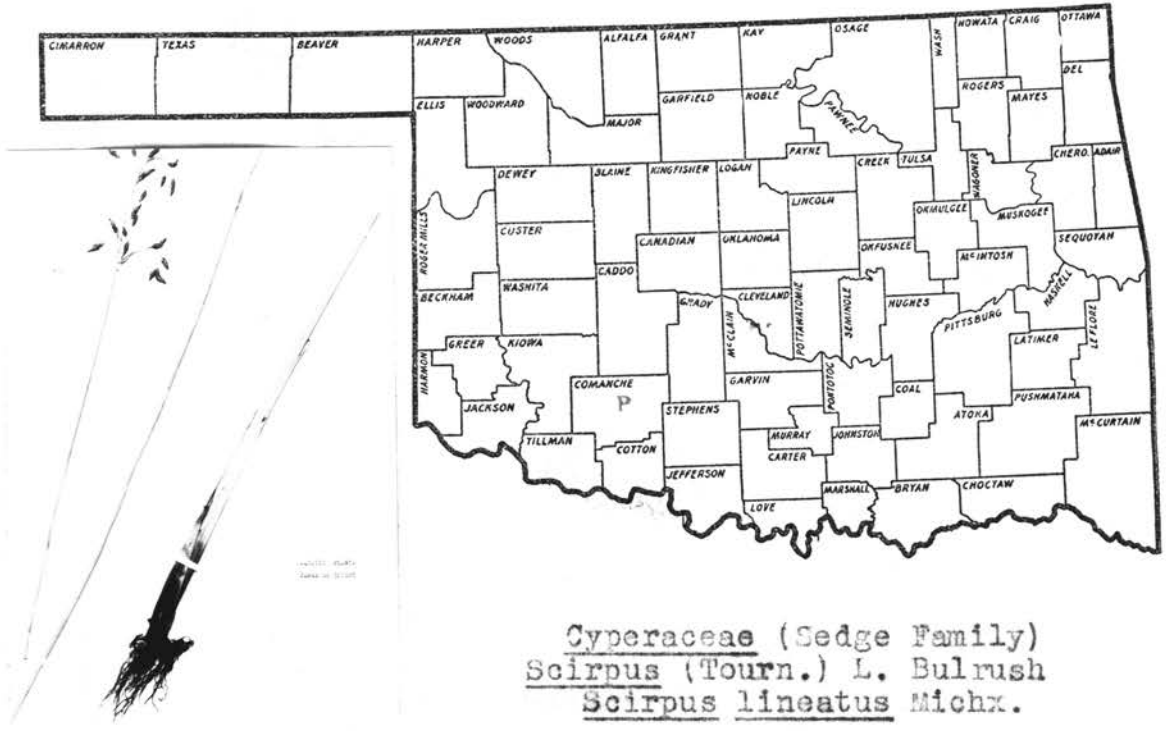
Cyperaceae (Sedge Family)
Scirpus (Tourn.) L. Bulrush
Scirpus californicus (C. A. Meyer)

General habitat shallow water and deep water
 Growth type . . . partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. poor
 Ornamental properties good
 Value as an oxygenator. poor
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. . . good
 Protection for fry. fair
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



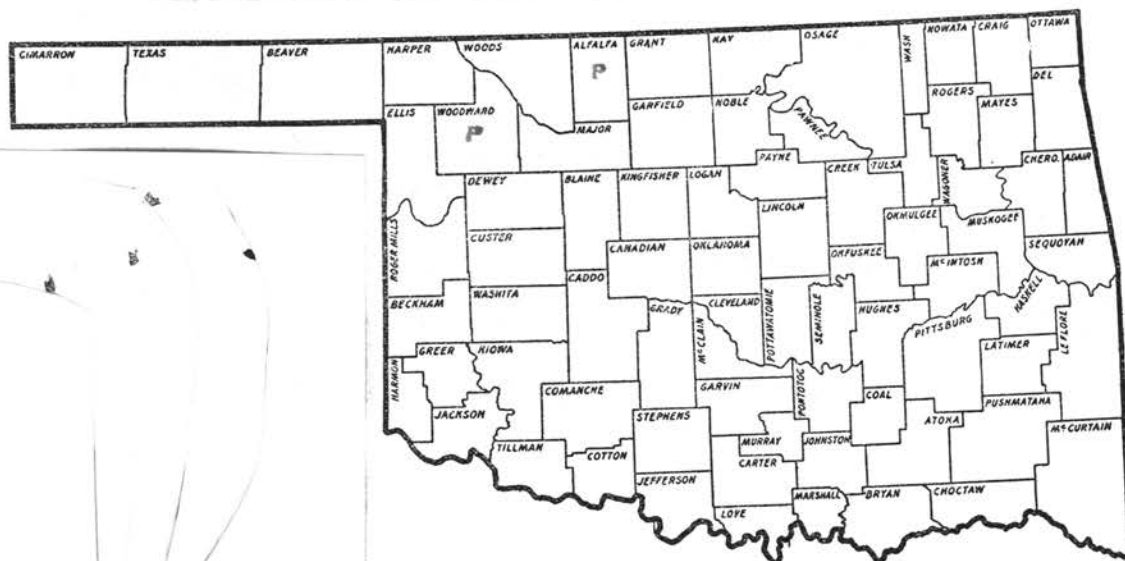
Cyperaceae (Sedge Family)
Scirpus (Tourn.) L. Bulrush
Scirpus lineatus Michx.

General habitatshallow water
 Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food poor
 Ornamental properties fair
 Value as an oxygenator poor
 Ability to increase fertility of water fair
 Ability to prevent silting and erosive wave action . . . good
 Protection for fry fair
 Protection for fingerlings and growing fish good
 Drouth resistance unknown
 Water clarifying qualities unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



Cyperaceae (Sedge Family)
Scirpus (Tourn.) L. Bulrush
Scirpus Torreyi Olney

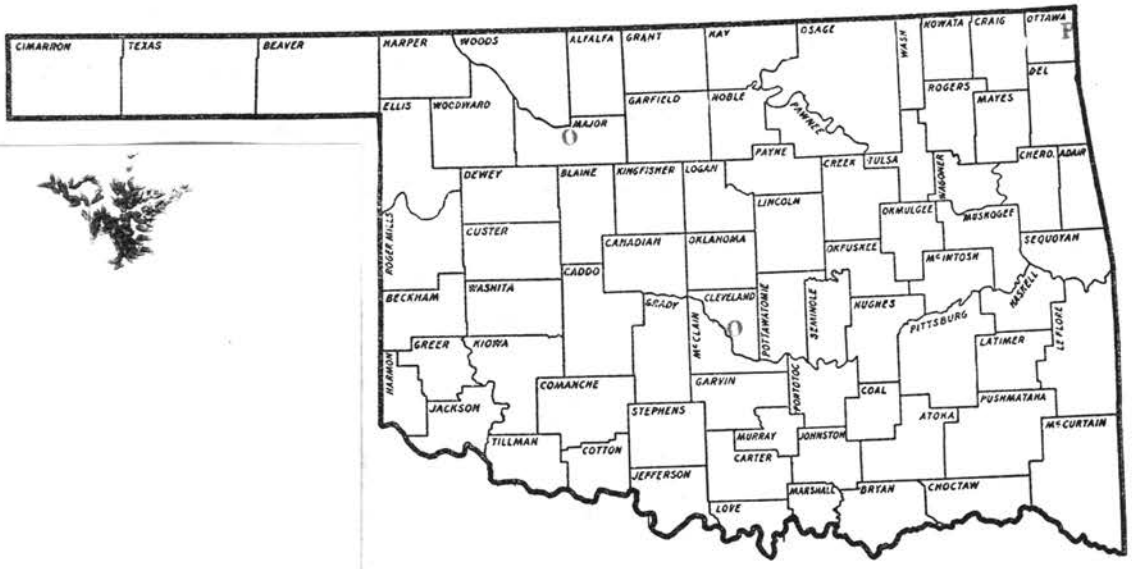
General habitat shallow water

Growth type . . . partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade	fair
Food.	poor
Ornamental properties	fair
Value as an oxygenator.	poor
Ability to increase fertility of water.	good
Ability to prevent silting and erosive wave action. . .	fair
Protection for fry.	fair
Protection for fingerlings and growing fish	fair
Drouth resistance	unknown
Water clarifying qualities.	unknown
Tolerance for turbidity	unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



Cyperaceae (Sedge Family)
Scirpus (Tourn.) L. Bulrush
Scirpus validus Vahl. (Great B.)

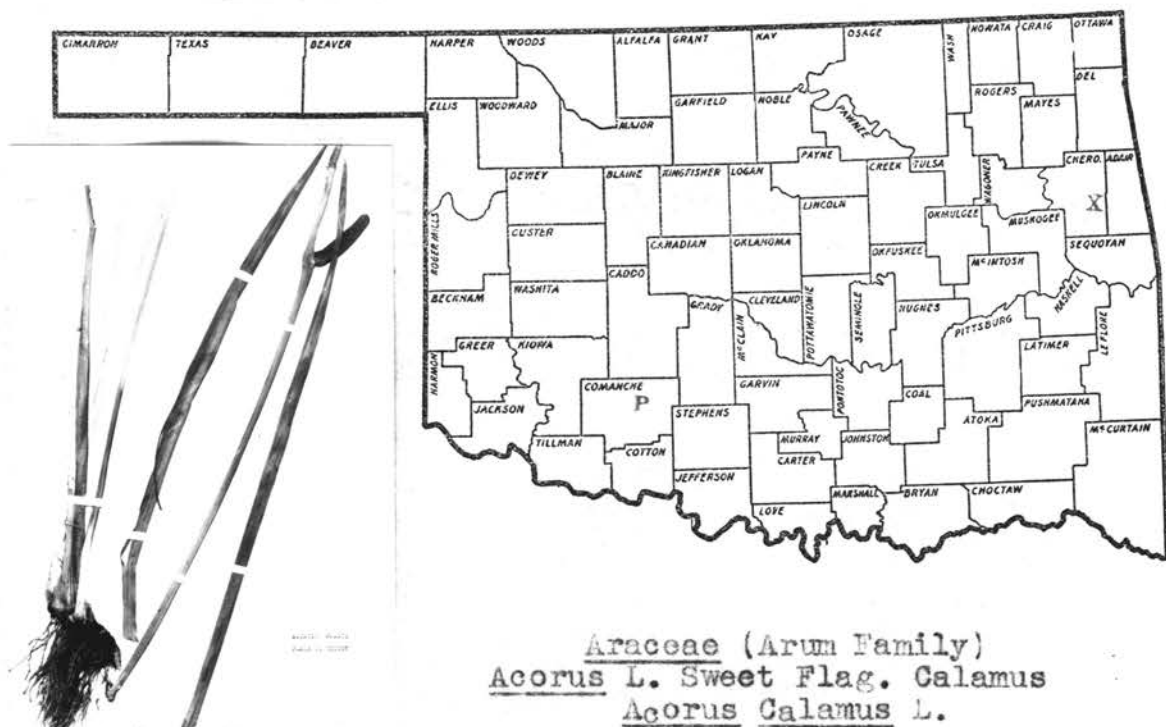
General habitat shallow water and deep water

Growth type . . . partially submersed with aerial leafy stems

RELATIVE VALUE IN FISH CULTURE

- Shade fair
- Food poor
- Ornamental properties good
- Value as an oxygenator fair
- Ability to increase fertility of water good
- Ability to prevent silting and erosive wave action . . . good
- Protection for fry fair
- Protection for fingerlings and growing fish good
- Drouth resistance good
- Water clarifying qualities unknown
- Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE

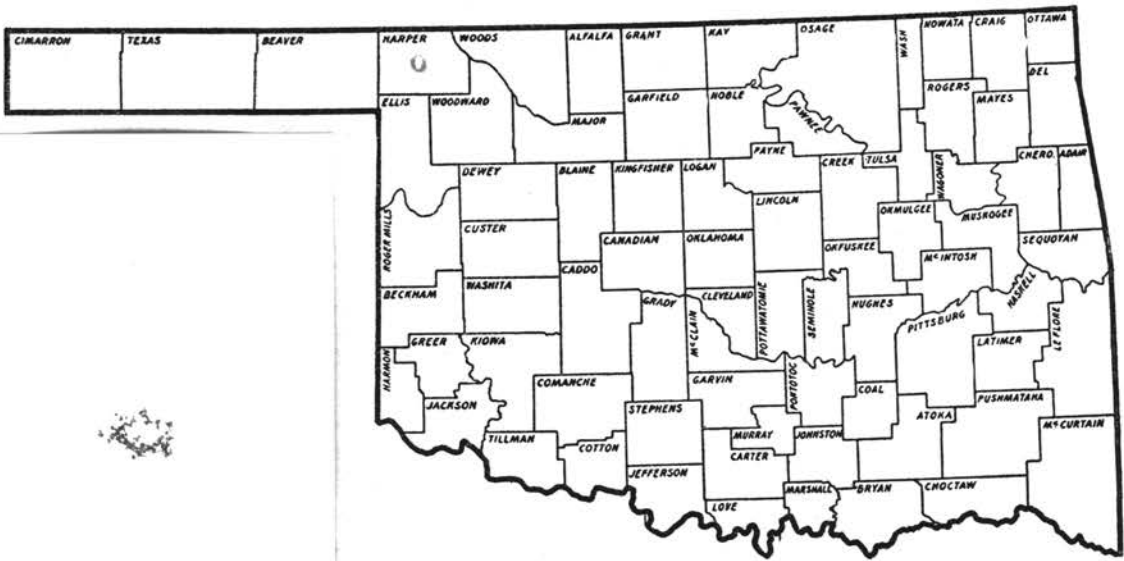


General habitat water's edge
 Growth type . . . partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. poor
 Ornamental properties good
 Value as an oxygenator. fair
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. . . good
 Protection for fry. fair
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



Lemnaceae (Duckweed Family)
Lemna L. Duckweed. Duck's-meat
Lemna cyclostasa (Ell.) Chev.

General habitat water's edge and shallow water

Growth type floating

RELATIVE VALUES IN FISH CULTURE

Shade good

Food. fair

Ornamental properties fair

Value as an oxygenator. poor

Ability to increase fertility of water. poor

Ability to prevent silting and erosive wave action. poor

Protection for fry. poor

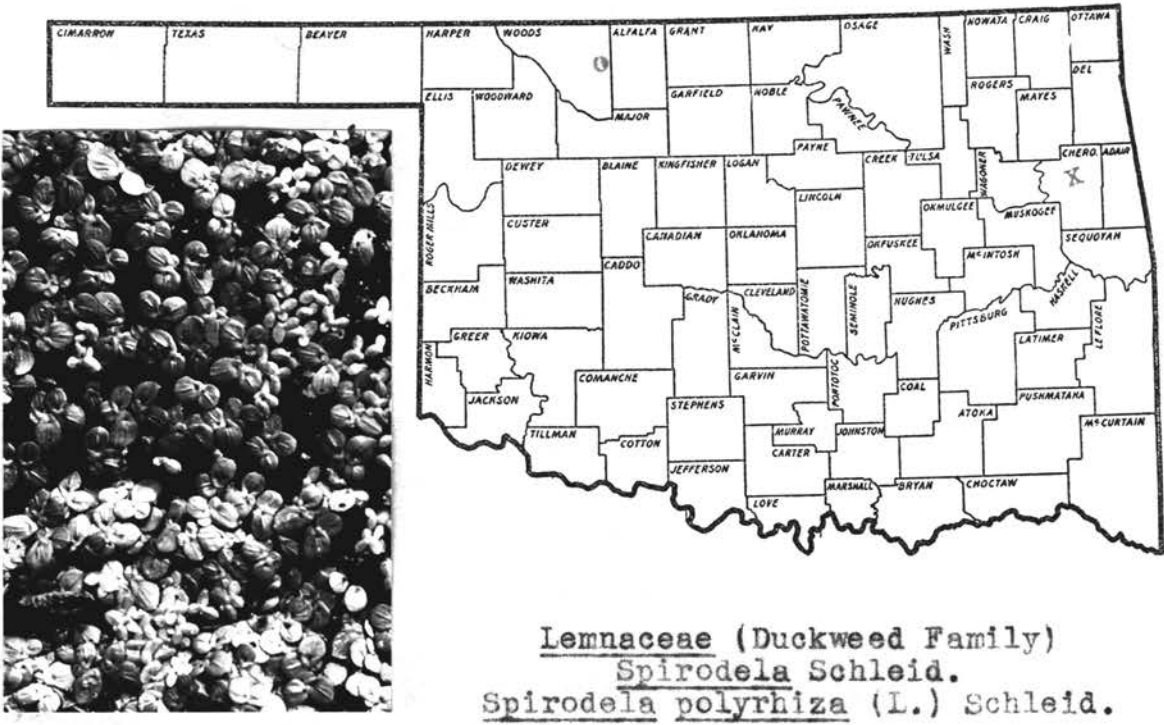
Protection for fingerlings and growing fish poor

Drouth resistance poor

Water clarifying qualities. unknown

Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



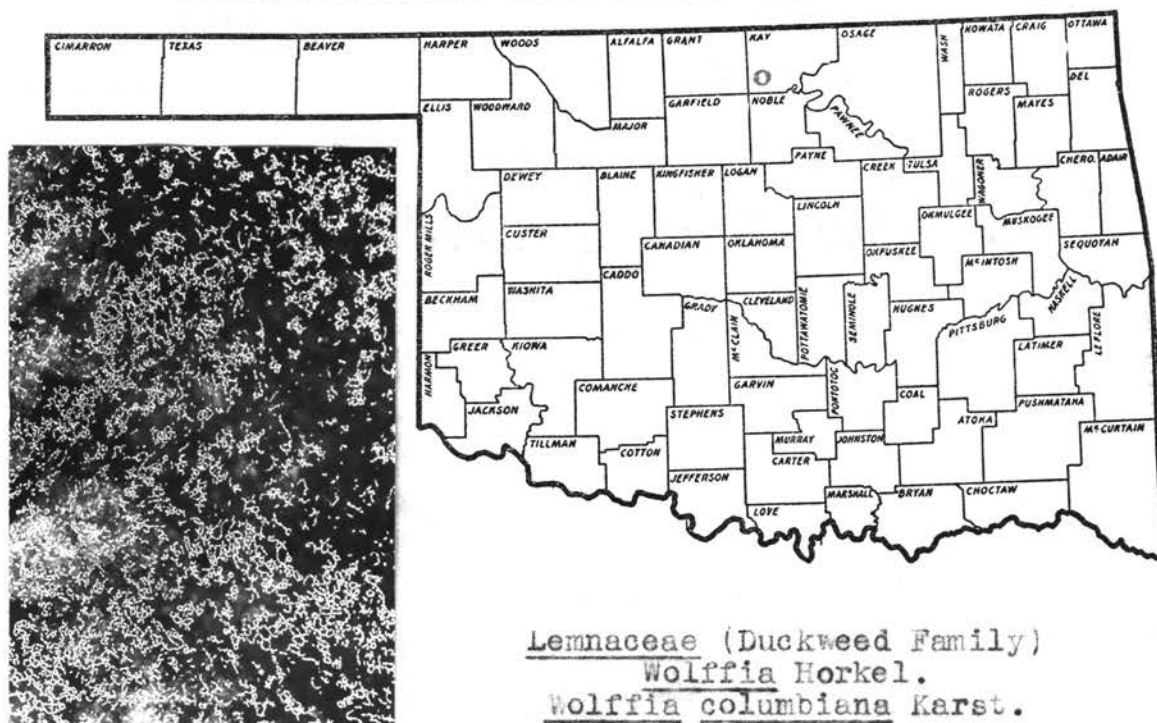
Lemnaceae (Duckweed Family)
Spirodela Schleid.
Spirodela polyrhiza (L.) Schleid.

General habitat water's edge and shallow water
 Growth type floating

RELATIVE VALUES IN FISH CULTURE

Shade good
 Food. fair
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. poor
 Ability to prevent silting and erosive wave action. poor
 Protection for fry. poor
 Protection for fingerlings and growing fish poor
 Drouth resistance poor
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE

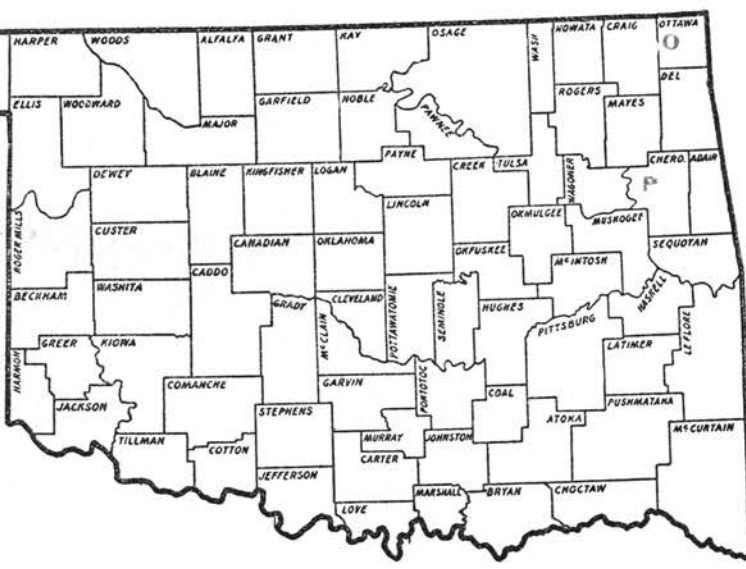


General habitat water's edge and shallow water
 Growth type floating

RELATIVE VALUES IN FISH CULTURE

Shade good
 Food fair
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. poor
 Ability to prevent silting and erosive wave action. poor
 Protection for fry. poor
 Protection for fingerlings and growing fish poor
 Drouth resistance poor
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



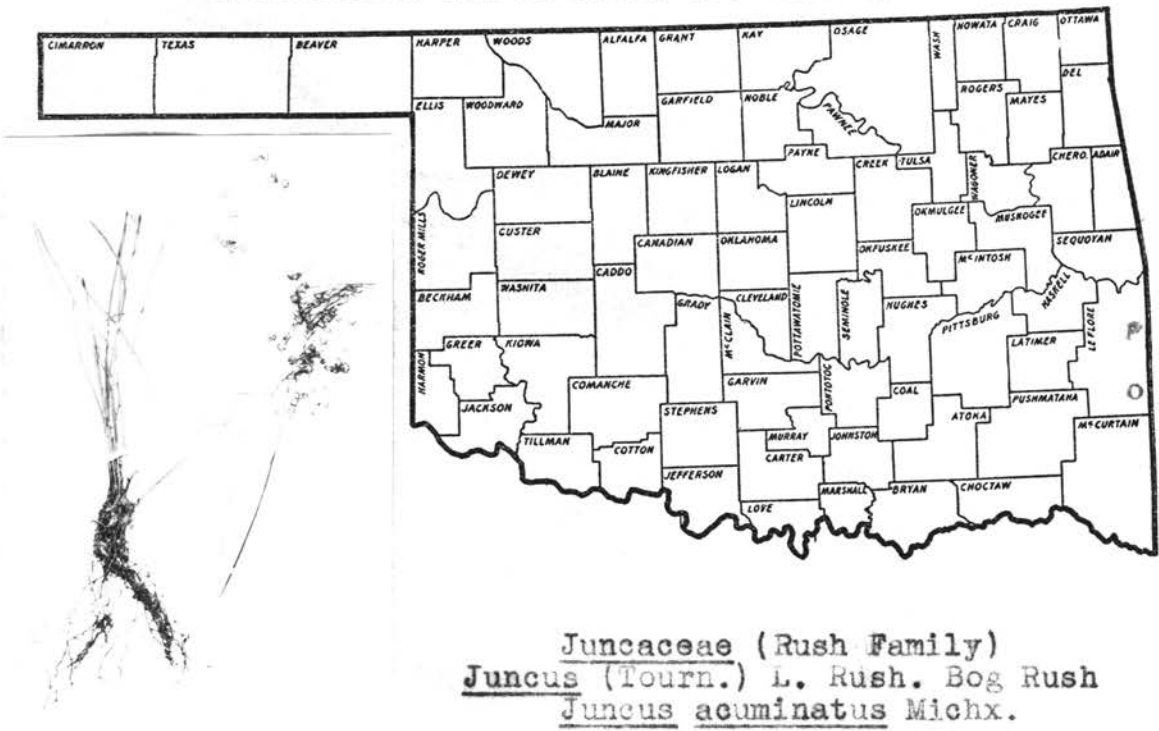
Pontederiaceae (Pickerel-weed Family)
Pontederia L. Pickerel-weed
Pontederia cordata L.

General habitatshallow water
 Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade good
 Food poor
 Ornamental properties **very** good
 Value as an oxygenator. fair
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . good
 Protection for fry. fair
 Protection for fingerlings and growing fish fair
 Drouth resistance good
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



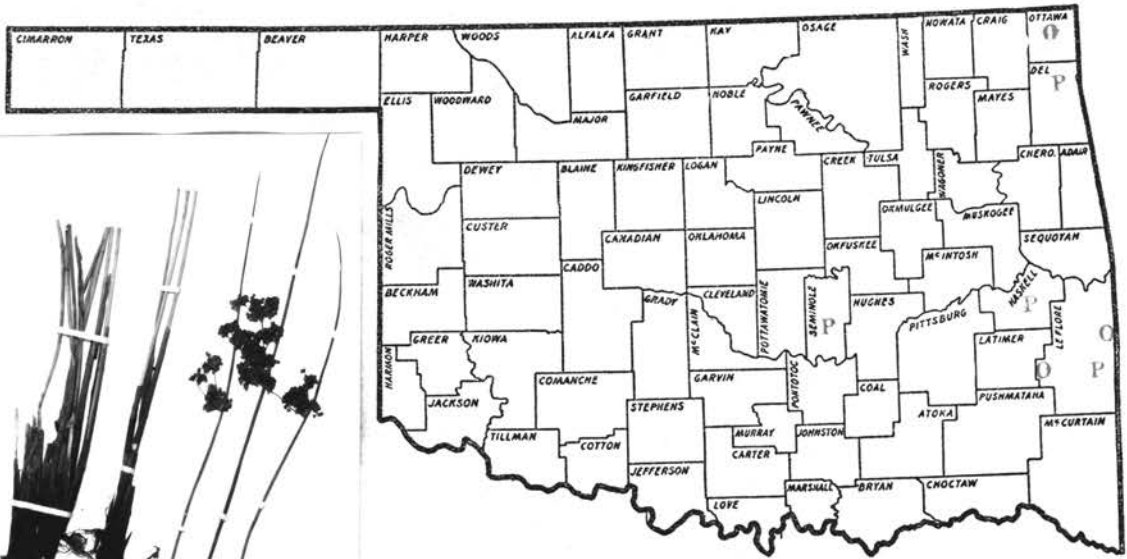
Juncaceae (Rush Family)
Juncus (Tourn.) L. Rush. Bog Rush
Juncus acuminatus Michx.

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade	poor
Food.	poor
Ornamental properties	fair
Value as an oxygenator.	poor
Ability to increase fertility of water.	fair
Ability to prevent silting and erosive wave action. . .	fair
Protection for fry.	poor
Protection for fingerlings and growing fish	poor
Drouth resistance	unknown
Water clarifying qualities.	unknown
Tolerance for turbidity	unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



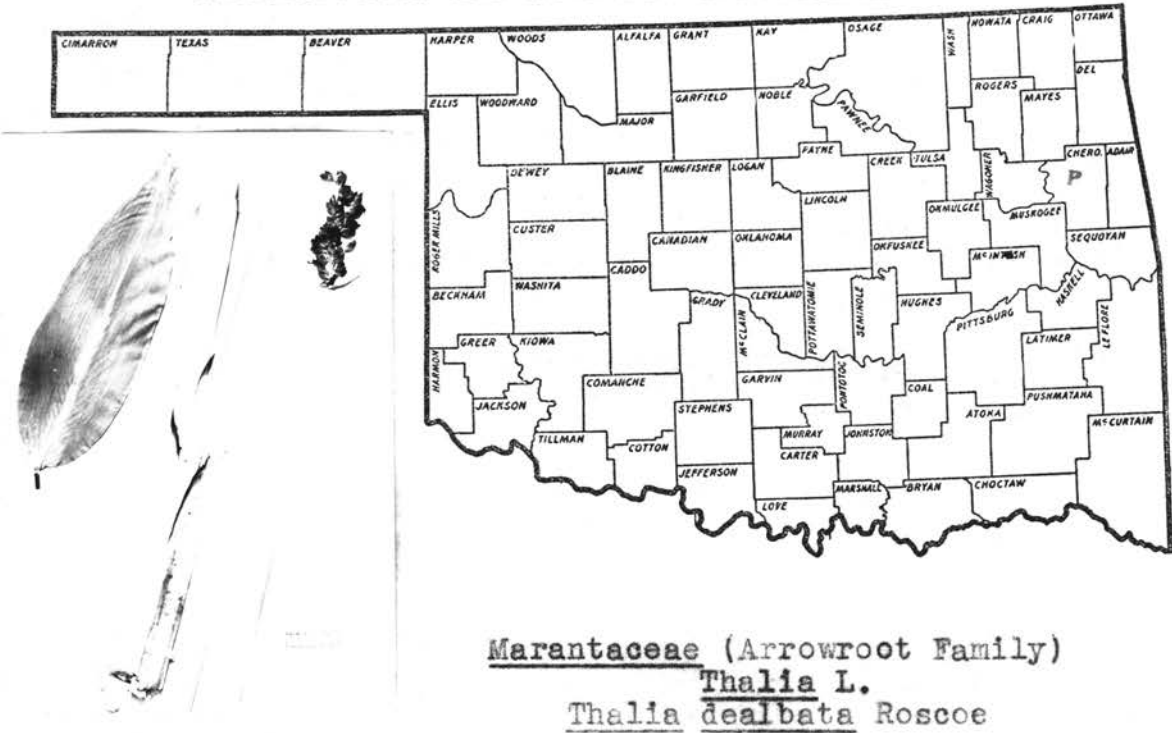
Juncaceae (Rush Family)
Juncus (Tourn.) L. Rush. Bog Rush
Juncus effusus L. (Common or Soft Rush)

General habitat water's edge
 Growth type . . . partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food poor
 Ornamental properties fair
 Value as an oxygenator poor
 Ability to increase fertility of water fair
 Ability to prevent silting and erosive wave action . . . fair
 Protection for fry fair
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



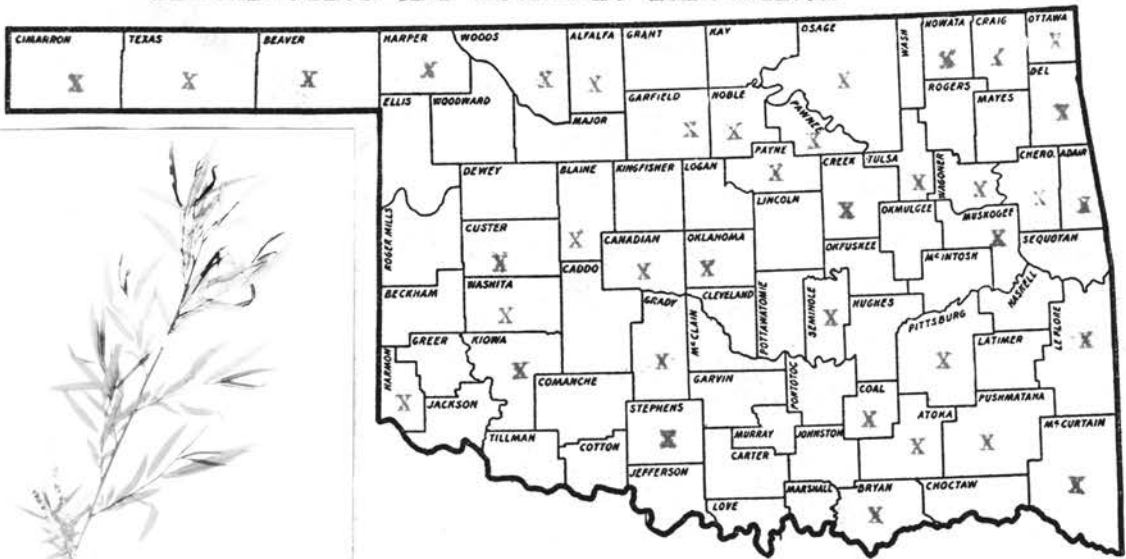
Marantaceae (Arrowroot Family)
Thalia L.
Thalia dealbata Roscoe

General habitatshallow water
 Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade	fair
Food.	poor
Ornamental properties	very good
Value as an oxygenator.	poor
Ability to increase fertility of water.	fair
Ability to prevent silting and erosive wave action.	good
Protection for fry.	poor
Protection for fingerlings and growing fish	fair
Drouth resistance	unknown
Water clarifying qualities.	unknown
Tolerance for turbidity	unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



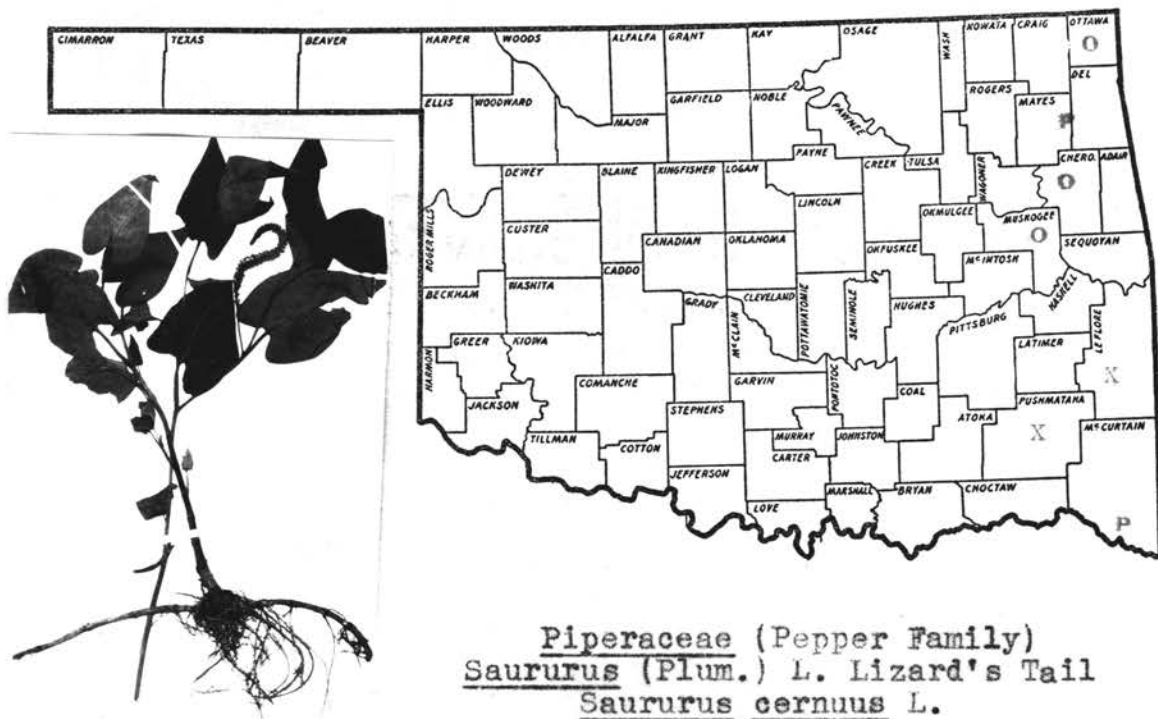
Piperaceae (Pepper Family)
Salix (Tourn.) L. Willow. Osier
Salix sp. and others.

General habitat water's edge and shallow water
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade good
 Food. poor
 Ornamental properties good
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . good
 Protection for fry. fair
 Protection for fingerlings and growing fish good
 Drouth resistance good
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE

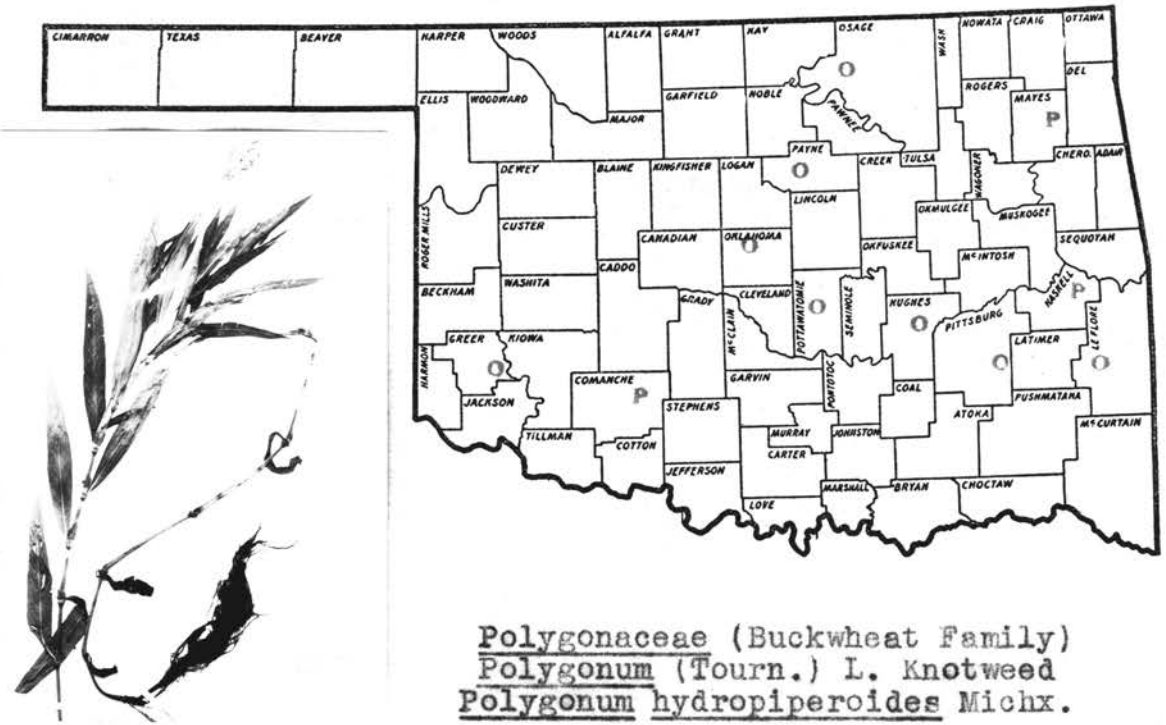


General habitatshallow water
 Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. poor
 Ornamental properties good
 Value as an oxygenator. poor
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. . . good
 Protection for fry. fair
 Protection for fingerlings and growing fish fair
 Drouth resistance good
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE

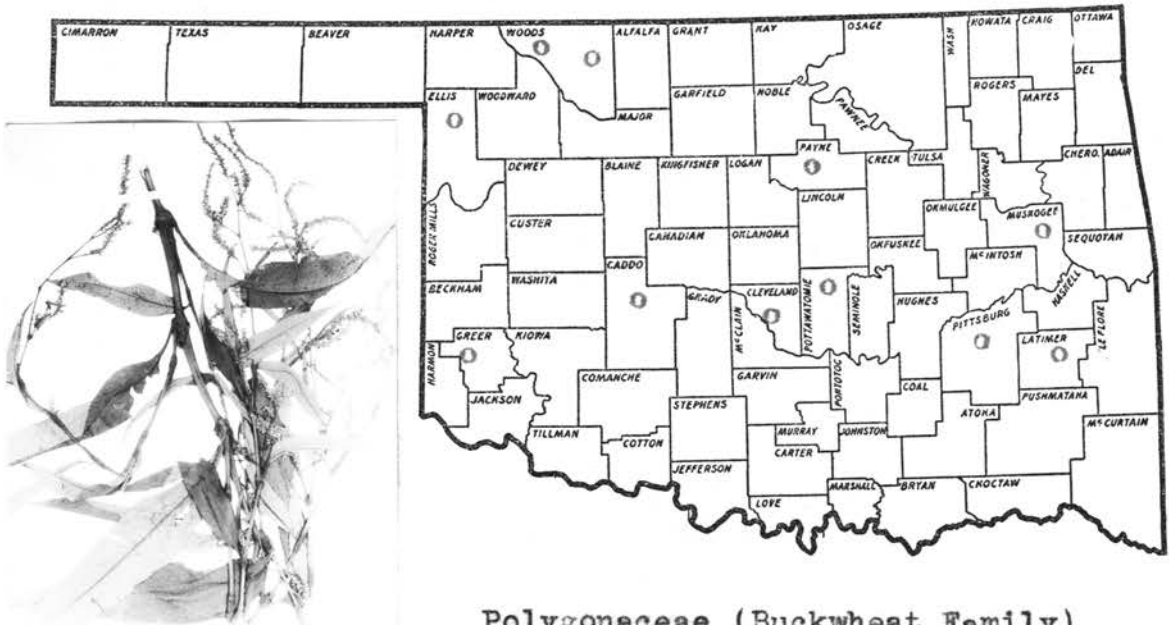


General habitat water's edge and shallow water
 Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. . . good
 Protection for fry. fair
 Protection for fingerlings and growing fish good
 Drouth resistance good
 Water clarifying qualities. unknown
 Tolerance for turbidity good

DISTRIBUTION AND ECONOMIC IMPORTANCE



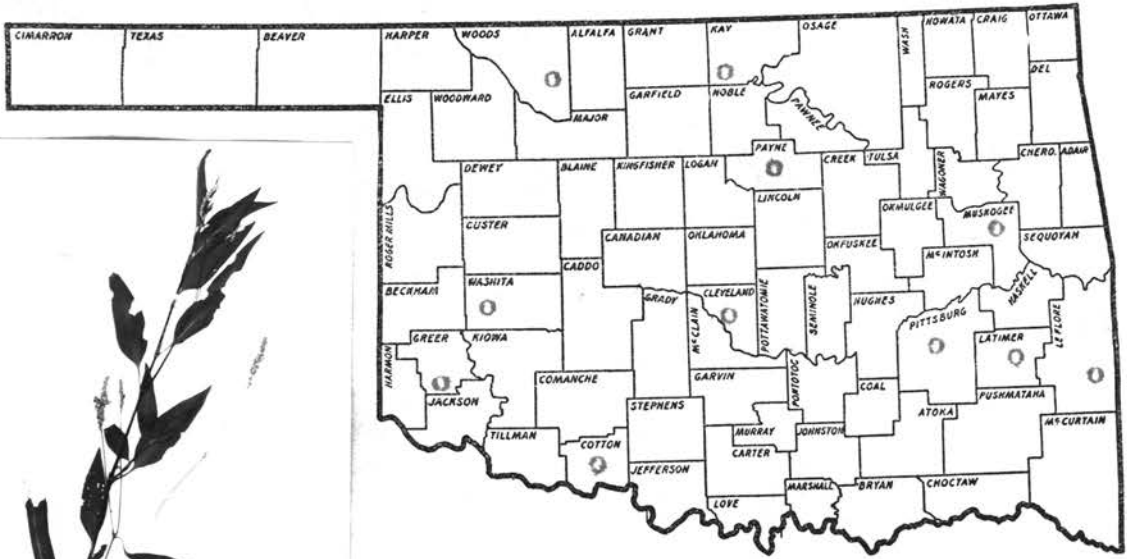
Polygonaceae (Buckwheat Family)
Polygonum (Tourn.) L. Knotweed
Polygonum lapathifolium L.

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. . . good
 Protection for fry. poor
 Protection for fingerlings and growing fish poor
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



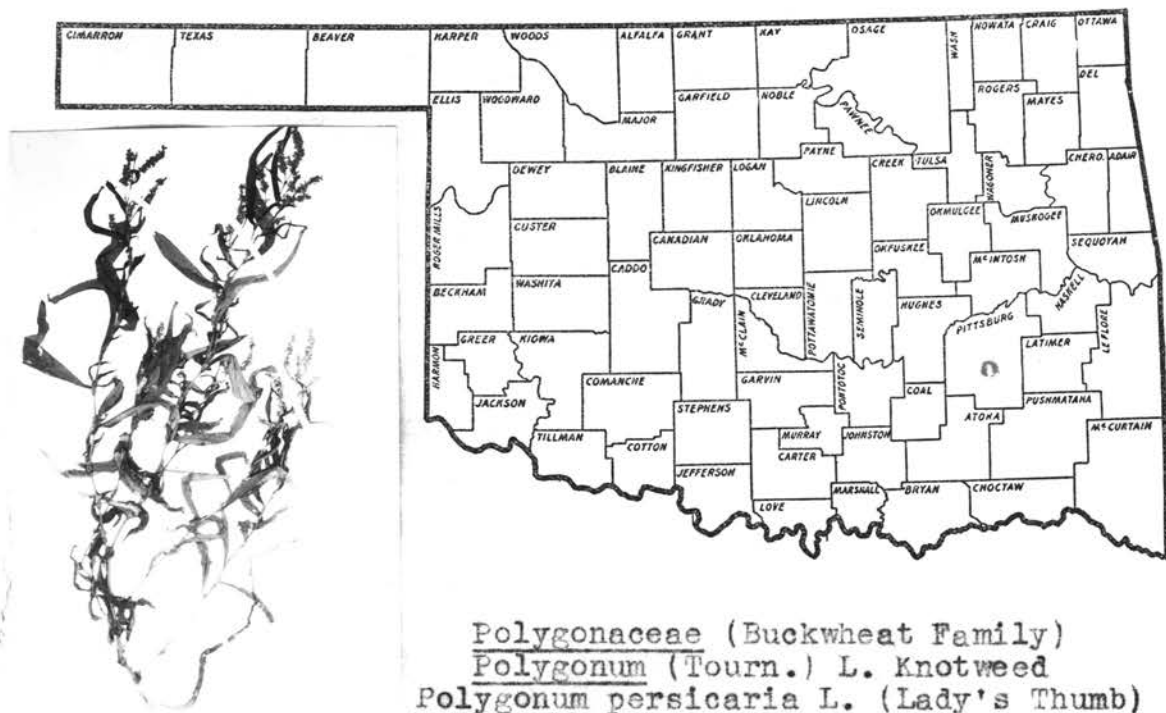
Polygonaceae (Buckwheat Family)
Polygonum (Tourn.) L. Knotweed
Polygonum pennsylvanicum L.

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. . . good
 Protection for fry. fair
 Protection for fingerlings and growing fish fair
 Drouth resistance good
 Water clarifying qualities. unknown
 Tolerance for turbidity good

DISTRIBUTION AND ECONOMIC IMPORTANCE

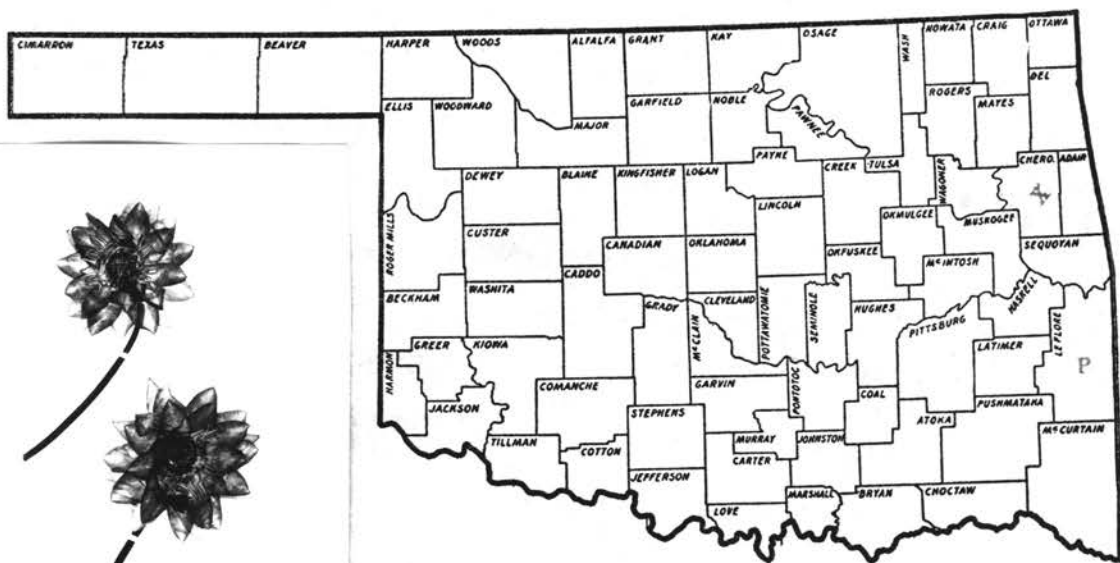


General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food poor
 Ornamental properties fair
 Value as an oxygenator poor
 Ability to increase fertility of water good
 Ability to prevent silting and erosive wave action . . . fair
 Protection for fry poor
 Protection for fingerlings and growing fish poor
 Drouth resistance good
 Water clarifying qualities unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



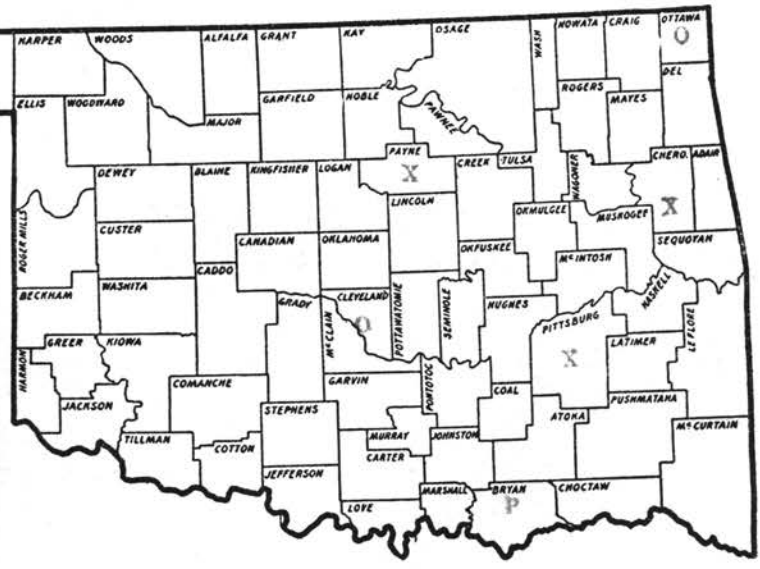
Nymphaeaceae (Water Lily Family)
Castalia Salisb. Water Nymph
Castalia Sp. - hybrid

General habitatshallow water
 Growth type partially submersed with floating leaves

RELATIVE VALUES IN FISH CULTURE

Shade good
 Food. poor
 Ornamental properties good
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. fair
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



Nymphaeaceae (Water Lily Family)
Castalia Salisb. Water Nymph
Castalia odorata Ait. Woodville & Wood

General habitat shallow water and deep water

Growth type partially submersed with floating leaves

RELATIVE VALUES IN FISH CULTURE

- Shade good
- Food. poor
- Ornamental properties good
- Value as an oxygenator. poor
- Ability to increase fertility of water. good
- Ability to prevent silting and erosive wave action. fair
- Protection for fry. fair
- Protection for fingerlings and growing fish fair
- Drouth resistance unknown
- Water clarifying qualities. unknown
- Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



Nymphaeaceae (Water Lily Family)
Castalia Salisb. Water Nymph
Castalia tuberosa (Paine) Greene

General habitat shallow water and deep water
 Growth type partially submersed with floating leaves

RELATIVE VALUES IN FISH CULTURE

Shade good
 Food. poor
 Ornamental properties good
 Value as an oxygenator. poor
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. fair
 Protection for fry. fair
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown



WATER LILY
 FROM A. W. COLE

DISTRIBUTION AND ECONOMIC IMPORTANCE

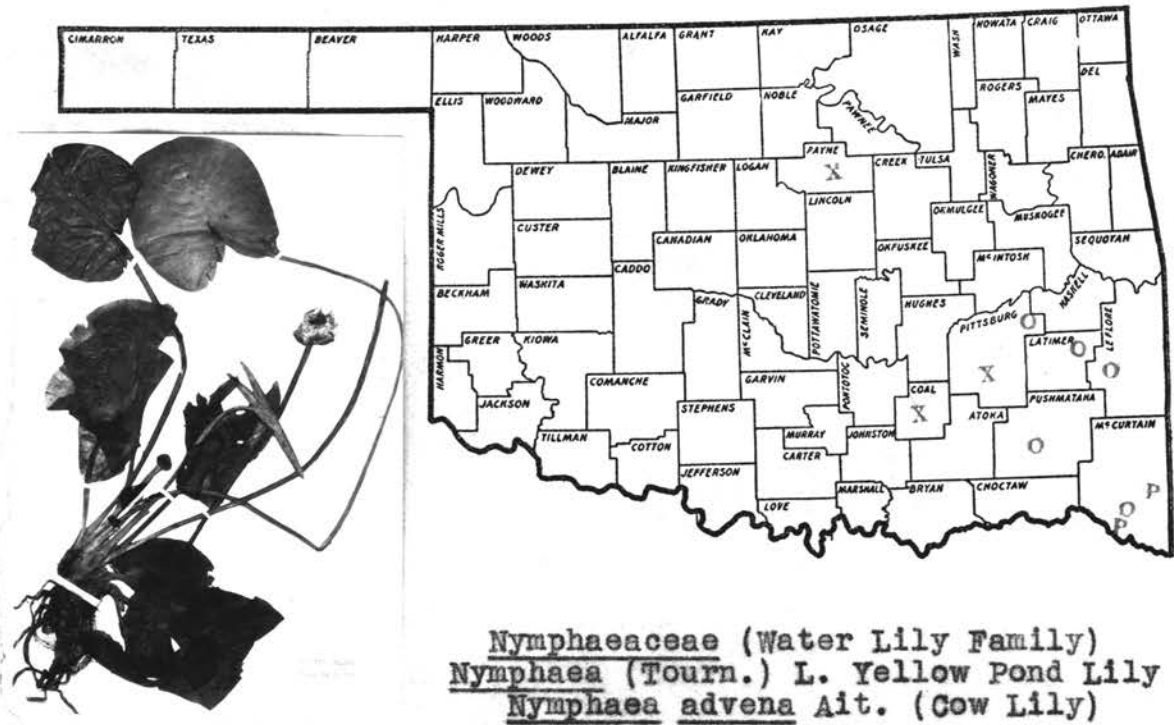


General habitat shallow water and deep water
 Growth type partially submersed with floating leaves

RELATIVE VALUES IN FISH CULTURE

Shade good
 Food. poor
 Ornamental properties good
 Value as an oxygenator. poor
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. fair
 Protection for fry. poor
 Protection for fingerlings and growing fish fair
 Drouth resistance good
 Water clarifying qualities. unknown
 Tolerance for turbidity fair

DISTRIBUTION AND ECONOMIC IMPORTANCE

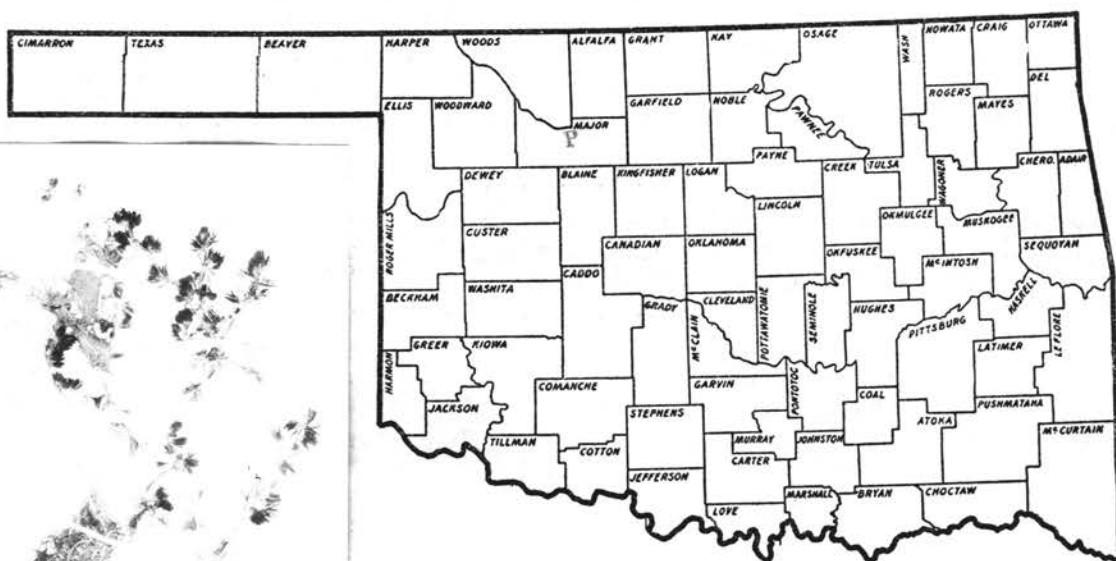


General habitatshallow water
 Growth type partially submersed with floating leaves

RELATIVE VALUES IN FISH CULTURE

Shade good
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. fair
 Protection for fingerlings and growing fish fair
 Drouth resistance good
 Water clarifying qualities. unknown
 Tolerance for turbidity fair

DISTRIBUTION AND ECONOMIC IMPORTANCE



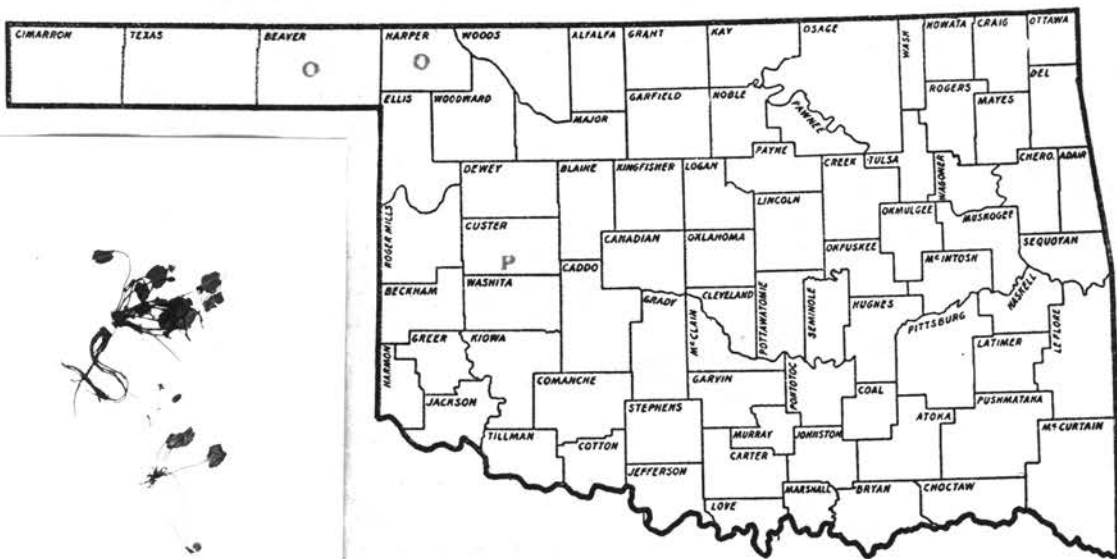
Ranunculaceae (Crowfoot Family)
Ranunculus (Tourn.) L. Crowfoot
R. aquatilis L., var. capillaceus DC.

General habitat shallow water
 Growth type wholly submersed

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. fair
 Ornamental properties fair
 Value as an oxygenator. good
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. good
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



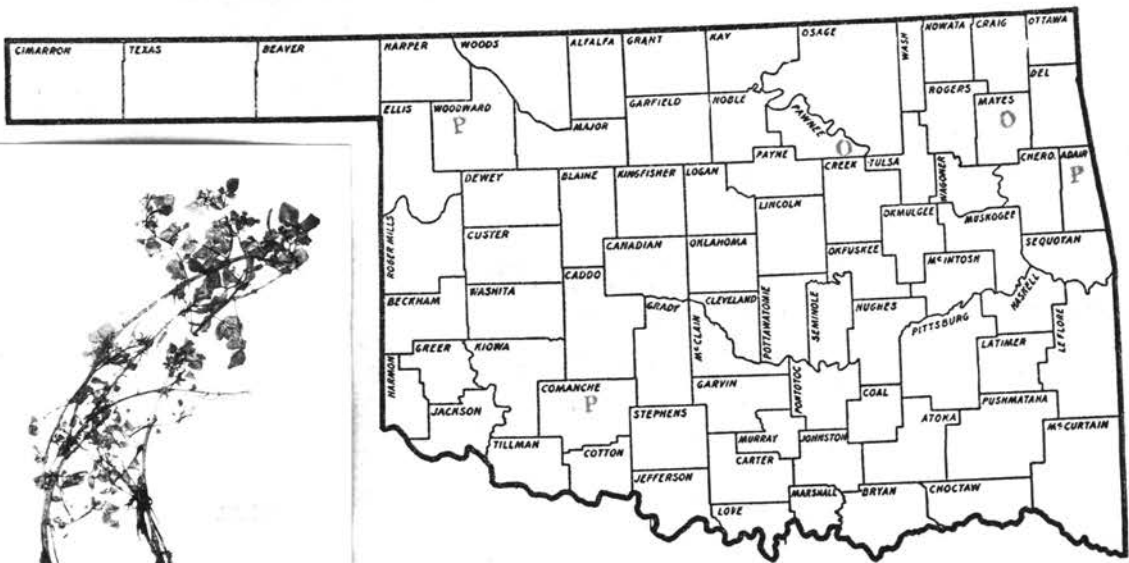
Ranunculaceae (Crowfoot Family)
Ranunculus (Tourn.) L. Crowfoot
Ranunculus Cymbalaria Pursh.

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade none
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. unknown
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. unknown
 Protection for fingerlings and growing fish unknown
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



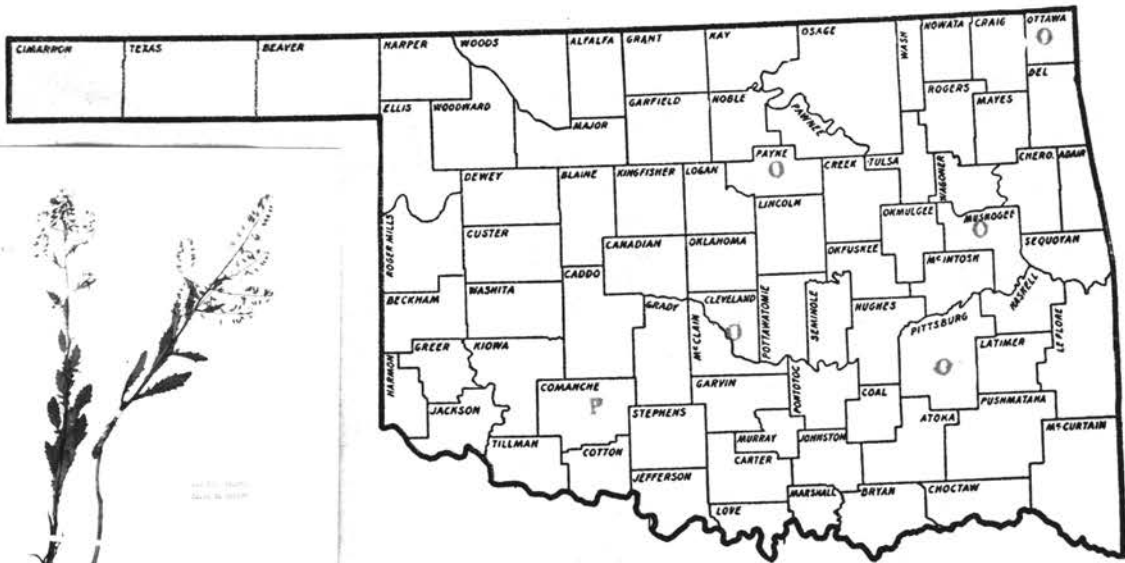
Cruciferae (Mustard Family)
Radicula (Dill.) Hill. Water Cress
R. Nasturtium-aquaticum (L.) Br. & R.

General habitatshallow water
 Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food. fair
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. fair
 Protection for fry. poor
 Protection for fingerlings and growing fish poor
 Drouth resistance poor
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



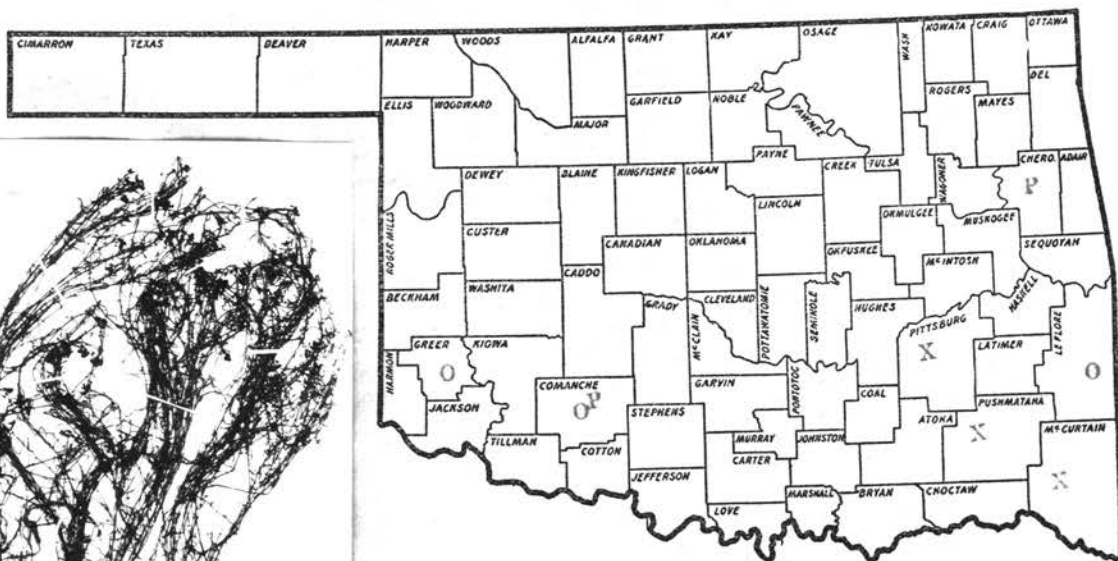
Cruciferae (Mustard Family)
Radicula (Dill.) Hill. Water Cress
R. palustris (L.) Moench. Marsh Cress

General habitat water's edge
 Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

- Shade poor
- Food. poor
- Ornamental properties poor
- Value as an oxy enator. poor
- Ability to increase fertility of water. fair
- Ability to prevent silting and erosive wave action. fair
- Protection for fry. poor
- Protection for fingerlings and growing fish poor
- Drouth resistance good
- Water clarifying qualities. unknown
- Tolerance for turbidity fair

DISTRIBUTION AND ECONOMIC IMPORTANCE



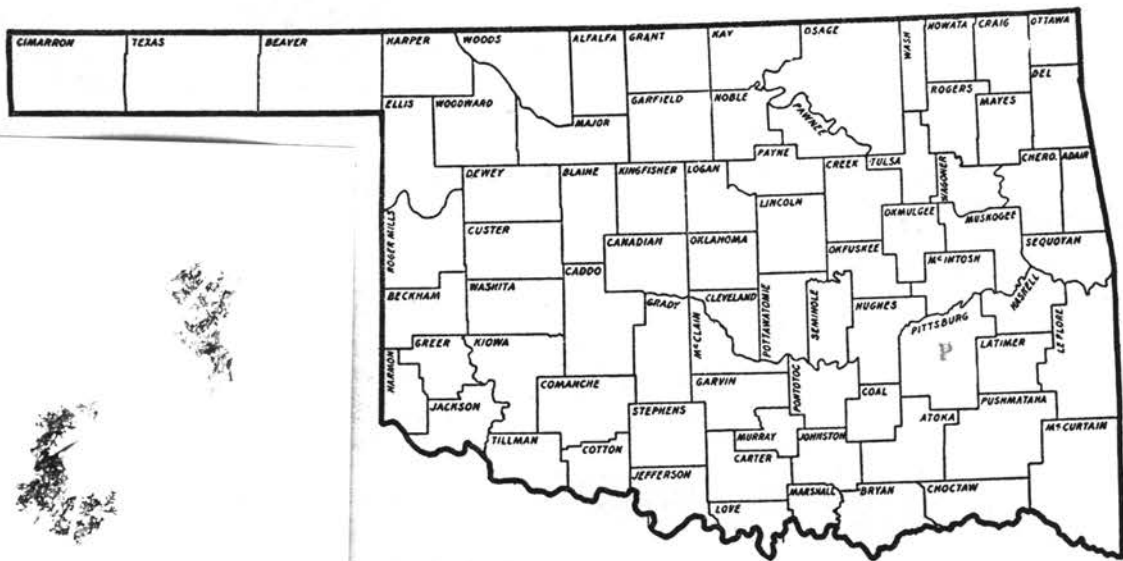
Callitrichaceae (Water Starwort Family)
Callitriche L. Water Starwort
Callitriche heterophylla Pursh.

General habitatshallow water
 Growth type partially submersed with floating leaves

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food. fair
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. fair
 Protection for fingerlings and growing fish poor
 Drouth resistance fair
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



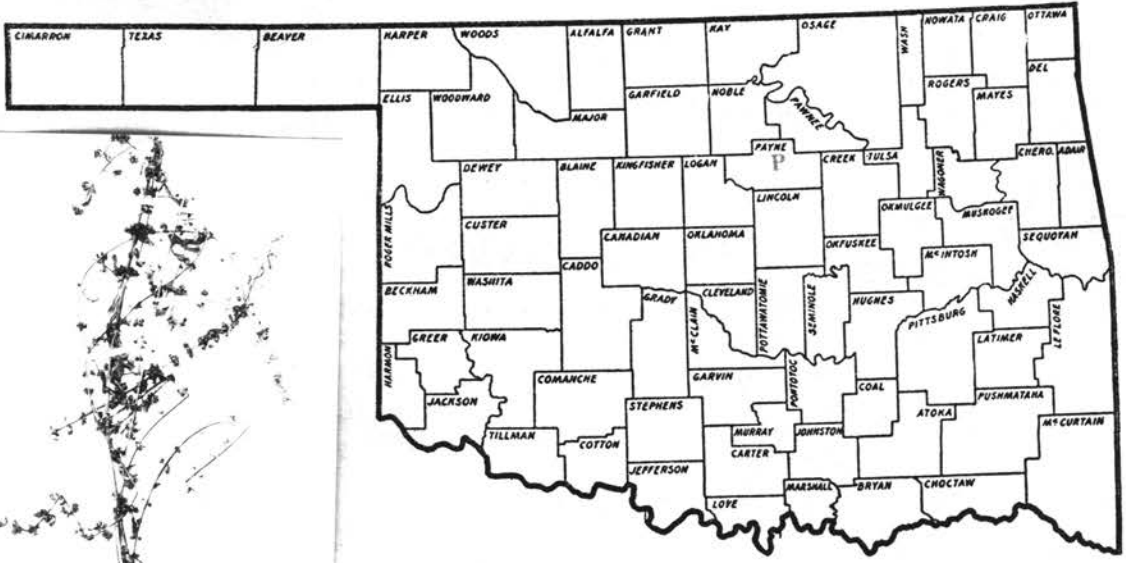
Cistaceae (Rockrose Family)
Elatine L. Waterwort
Elatine americana (Pursh) Arn.

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade none
 Food. fair
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. poor
 Ability to prevent silting and erosive wave action. . . poor
 Protection for fry. none
 Protection for fingerlings and growing fish none
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



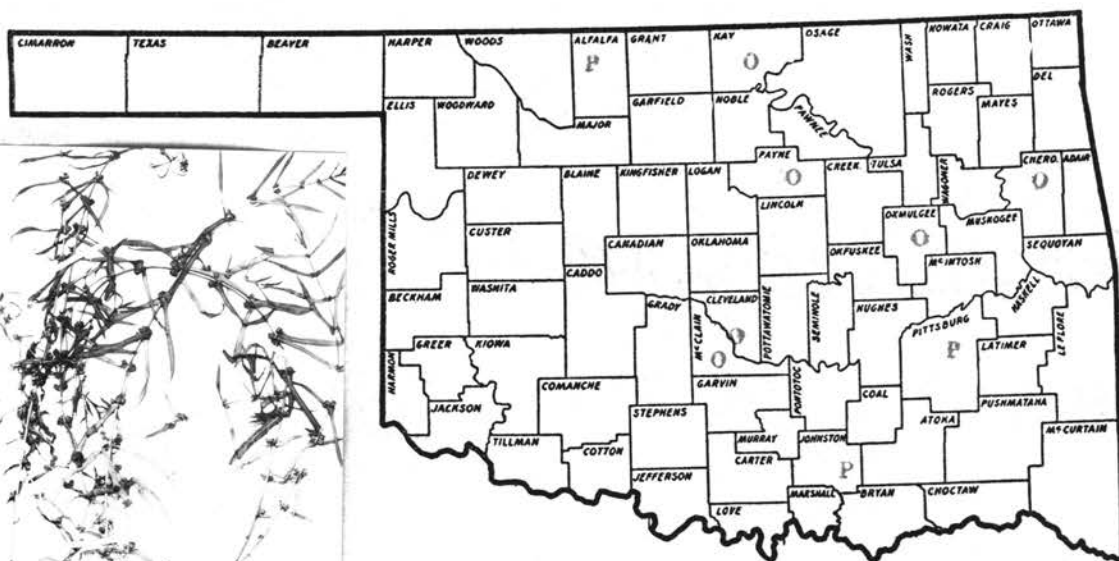
Lythraceae (Loosestrife Family)
Ammannia (Houston) L.
Ammannia auriculata Willd.

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. poor
 Protection for fingerlings and growing fish poor
 Drouth resistance good
 Water clarifying qualities. unknown
 Tolerance for turbidity fair

DISTRIBUTION AND ECONOMIC IMPORTANCE



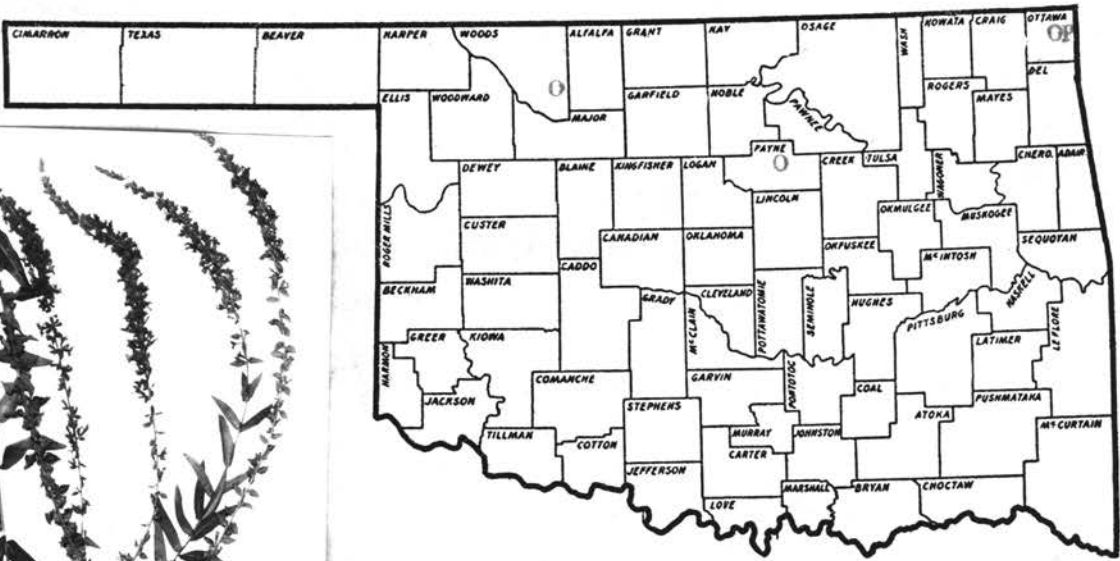
Lythraceae (Loosestrife Family)
Ammannia (Houston) L.
Ammannia coccinea Rottb.

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. poor
 Protection for fingerlings and growing fish poor
 Drouth resistance good
 Water clarifying qualities. unknown
 Tolerance for turbidity fair

DISTRIBUTION AND ECONOMIC IMPORTANCE



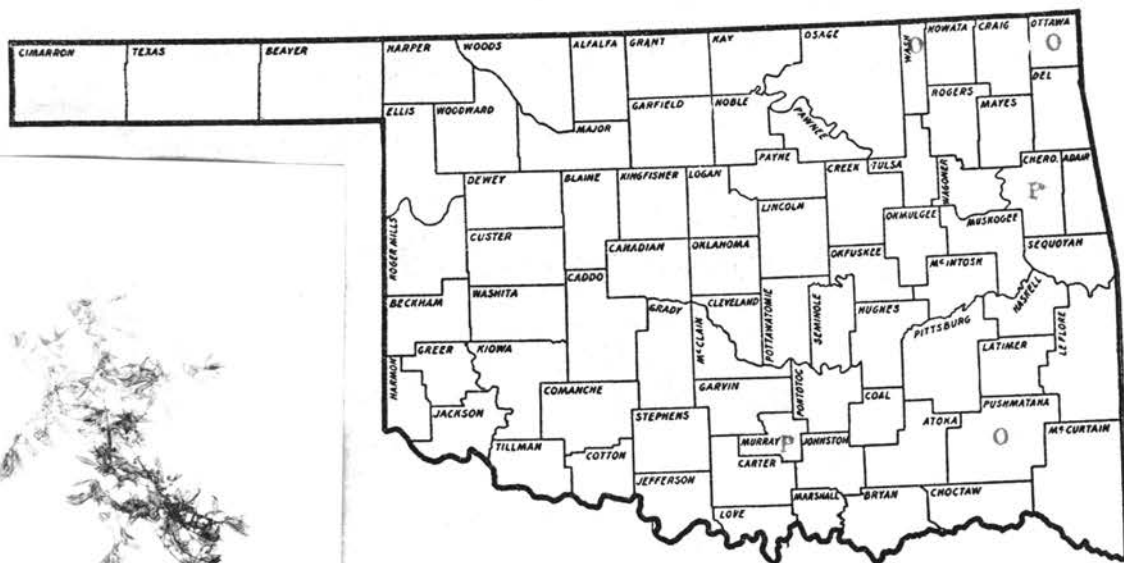
Lythraceae (Loosestrife Family)
Lythrum L. Loosestrife
Lythrum alatum Pursh.

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. poor
 Ornamental properties good
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. poor
 Protection for fingerlings and growing fish poor
 Drouth resistance fair
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



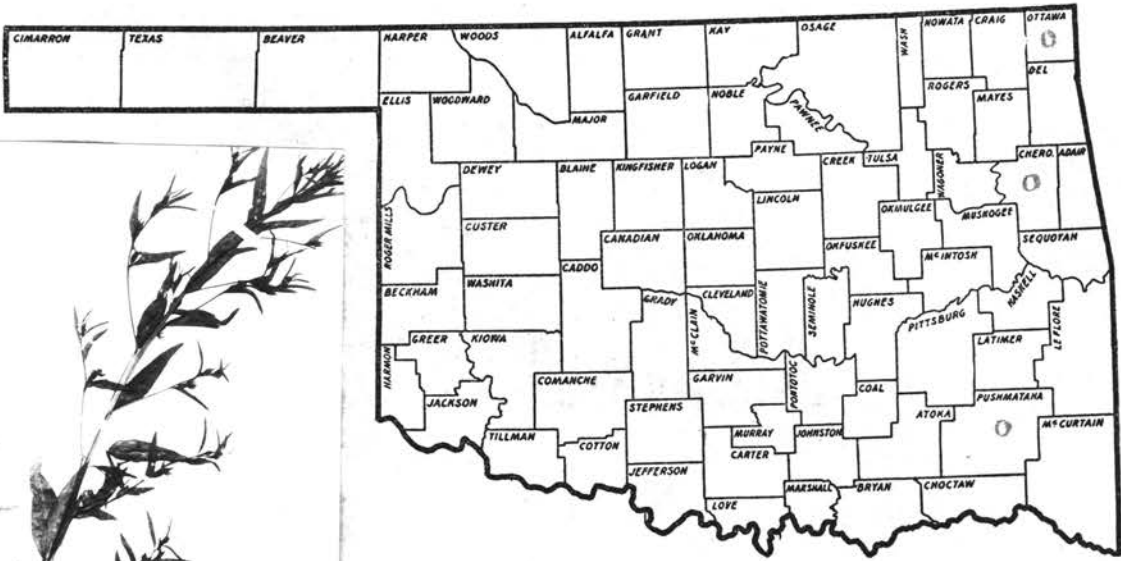
Lythraceae (Loosestrife Family)
Rotala L.
Rotala ramosior (L.) Koehne

General habitat water's edge
 Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. fair
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. fair
 Protection for fingerlings and growing fish poor
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



Onagraceae (Evening Primrose Family)
Jussiaea L. Primrose-willow
Jussiaea decurrens (Walt.) DC.

General habitat water's edge

Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair

Food. poor

Ornamental properties good

Value as an oxygenator. poor

Ability to increase fertility of water. fair

Ability to prevent silting and erosive wave action. . . good

Protection for fry. poor

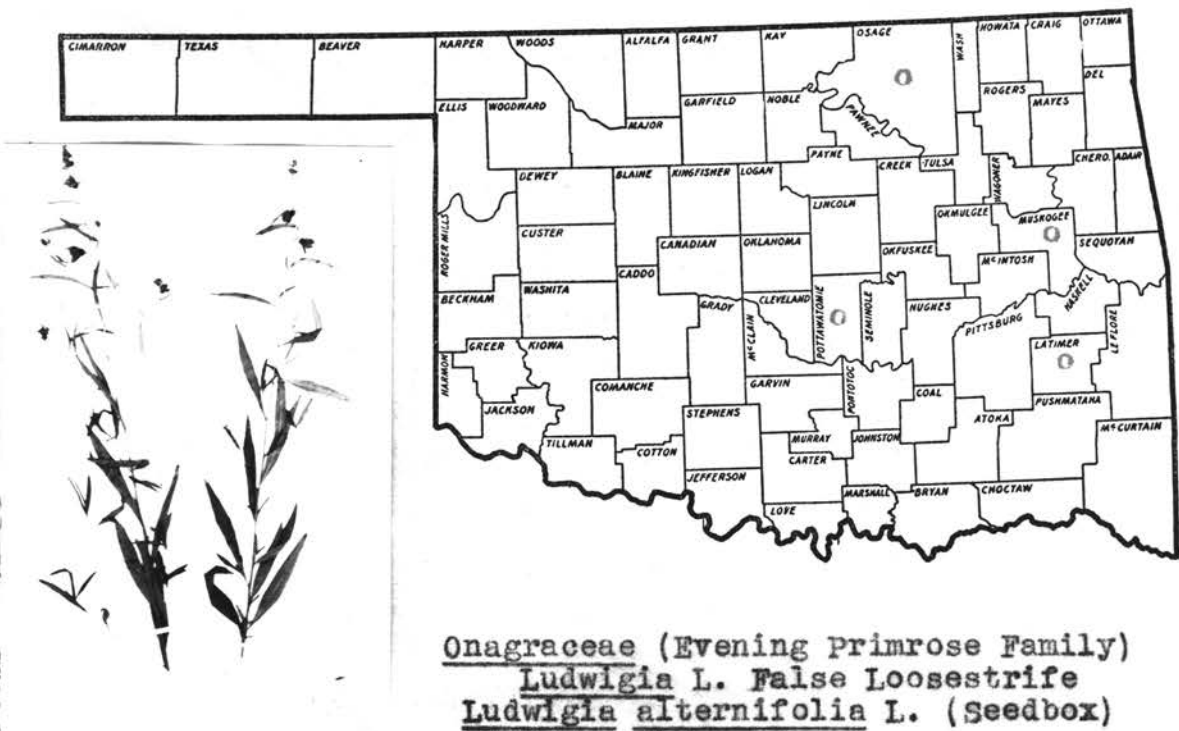
Protection for fingerlings and growing fish poor

Drouth resistance unknown

Water clarifying qualities. unknown

Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE

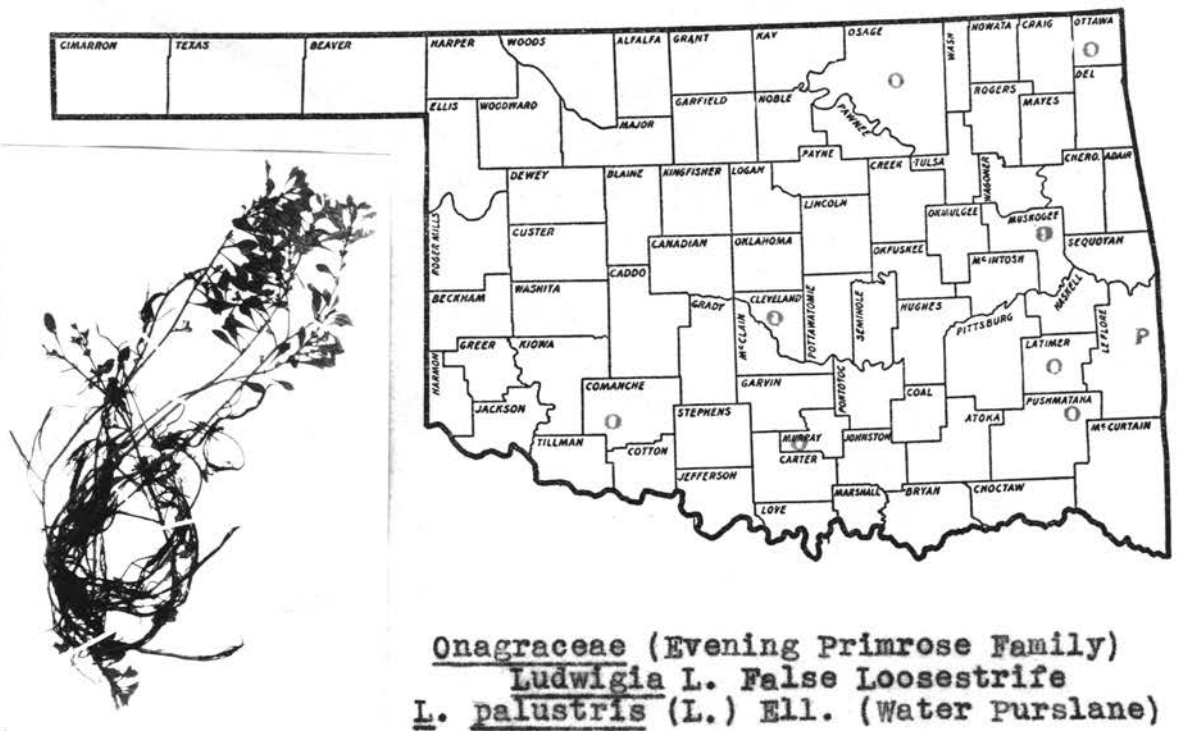


General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

- Shade poor
- Food. poor
- Ornamental properties fair
- Value as an oxygenator. poor
- Ability to increase fertility of water. fair
- Ability to prevent silting and erosive wave action. . . fair
- Protection for fry. poor
- Protection for fingerlings and growing fish poor
- Drouth resistance unknown
- Water clarifying qualities. unknown
- Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



Onagraceae (Evening Primrose Family)
Ludwigia L. False Loosestrife
L. palustris (L.) Ell. (Water Purslane)

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

- Shade fair
- Food. fair
- Ornamental properties fair
- Value as an oxygenator. poor
- Ability to increase fertility of water. fair
- Ability to prevent silting and erosive wave action. . . fair
- Protection for fry. poor
- Protection for fingerlings and growing fish poor
- Drouth resistance fair
- Water clarifying qualities. unknown
- Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



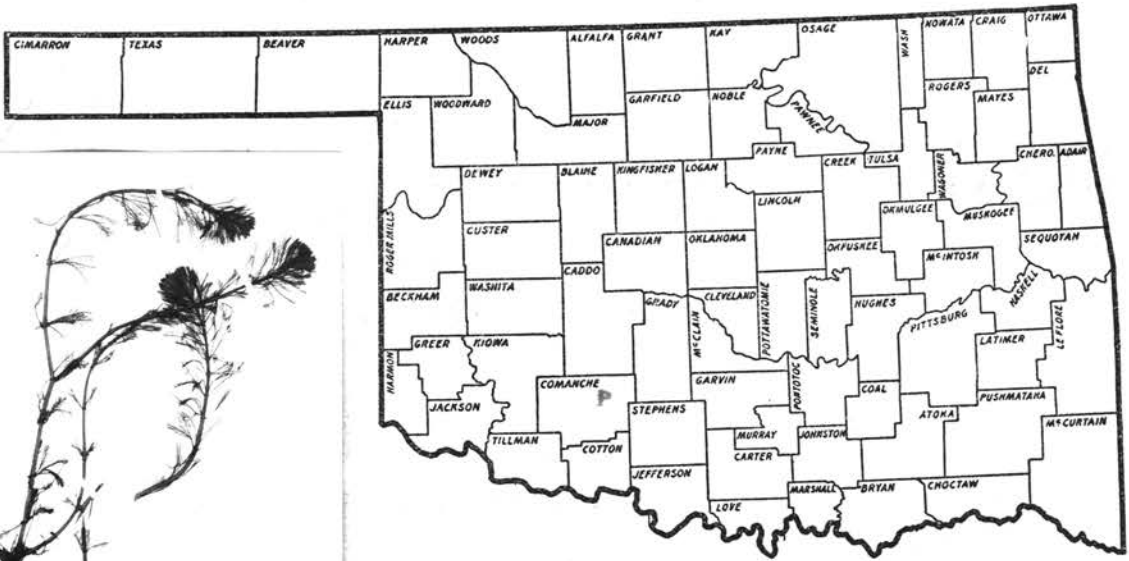
Haloragidaceae (Water Milfoil Family)
Myriophyllum (Vaill.) L. Water Milfoil
Myriophyllum heterophyllum Michx.

General habitat shallow water and deep water
 Growth type . . . partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. good
 Ornamental properties fair
 Value as an oxygenator. fair
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. fair
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



WRIGHT PLANTS
PLANT 28 1927

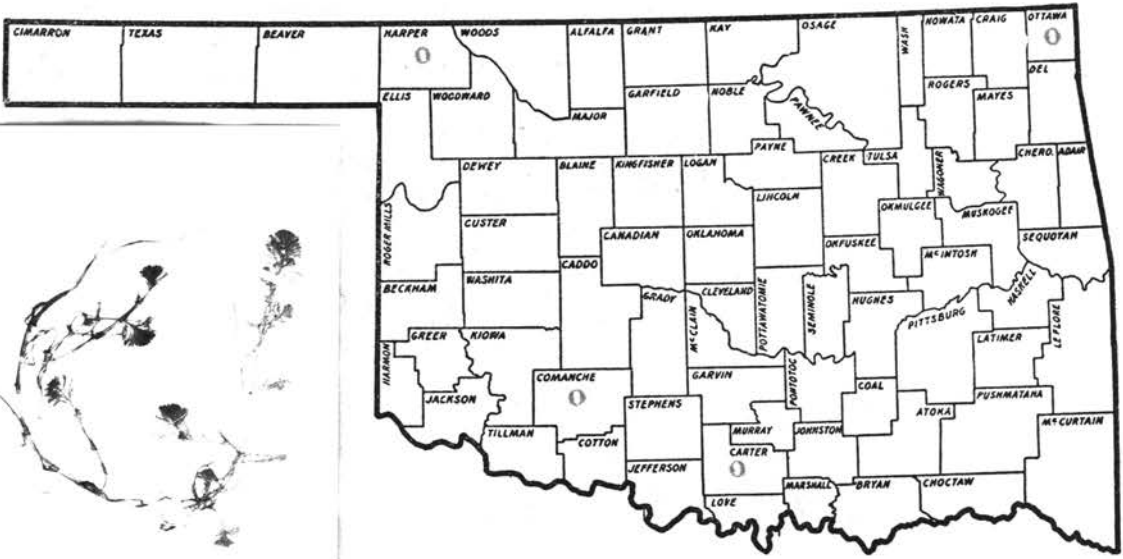
Haloragidaceae (Water Milfoil Family)
Myriophyllum (Vaill.) L. Water Milfoil
Myriophyllum proserpinacoides (?)

General habitat shallow water
 Growth type . . . partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. good
 Ornamental properties good
 Value as an oxygenator. fair
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. fair
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



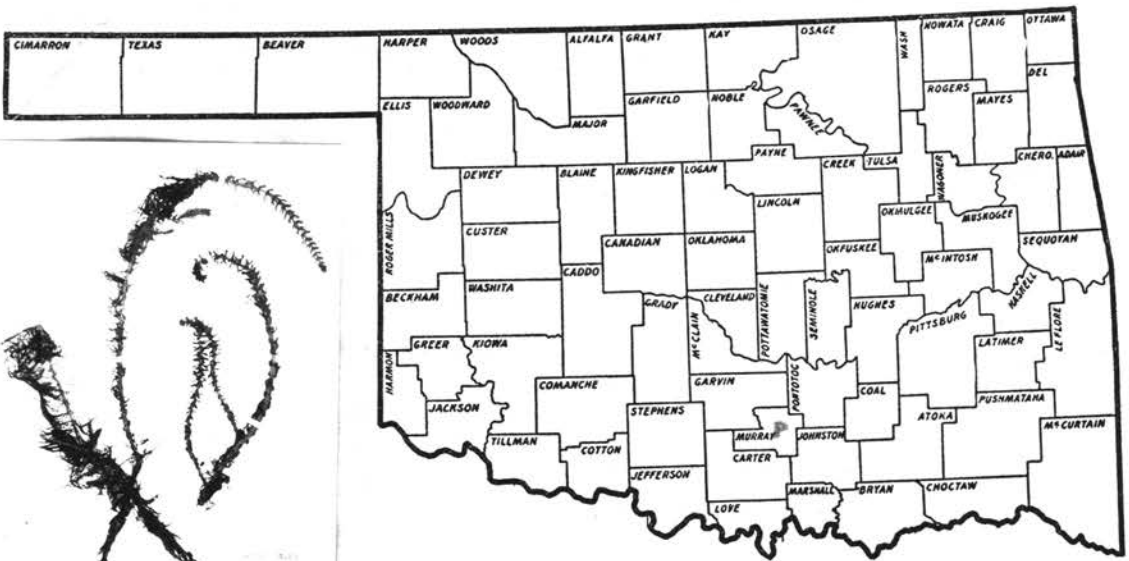
Haloragidaceae (Water Milfoil Family)
Myriophyllum (Vaill.) L. Water Milfoil
Myriophyllum scabratum Michx.

General habitat shallow water and deep water
 Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

- Shade fair
- Food. good
- Ornamental properties fair
- Value as an oxygenator. fair
- Ability to increase fertility of water. good
- Ability to prevent silting and erosive wave action. . . fair
- Protection for fry. fair
- Protection for fingerlings and growing fish fair
- Drouth resistance unknown
- Water clarifying qualities. unknown
- Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



Haloragidaceae (Water Milfoil Family)
Myriophyllum (Vaill.) L. Water Milfoil
Myriophyllum spicatum L.

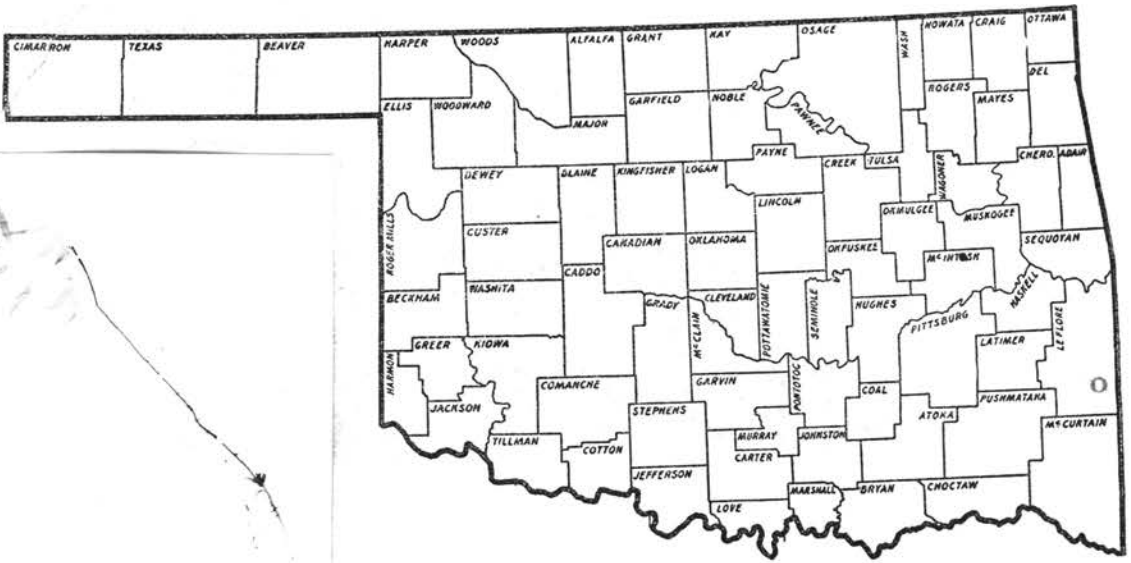
General habitat shallow water and deep water

Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

- Shade fair
- Food. good
- Ornamental properties fair
- Value as an oxygenator. fair
- Ability to increase fertility of water. good
- Ability to prevent silting and erosive wave action. . . fair
- Protection for fry. fair
- Protection for fingerlings and growing fish fair
- Drouth resistance unknown
- Water clarifying qualities. unknown
- Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



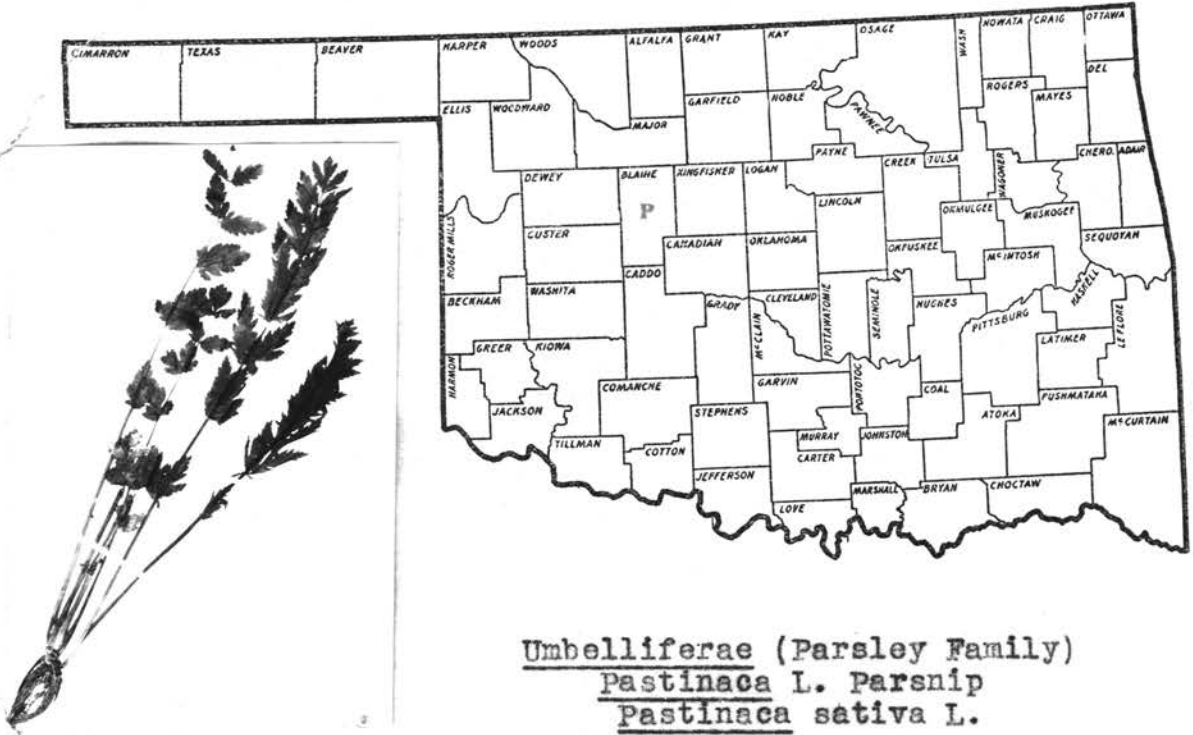
Araliaceae (Ginseng Family)
Proserpinaca L. Mermaid-weed
Proserpinaca palustris L.

General habitat water's edge and shallow water
 Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade fair
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. fair
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. fair
 Protection for fingerlings and growing fish fair
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



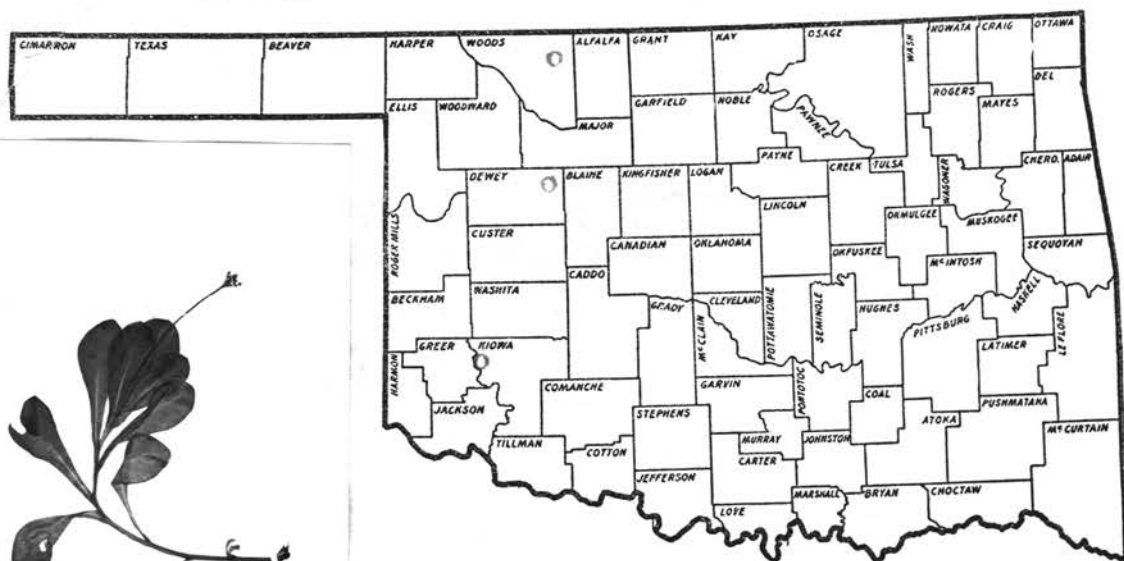
Umbelliferae (Parsley Family)
Pastinaca L. Parsnip
Pastinaca sativa L.

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food. poor
 Ornamental properties. fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. none
 Protection for fingerlings and growing fish none
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



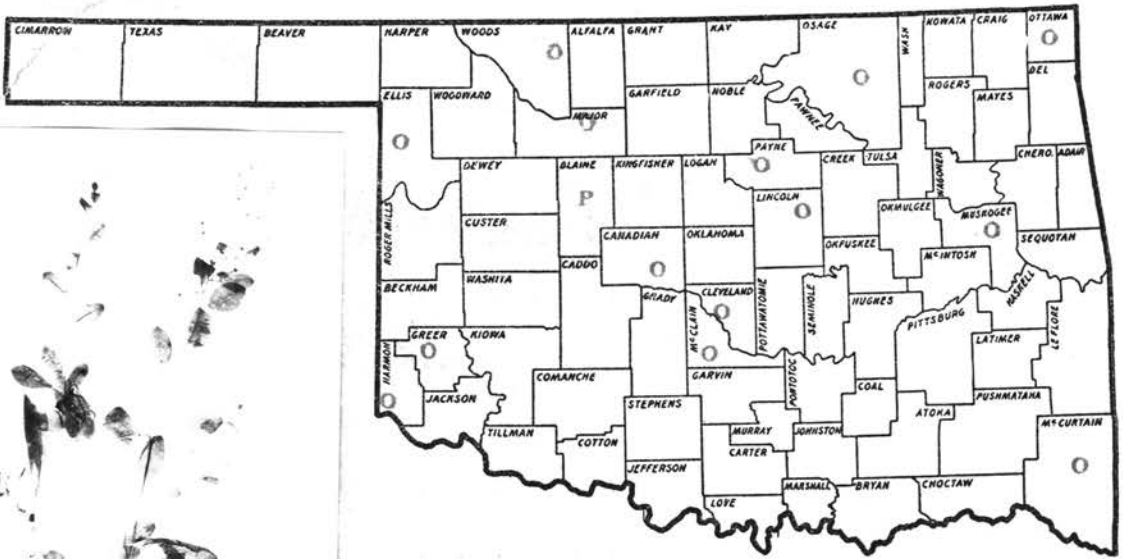
Primulaceae (Primrose Family)
Samolus (Tourn.) L. Water Pimpernel.
Samolus ebracteatus HBK

General habitat water's edge
 Growth type . . . sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade	poor
Food.	fair
Ornamental properties	fair
Value as an oxygenator.	poor
Ability to increase fertility of water.	poor
Ability to prevent silting and erosive wave action.	poor
Protection for fry.	none
Protection for fingerlings and growing fish	none
Drouth resistance	poor
Water clarifying qualities.	unknown
Tolerance for turbidity	unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



Primulaceae (Primrose Family)
Samolus (Tourn.) L. Water Pimpernel.
Samolus floribundus HBK

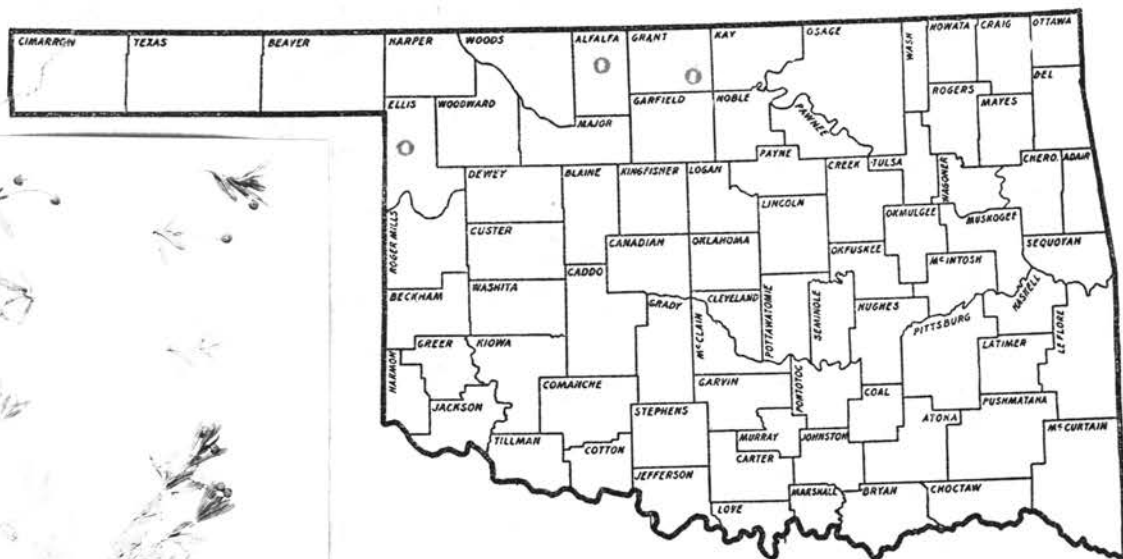
General habitat water's edge

Growth type . . . sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade	poor
Food.	fair
Ornamental properties	fair
Value as an oxygenator.	poor
Ability to increase fertility of water.	poor
Ability to prevent silting and erosive wave action.	poor
Protection for fry.	none
Protection for fingerlings and growing fish	none
Drouth resistance	poor
Water clarifying qualities.	unknown
Tolerance for turbidity	unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



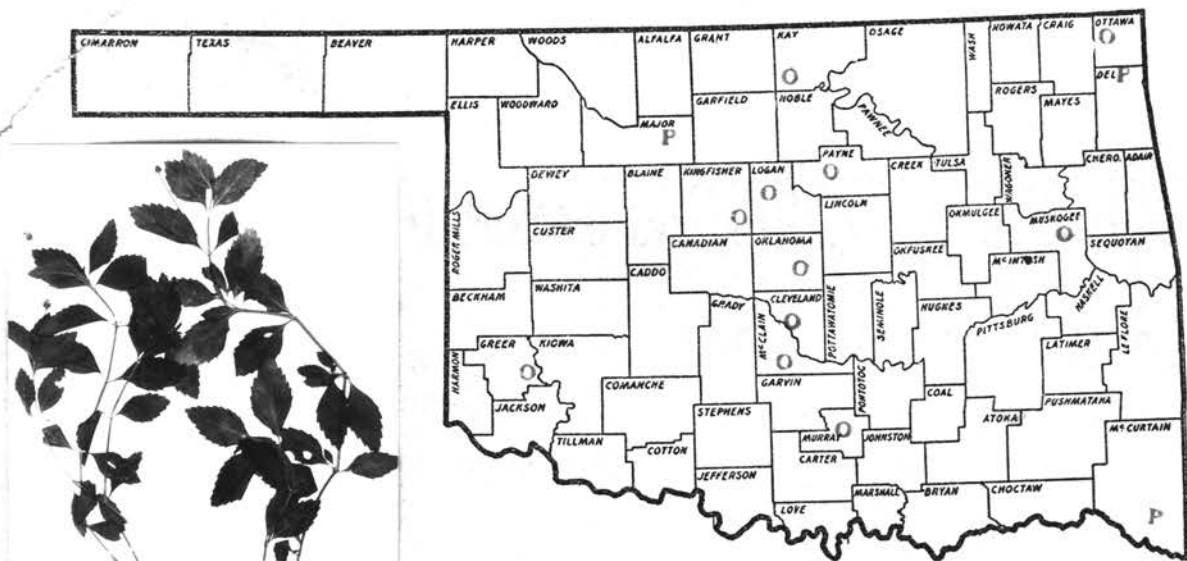
Verbenaceae (Vervain Family)
Lippia (Houston) L.
Lippia cuneifolia (Torr.) Steud.

General habitat water's edge
 Growth type sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. fair
 Protection for fry. poor
 Protection for fingerlings and growing fish poor
 Drouth resistance good
 Water clarifying qualities. unknown
 Tolerance for turbidity good

DISTRIBUTION AND ECONOMIC IMPORTANCE



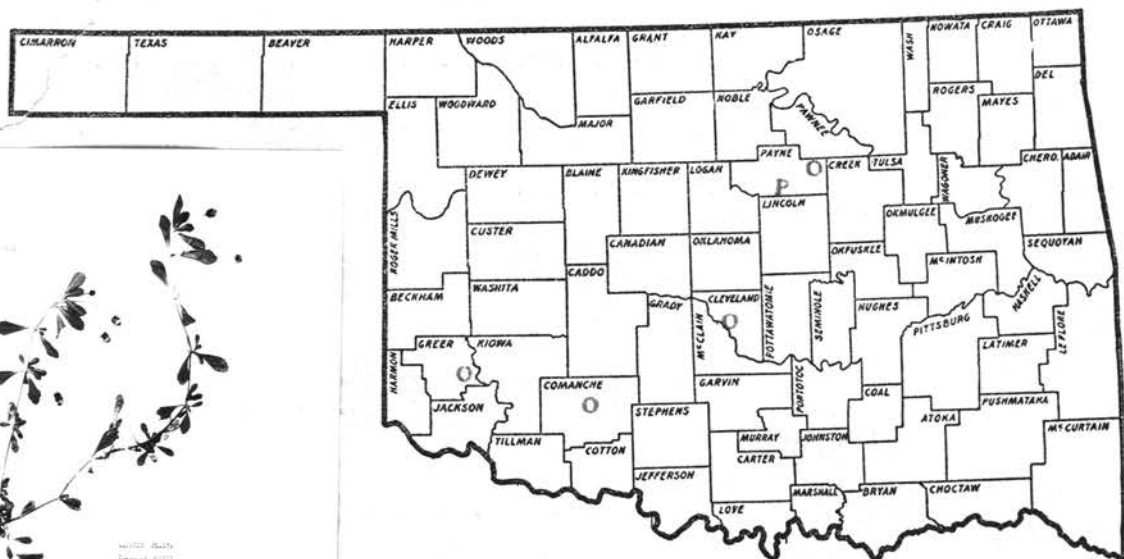
Verbenaceae (Vervain Family)
Lippia (Houston) L.
Lippia lanceolata Michx. (Fog-fruit)

General habitat water's edge
 Growth type . . . sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade	poor
Food.	poor
Ornamental properties	fair
Value as an oxygenator.	poor
Ability to increase fertility of water.	good
Ability to prevent silting and erosive wave action.	fair
Protection for fry.	poor
Protection for fingerlings and growing fish	poor
Drouth resistance	good
Water clarifying qualities.	unknown
Tolerance for turbidity	good

DISTRIBUTION AND ECONOMIC IMPORTANCE



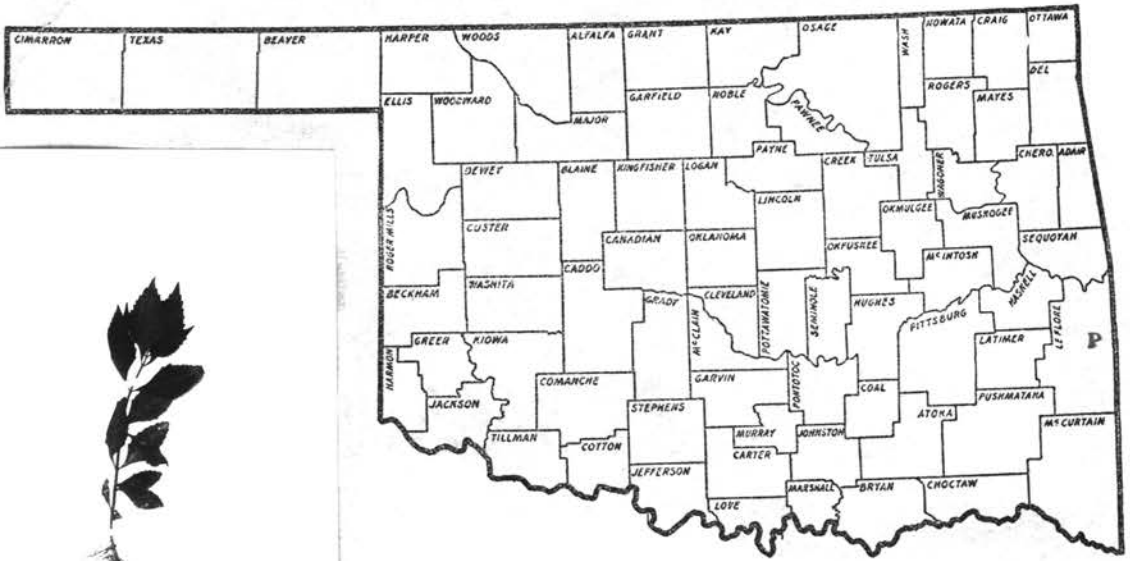
Verbenaceae (Vervain Family)
Lippia (Houston) L.
Lippia nodiflora (L.) Michx.

General habitat water's edge
 Growth type sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food. poor
 Ornamental properties fail
 Value as an oxygenator. poor
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. fair
 Protection for fry. poor
 Protection for fingerlings and growing fish poor
 Drouth resistance good
 Water clarifying qualities. unknown
 Tolerance for turbidity good

DISTRIBUTION AND ECONOMIC IMPORTANCE



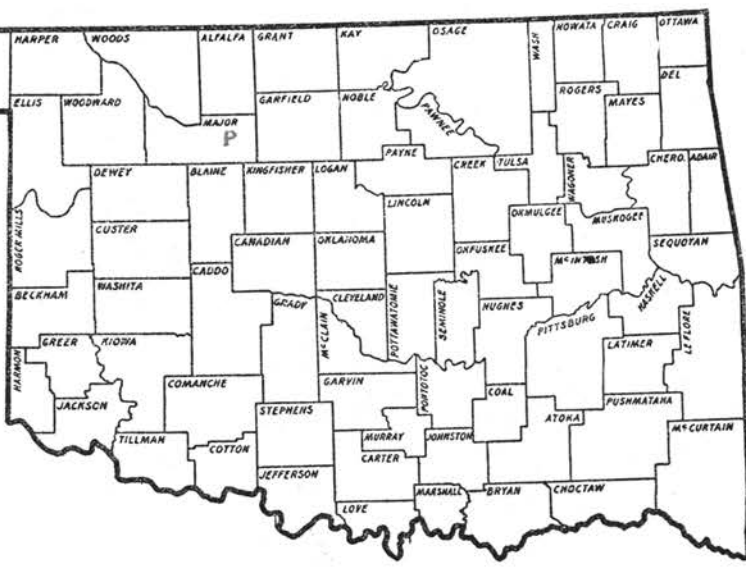
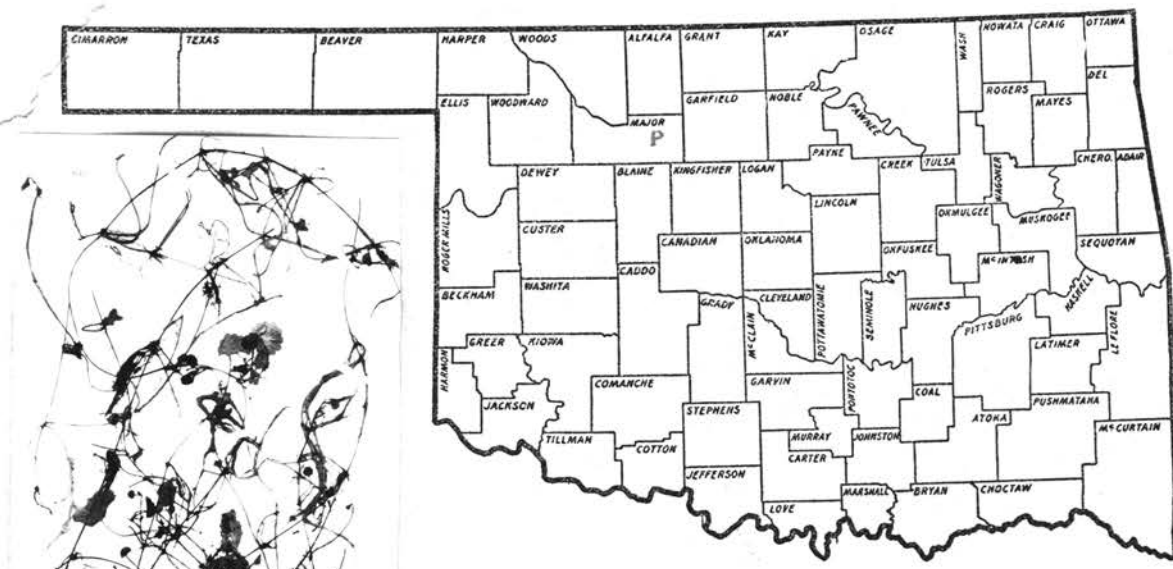
Labiatae (Mint Family)
Lycopus (Tourn.) L. Water Horehound
Lycopus virginicus L. (Bugle Weed.)

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food. poor
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. poor
 Protection for fingerlings and growing fish poor
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



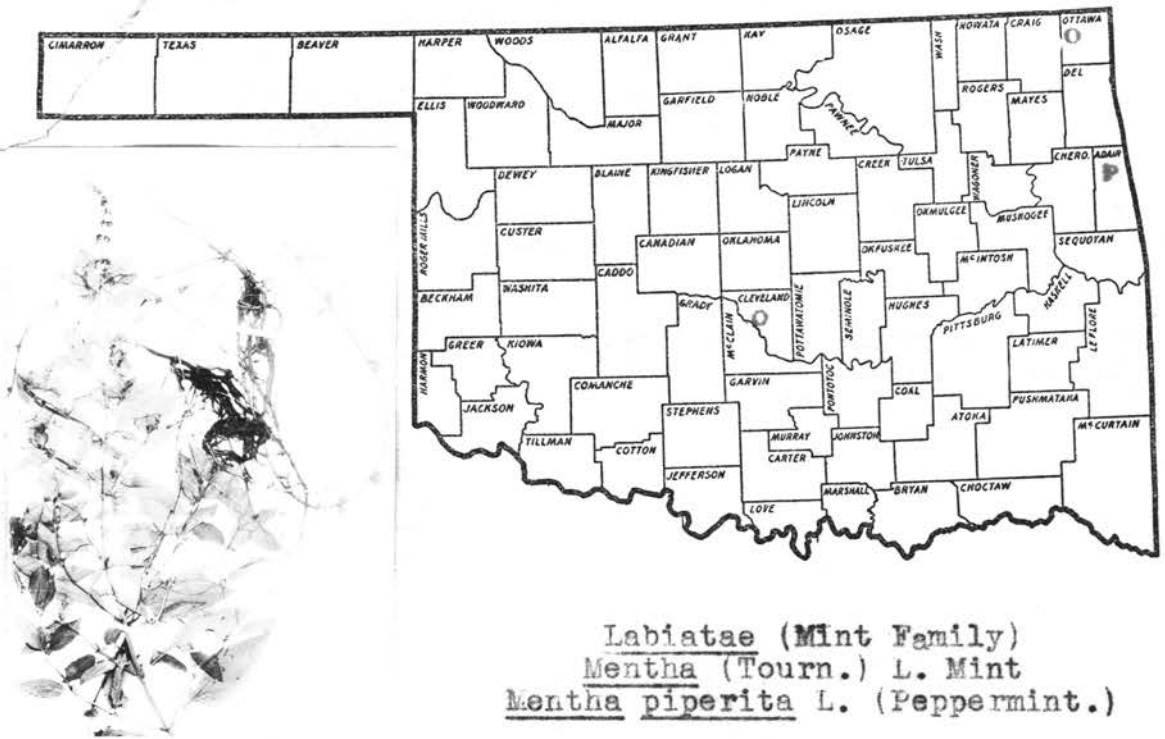
Labiatae (Mint Family)
Nepeta L. Cat Mint
N. hederacea (L.) Trevisan. Ground Ivy

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade	none
Food.	none
Ornamental properties	fair
Value as an oxygenator.	poor
Ability to increase fertility of water.	fair
Ability to prevent silting and erosive wave action.	poor
Protection for fry.	none
Protection for fingerlings and growing fish	none
Drouth resistanceunknown
Water clarifying qualities.unknown
Tolerance for turbidityunknown

DISTRIBUTION AND ECONOMIC IMPORTANCE

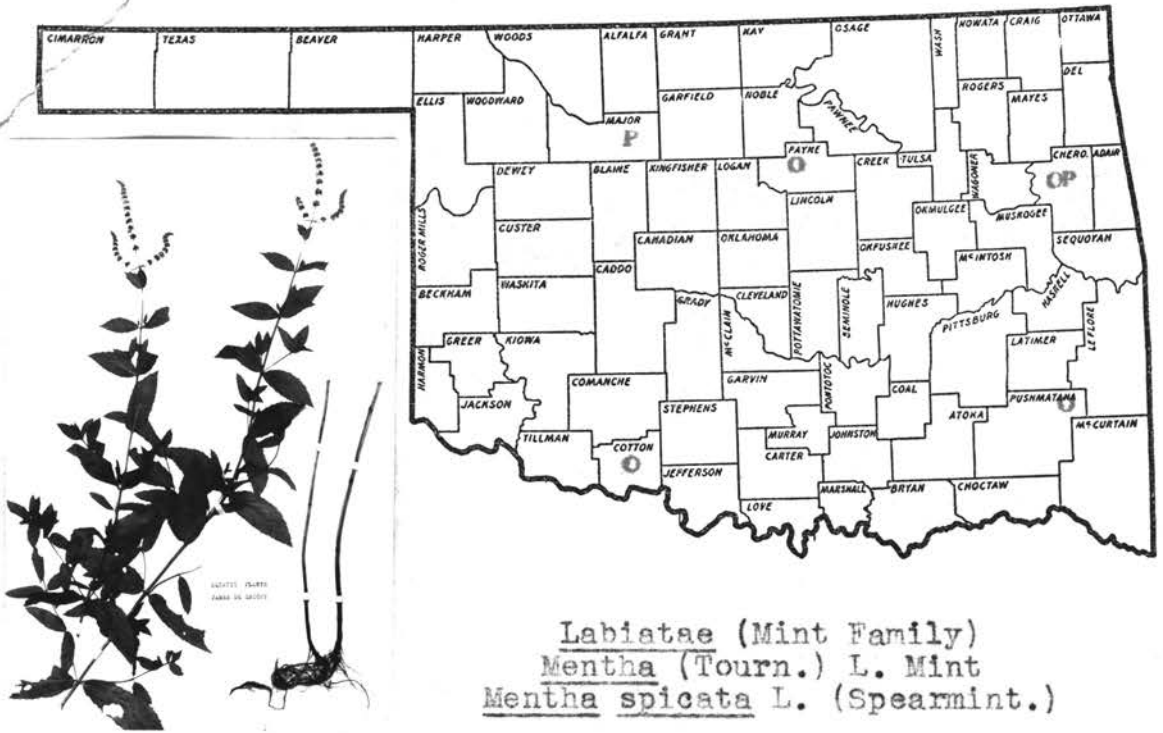


General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food poor
 Ornamental properties good
 Value as an oxygenator poor
 Ability to increase fertility of water fair
 Ability to prevent silting and erosive wave action . . . fair
 Protection for fry poor
 Protection for fingerlings and growing fish poor
 Drouth resistance good
 Water clarifying qualities unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE

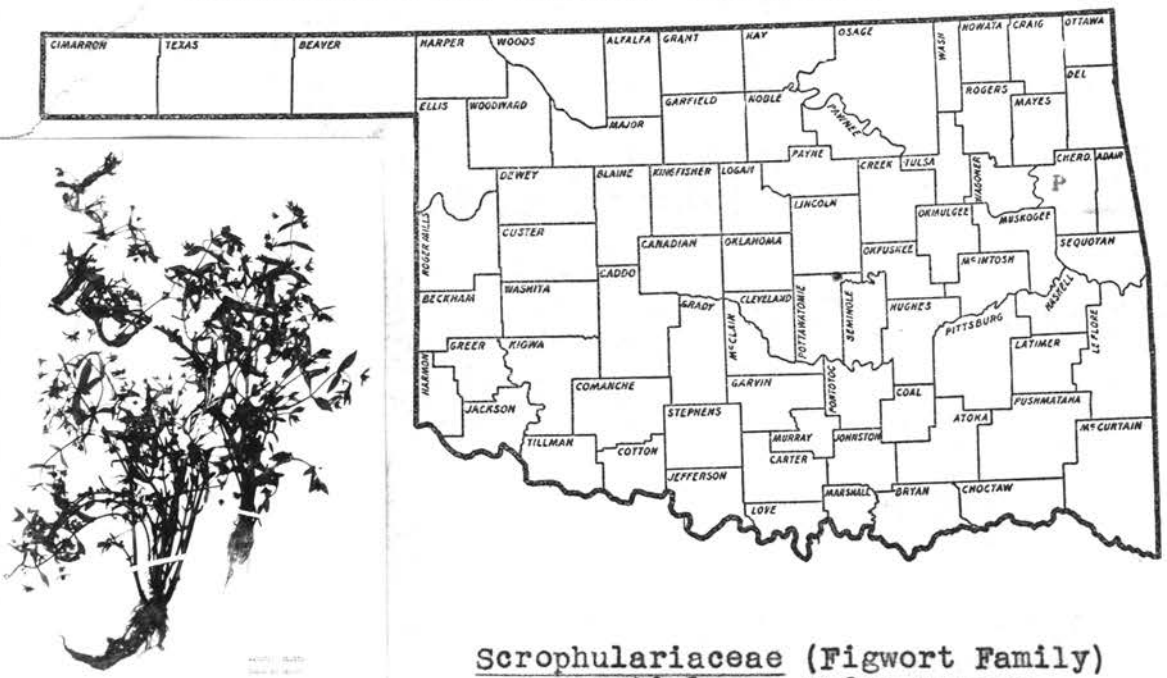


General habitat water's edge
 Growth type sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade	poor
Food.	poor
Ornamental properties	good
Value as an oxygenator.	poor
Ability to increase fertility of water.	fair
Ability to prevent silting and erosive wave action.	fair
Protection for fry.	poor
Protection for fingerlings and growing fish	poor
Drouth resistance	good
Water clarifying qualities.	unknown
Tolerance for turbidity	unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



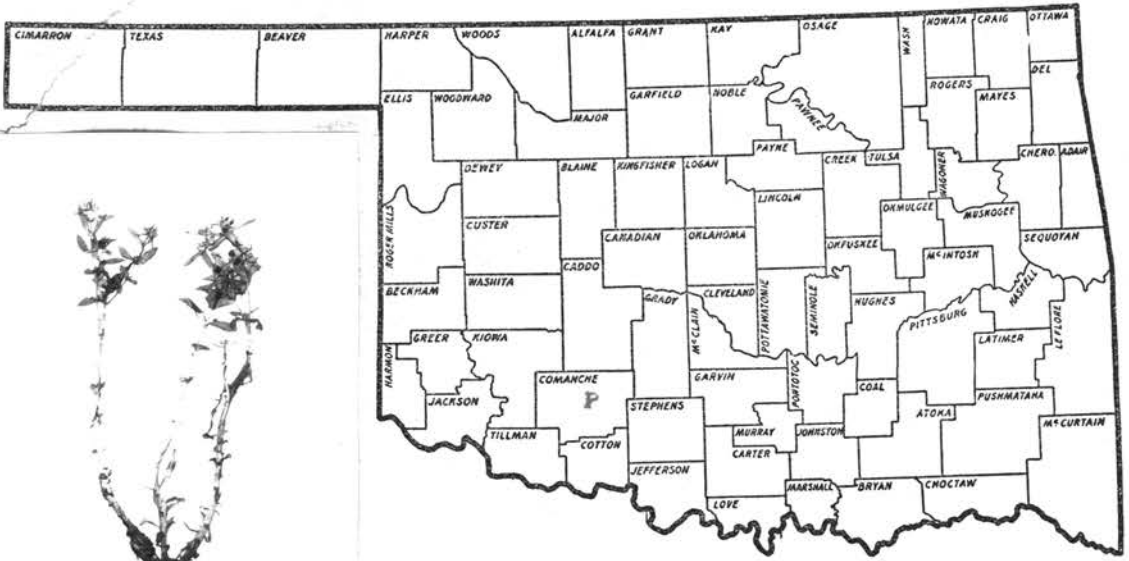
Scrophulariaceae (Figwort Family)
Gratiola L. Hedge Hyssop
Gratiola neglecta Torr.

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food. poor
 Ornamental properties poor
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. none
 Protection for fingerlings and growing fish none
 Drouth resistance good
 Water clarifying qualities. unknown
 Tolerance for turbidity fair

DISTRIBUTION AND ECONOMIC IMPORTANCE



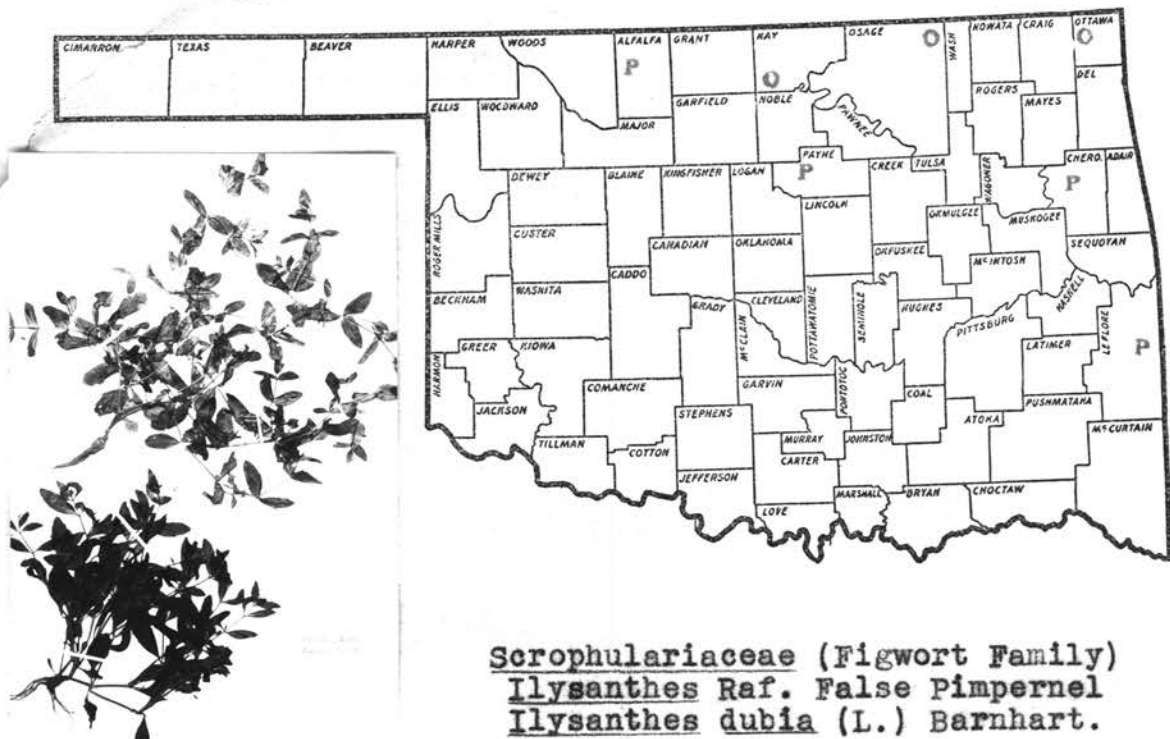
Scrophulariaceae (Figwort Family)
Gratiola L. Hedge Hyssop
Gratiola sphaerocarpa Ell.

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food. poor
 Ornamental properties poor
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. none
 Protection for fingerlings and growing fish none
 Drouth resistance good
 Water clarifying qualities. unknown
 Tolerance for turbidity fair

DISTRIBUTION AND ECONOMIC IMPORTANCE

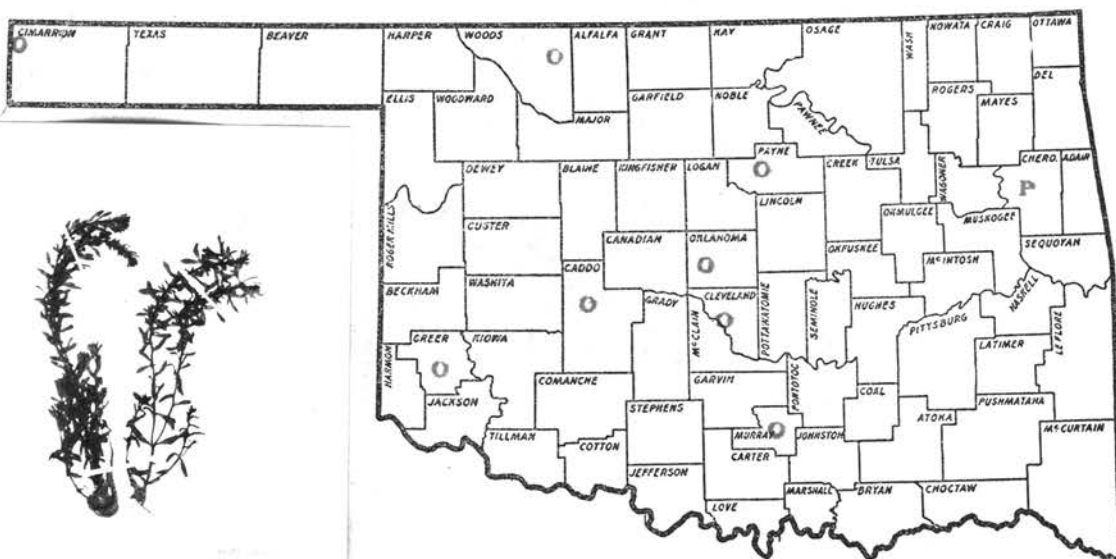


General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade none
 Food. none
 Ornamental properties fair
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. none
 Protection for fingerlings and growing fish none
 Drouth resistance fair
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



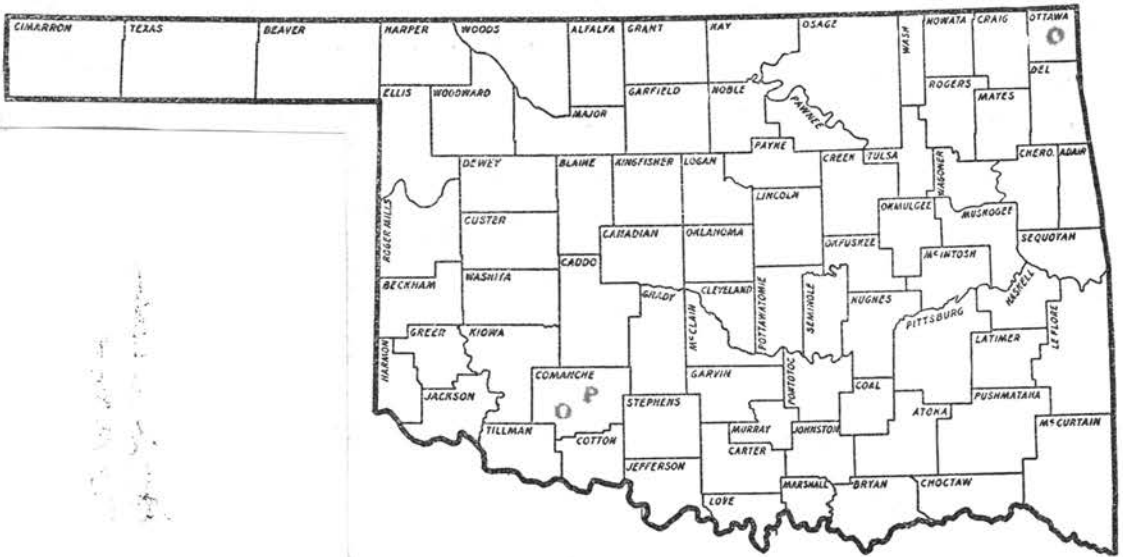
Scrophulariaceae (Figwort Family)
Veronica (Tourn.) L. Speedwell
V. peregrina L. (Neckweed, Purslane S)

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food poor
 Ornamental properties poor
 Value as an oxygenator poor
 Ability to increase fertility of water fair
 Ability to prevent silting and erosive wave action . . . fair
 Protection for fry poor
 Protection for fingerlings and growing fish poor
 Drouth resistance good
 Water clarifying qualities unknown
 Tolerance for turbidity fair

DISTRIBUTION AND ECONOMIC IMPORTANCE



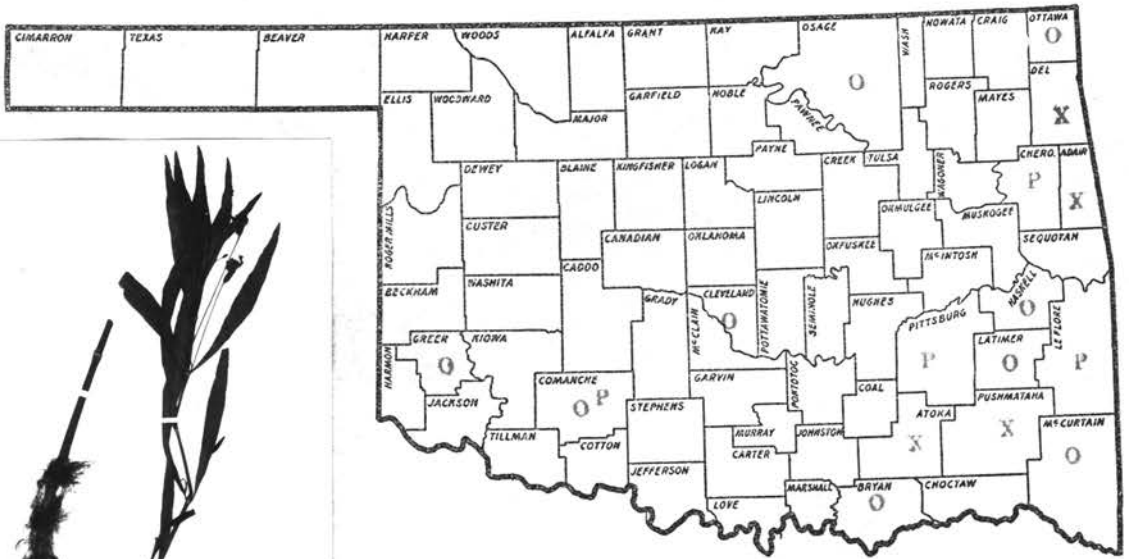
Lentibulariaceae (Bladderwort Family)
Utricularia L. Bladderwort
Utricularia biflora Lam.

General habitatshallow water
 Growth type partially submersed with floating leaves

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food. good
 Ornamental properties fair
 Value as an oxygenator. good
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. poor
 Protection for fry. fair
 Protection for fingerlings and growing fish poor
 Drouth resistance unknown
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



Acanthaceae (Acanthus Family)
 Dianthera (Gronov.) L. Water Willow
 Dianthera americana L.

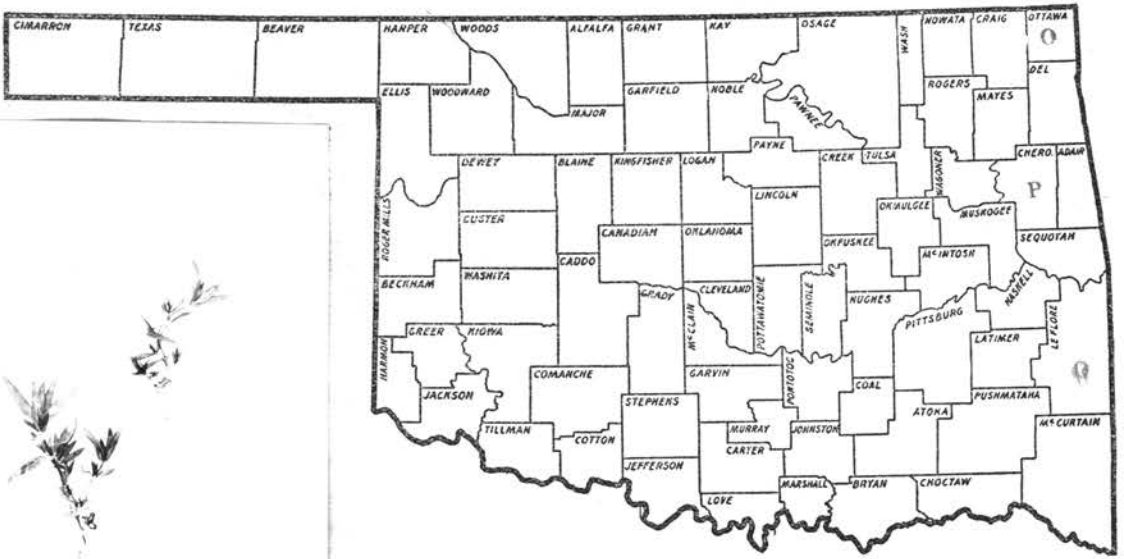
General habitat water's edge and shallow water

Growth type . . .partially submersed with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

- Shade fair
- Food. poor
- Ornamental properties good
- Value as an oxygenator. fair
- Ability to increase fertility of water. good
- Ability to prevent silting and erosive wave action. . . good
- Protection for fry. good
- Protection for fingerlings and growing fishvery good
- Drouth resistance good
- Water clarifying qualities.very good
- Tolerance for turbidity fair

DISTRIBUTION AND ECONOMIC IMPORTANCE



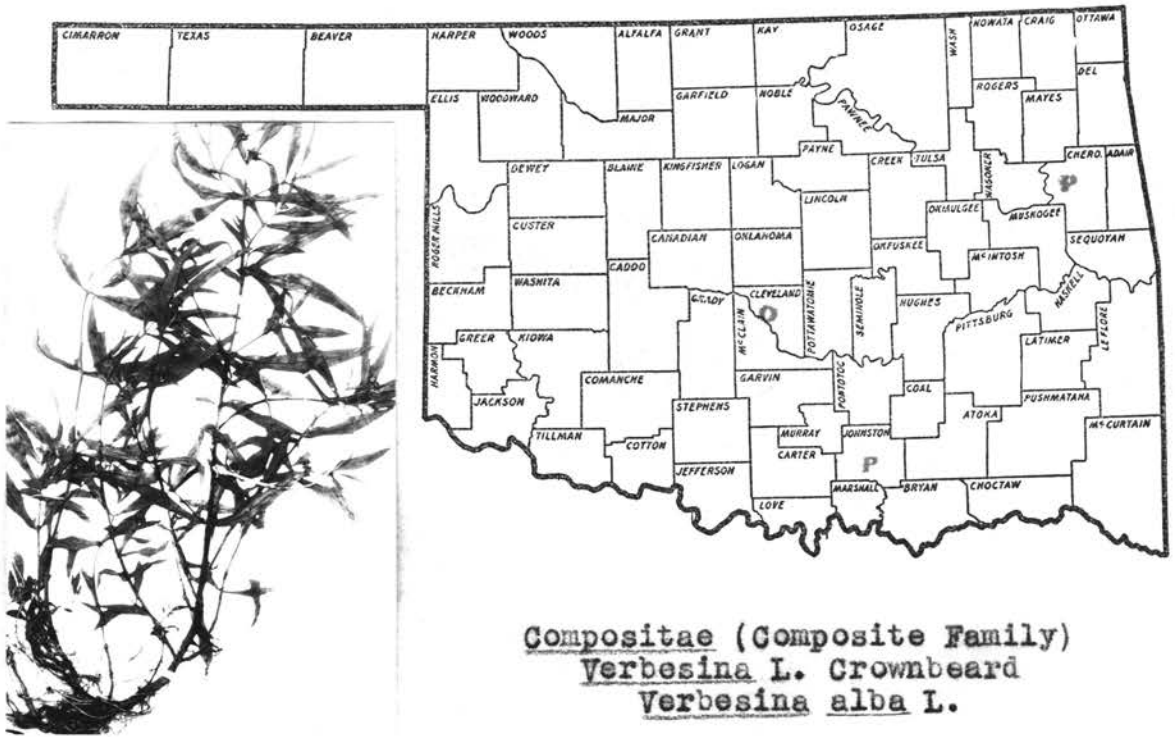
Rubiaceae (Madder Family)
***Diodia* (Gronov.) L. Buttonweed**
***Diodia virginiana* L.**

General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food. poor
 Ornamental properties poor
 Value as an oxygenator. poor
 Ability to increase fertility of water. fair
 Ability to prevent silting and erosive wave action. . . poor
 Protection for fry. none
 Protection for fingerlings and growing fish none
 Drouth resistance fair
 Water clarifying qualities. unknown
 Tolerance for turbidity unknown

DISTRIBUTION AND ECONOMIC IMPORTANCE



General habitat water's edge
 Growth type . . .sometimes submerged with aerial leafy stems

RELATIVE VALUES IN FISH CULTURE

Shade poor
 Food. poor
 Ornamental properties poor
 Value as an oxygenator. poor
 Ability to increase fertility of water. good
 Ability to prevent silting and erosive wave action. . . fair
 Protection for fry. poor
 Protection for fingerlings and growing fish poor
 Drouth resistance good
 Water clarifying qualities. unknown
 Tolerance for turbidity fair

SUMMARY OF SPECIES WITH OUTSTANDING VALUES

The foregoing list gives one a fair estimate of the number and variety of types found growing in Oklahoma. Some of these species intermix or are found in the different habitats and, as a general rule, they are better fitted for the Oklahoma climate since they can adapt themselves to the changing conditions. As previously stated, Oklahoma climatic conditions are extremely variable. This means that there is a widely fluctuating water line in the lakes and streams. Therefore one should choose plants that are fairly versatile in their needs for a water environment; plants that can stand a drouth and return to their normal activity when conditions permit.

The native water willow, Dianthera americana (Plate I), is probably the best all-round aquatic plant for Oklahoma. It has been found in good condition after having experienced a siege of seven months dry weather in which only two and ninety-seven hundredths inches of rain had fallen. The water in this lake (Dow Lake) had receded to a distance of at least one hundred feet (Plate II). At State Fish Hatchery number four, plants that were allowed to dry for forty days resumed growth when they were again covered with water. The plant grows in a more or less open manner near the edge of the deep water (See A, Plates I and III). This is a very desirable quality since it provides a hiding place for the smaller fish thus protecting them from the larger ones. Quite essential is this factor, in bass culture

ponds, where the young fish soon assume cannibalistic habits, the larger ones devouring the smaller. C. N. Davidson at State Fish Hatchery number four, from observations extending over a period of three years, states that the ponds containing the water willow produce at least one-third more fish than other ponds in the hatchery. Also the water in these ponds will clarify more quickly after a rain. The plant's inability to grow in water over a depth of three feet, and rarely over a depth of thirty inches, makes it quite desirable for the angler. This factor keeps the plant from closing the best fishing waters, which are generally found in the upper end of a lake (See B, Plate III). Its purple-centered white blossom also adds to its attractiveness and value.

Probably the most hardy species of aquatic plants occur in the semi-aquatic knotweeds with Polygonum hydropiperoides leading the list. This plant will grow equally well in or out of water and is resistant to the killing action of our muddy streams. It has several valuable properties and should not be overlooked in stocking a pond. Other hardy plants that will probably prove of great value in fish culture are the cow lily, Nymphaea advena (Plate IV); primrose-willow, Jussiaea diffusa (Plate V); water starwort, Callitriche heterophylla (Plate VI); arrow-heads, Sagittaria latifolia (Plate VII), S. lancifolia, (Plate VIII), S. graminea (Plate IX); water plantain, Alisma Plantago-aquatica (Plate X); Echinodorus radicans (Plate XI); Chilean water milfoil, Myriophyllum proserpinacoides (Plate XII); and the

galingales, Cyperus strigosus and C. erythrorhizos (?) (Plate XIII).

The galingales, Cyperus strigosus and C. erythrorhizos, probably will rank first in the ability to increase the fertility of the water. These rapidly growing plants follow the water line (See A, Plate XIV) as it gradually recedes during dry weather. The plant is killed when it is again covered with water. Its rapid decomposition in shallow water gives to the water the minerals essential to the growth of the vegetable plankton.

Our best food makers are found in the submersed associations with the following species: the hornwort, Geratophyllum demersum (Plate XV); the pondweeds, Potamogeton crispus, P. pectinatus, P. foliosus, P. pusillus; the naiads, Naias flexilis, N. guadalupensis; the water seeds, Elodea canadensis, E. minor, E. occidentalis; the water milfoils, Myriophyllum spicatum, M. heterophyllum, M. scabratum; the water crowfoot, Ranunculus aquatilis; the water stargrass, Heteranthera dubia (Plate XVI); and the algae, Chara fragilis. These plants are excellent oxygenators and provide a good shelter for fry.

The water weeds, Elodea minor and E. occidentalis, and the afore-mentioned water willow make up the plant list known to the author for their clarifying qualities. Elodea minor and E. occidentalis have been observed by V. C. Graham in the ponds at State Fish Hatchery number three and from his observations covering a period of years, says that water in ponds containing these plants will clear more quickly

after a rain than water in other ponds in the hatchery. This quality is quite essential in fish culture since material held in suspension reduces to a minimum the amount of light that penetrates the lower portions of the water. This does not seriously reduce the production of the vegetable plankton⁵ but is decidedly destructive to the larger submersed aquatic plants.

The beauty of our ponds and streams can be improved by some of the following ornamentals: white water lily, Castalia tuberosa (See A, Plate XVII); pickerel weed, Pontederia cordata (See B, Plate XVII); Thalia dealbata (See C, Plate XVII); cardinal flower, Lobelia cardinalis; yellow water lily, Nymphaea advena; lotus, Nelumbo lutea; Echinodorus radicans (Plate XI); Myriophyllum proserpinacoides (Plate XII); Sagittaria graminea (Plate IX); and the button bush, Cephalanthus occidentalis. By their color and fragrance, the flowers attract many flying insects which may fall in the water and add to the food of the fishes.

On the other hand we have plants like the cat-tails, the lotus (Plate XVIII), the water lilies, and some of the pondweeds of such exuberant growth that their floating leaves and closely matted rhizomes crowd out beneficial plants (Plate XIX). Heteranthera dubia and most of our submersed varieties can become a nuisance when they close the boat landings (Plate XX). This difficulty can be

5 A. H. Wiebe, Investigations on Plankton Production in Fish Ponds, p. 144.

overcome by placing the boat landings in deep water or by digging out deep channels through which the boats may be brought to shore.

Care should be taken in selecting the plants to be introduced into a new lake. No particular species of plant can be said to be always desirable. The fertility and kind of soil, size and depth of lake, the depth of shore line, the steepness of slope, type of banks, landscaping, fluctuation of water level, and the isolation from the rest of the lake are factors that need to be taken into consideration. An intimate study of these factors is necessary to determine the proper plant to introduce in each specific local condition.

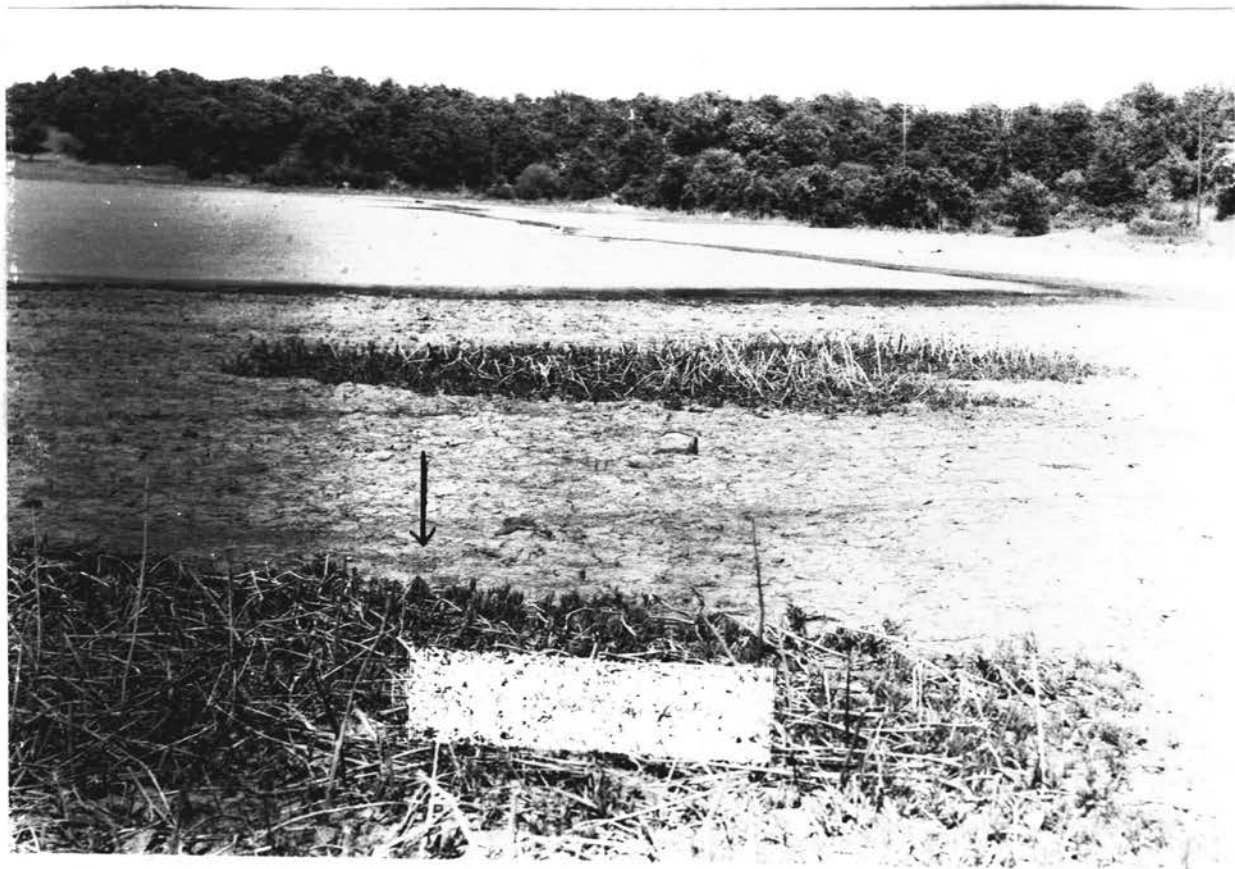
Plate I



Dianthera americana. (Water willow.)

Lost Lake, Medicine Park, Okla. May 27, 1936.

Plate II



Dianthera americana. (Water willow.)

Dow Lake, Dow, Okla. June 19, 1936.

Plate III



Dianthera americana. (Water willow.)

Reynolds Lake, Reynolds, Okla. May 31, 1936.

Plate IV



Nymphaea advena. (Cow lily.)

Holly Gage Lake, Keota, Okla. June 20, 1936.

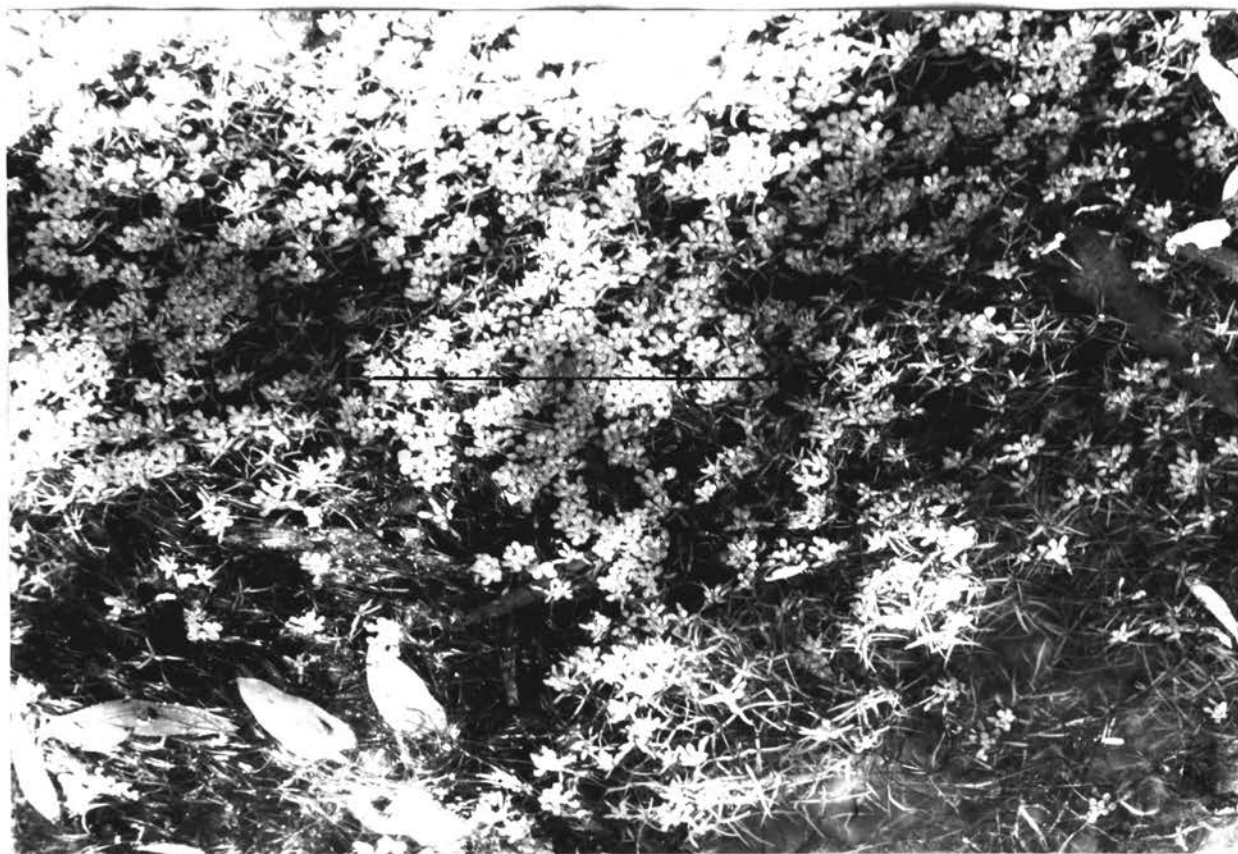
Plate V



Jussiaea diffusa. (Primrose willow.)

Ross Lake, Muskogee, Okla. July 3, 1936.

Plate VI



Callitriche heterophylla. (Water starwort.)

Barron Fork Creek, Tahlequah, Okla. July 4, 1936.

Plate VII



AQUATIC PLANTS
JAMES DE GRUCHY

Sagittaria latifolia. (Arrow-head.)

Wewoka Lake, Seminole, Okla. June 18, 1936.

Plate VIII



Sagittaria lanceefolia. (Arrow-head.)

Fish Hatchery, McAlester, Okla. June 19, 1936.

Plate XI



Sagittaria graminea. (Arrow-head.)

State Fish Hatchery, Heavener, Okla. June 20, 1936.

Plate X



Alisma Plantago-aquatica. (Water plantain.)

Prices' Falls Lake, Davis, Okla. May 29, 1936.

Plate XI

Echinodorus radicans

State Fish Hatchery, Heavener, Okla. June 20, 1936.

Plate XII



Myriophyllum proserpinacoides. (Chilean water milfoil.)

Fish pond, Stillwater, Okla. October 15, 1936.

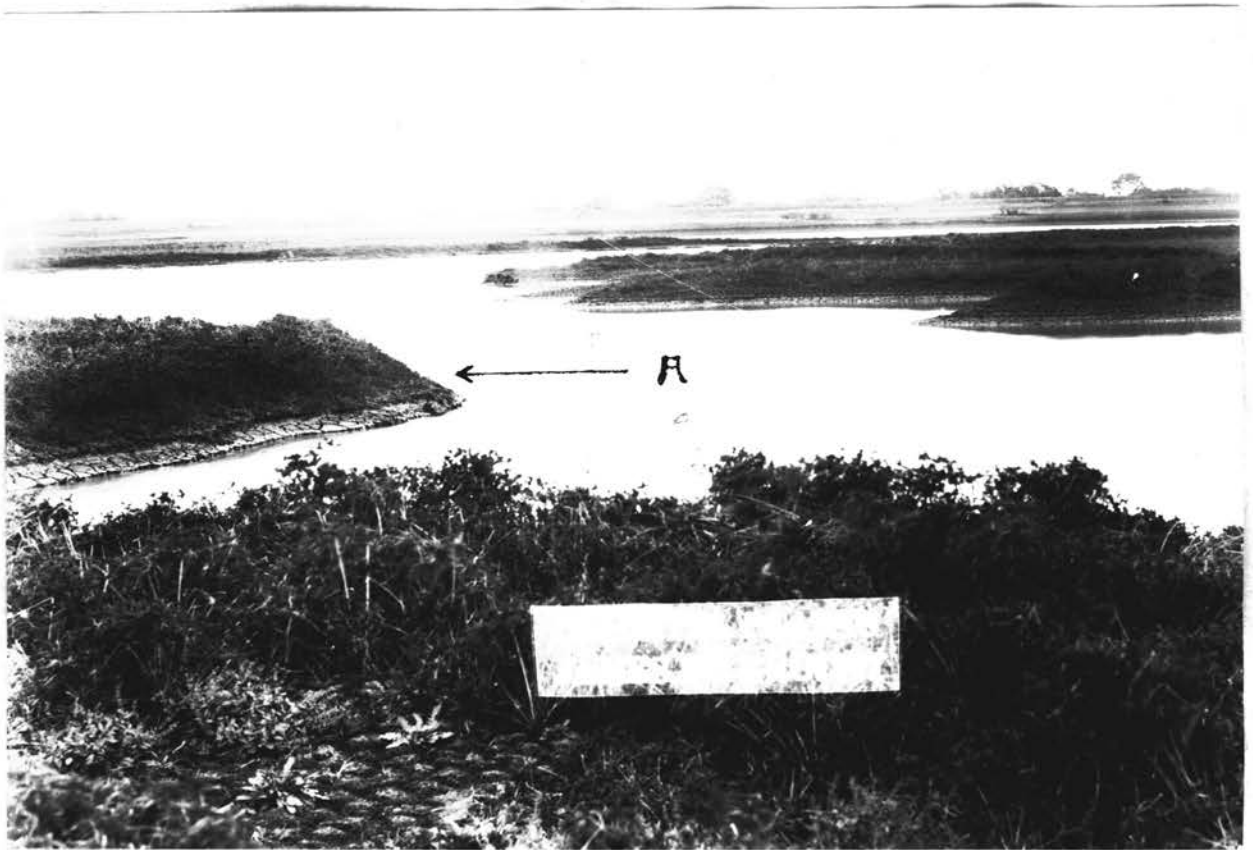
Plate XIII



Cyperus strigosus and C. erythrorhizos. (Galingales.)

Boomer Lake, Stillwater, Okla. October 15, 1936.

Plate XIV



Cyperus strigosus and C. erythrorhizos. (Galingales.)

Boomer Lake, Stillwater, Okla. October 15, 1936.

Plate XV



Ceratophyllum demersum. (Hornwort.)

Tourists' Park Lake, Stillwater, Okla. July 12, 1936.

Plate XVI



Heteranthera dubia. (Water stargrass.)
Spavinaw Lake, Spavinaw, Okla. July 7, 1936.

Plate XVII



A - Castalia tuberosa. (White water lily.) B - Pontederia cordata. (Pickerel weed.) C - Thalia dealbata.

State Fish Hatchery, Tahlequah, Okla. June 21, 1936.

Plate XVIII



A - Typha latifolia. (Cat-tail.) B - Nelumbo lutea. (Lotus.)

Country Club Lake, Stillwater, Okla. June 25, 1934.

Plate XIX



Potamogeton americanus crowding out
the white flowered Ranunculus aquatilis.

Cache Creek, Cache, Okla. May 26, 1936.

Plate XX



Removing Heteranthera dubia. (Water stargrass.)

Spavinaw Lake, Spavinaw, Okla. July 7, 1936.

LIST OF PLANTS USED TO DETERMINE DISTRIBUTION

Acorus Calamus L.

Water up to 2 feet, fish hatchery, Medicine Park, Okla., May 28, 1936. James de Gruchy.

Alisma plantago-aquatic L.

Wet sandy shore of Crystal Lake, 2 miles north of Norman, Okla., Cleveland Co., October 9, 1936. (O.U.)¹

Along creeks, Wilburton, Okla., August 10, 1930. O. M. Clark. (O.U.)

At lower margin of erect vegetation at border of pond, near Ottawa, Ottawa Co., Okla., August 27, 1913. G. W. Stevens. (A. & M.)²

Water 18 inches deep, Prices' Falls, Davis, Okla., May 29, 1936. James de Gruchy.

Shallow water, Francis Lake, 2 miles north of Watts, Okla., July 4, 1936. James de Gruchy.

Ammannia auriculata Willd.

Shallow water, fish pond, Stillwater, Okla., October 15, 1936. James de Gruchy.

Ammannia coccinea Rottb.

Wet sandy river bank and bottomlands, Purcell, McClain Co., Okla., September 26, 1936. Milton Hopkins. (O.U.)

Muskogee Co., Okla., September 2, 1928. Elbert J. Little, Jr. (O.U.)

Muskogee Co., Okla., June 18, 1927. Elbert J. Little, Jr. (O.U.)

Muskogee Co., Okla., August 26, 1927. Elbert J. Little, Jr. (O.U.)

¹ Herbarium, Oklahoma University, Norman, Oklahoma.

² Herbarium, Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma.

Ammannia coccinea Rottb. (continued)

Muskogee Co., Okla., September 3, 1927. Elbert L. Little, Jr. (O.U.)

Muskogee Co., September 2, 1928. Elbert L. Little, Jr. (O.U.)

Near base of Mt. Sheridan, July 11, 1909. A. H. Van Vleet. (O.U.)

Near foot of Mt. Sheridan, July 11, 1913. A. H. Van Vleet. (O.U.)

Wet plains, south of Norman, Okla., July. R. L. Ciplain. (O.U.)

Sandy river bank, Ripley, Payne Co., Okla., October 6, 1932. Mamie Wilson. (A. & M.)

Clay sand, 3 miles north of Stillwater, Payne Co., Okla., September 26, 1933. Leon Hubartt. (A. & M.)

Found in lowlands, south of Tahlequah, August 8, 1924. C. W. Prier. (A. & M.)

Found in swamps, south of Tahlequah, Okla., August 18, 1924. C. W. Prier. (A. & M.)

At creek's edge, near Tonkawa, Kay Co., Okla., August 4, 1913. G. W. Stevens. (A. & M.)

Water 3 feet deep, fish hatchery, 11 miles northeast of Cherokee, Okla., July 19, 1936. James de Gruchy.

Shallow water and on banks, Talawanda Lake No. 1, June 19, 1936. James de Gruchy.

Water 2 feet deep, fish hatchery, Tishomingo, Okla., Sept. 6, 1936. James de Gruchy.

Berula erecta (Huds.) Coville.

In spring, near Alva, Woods Co., Okla., July 14, 1913. G. W. Stevens. (A. & M.)

In mud by spring, near Cleo, Major Co., Okla., July 19, 1913. G. W. Stevens. (A. & M.)

Callitriche heterophylla Pursh.

Callitriche heterophylla Pursh. (continued)

Along road between Ludlow and Fewell, Push. Co., Okla., June 8, 1930. Small stream, oak-hickory-pine-Liquidambar forest. Elbert L. Little, Jr. and Charles E. Olmstead, Oklahoma Forest Service. (O.U.)

Fort Sill, Comanche Co., Okla., April 21, 1916. Mrs. J. Clemens. (O.U.)

In mountain creek, near Granite Greer Co., Okla., June 17, 1913. G. W. Stevens. (A. & M.)

Shallow water, creek bed, Pecan Springs, Medicine Park, Okla., May 27, 1937. James de Gruchy.

Water 8 inches, Panther Creek Lake, Medicine Park, Okla., May 27, 1936. James de Gruchy.

Water 2 feet deep, Barron Fork Creek, 12 miles northeast of Tahlequah, Okla., July 4, 1936. James de Gruchy.

Carex Frankii Kunth.

Shallow water, small creek, 6 miles south of Heavener, Okla., June 20, 1936, James de Gruchy.

Castalia odorata (Dryand) Woodv. & Wood.

Fairly fresh pools, west of Norman, Okla., K. Personett. (O.U.)

Shawnee Lake, 7 miles southeast of Miami, Okla., August, 1928.

Water 8 feet deep, Durant fish hatchery, Durant, Okla., May 29, 1936. James de Gruchy.

Castalia sp. - hybrid

Water 2 feet deep, fish pond, 5 miles south of Heavener, Okla., June 20, 1936. James de Gruchy.

Castalia tuberosa (Paine) Greene.

In Oxbow Lake, near Ottawa, Ottawa Co., Okla., August 27, 1913. G. W. Stevens. (A. & M.)

Water 4 feet, Lake Austin, Pittsburg, Okla., May 31, 1936. James de Gruchy.

Water 2½ feet deep, fish hatchery, Medicine Park, Okla., May 28, 1936. James de Gruchy.

Ceratophyllum demersum L.

Cotton Co., Okla., July 2, 1934. Bot. 306 Class. (O.U.)

Submerged, west of Walters, Cotton Co., Okla., July 2, 1934. G. E. Pottz. (O.U.)

Water 2 feet deep, fish hatchery, Medicine Park, Okla., May 28, 1936. James de Gruchy.

Water 2 feet deep, Tourists' Park Creek, Stillwater, Okla., June 30, 1936. James de Gruchy.

Water 4 feet deep, Spavinaw Lake, Spavinaw, Okla., July 7, 1936. James de Gruchy.

Water 4 feet, fish hatchery No. 3, Tahlequah, Okla., June 21, 1936. James de Gruchy.

Water 4 feet, 2 miles southwest of Ringwood, Okla., July 17, 1936. James de Gruchy.

Water 3 feet, Cache Creek, 2 miles southwest of Cache, Okla., May 26, 1936. James de Gruchy.

Water 18 inches, fish hatchery, Neosha, Missouri, July 5, 1936. James de Gruchy.

Water 2 feet deep, fish hatchery, Tahlequah, Okla., July 4, 1936. James de Gruchy.

Water 1 foot deep, fish hatchery, Neosha, Missouri, July 5, 1936. James de Gruchy.

Chara fragilis Desvaux.

Water 2 feet deep, fish hatchery, Neosha, Missouri, July 5, 1936. James de Gruchy.

Water 2 feet, Lake Austin, Pittsburg, Okla., May 31, 1936. James de Gruchy.

Water 4 feet, Tourists' Park Creek, Stillwater, Oklahoma, June 30, 1936. James de Gruchy.

Water 4 feet, 2 miles southwest of Ringwood, Oklahoma, July 17, 1936. James de Gruchy.

Water 8 inches, fish hatchery No. 4, 5 miles south of Heavener, Okla., June 20, 1936. James de Gruchy.

Water 2 feet deep, Barron Fork Creek, 12 miles northeast of Tahlequah, Okla., July 4, 1936. James de Gruchy.

Chara fragilis Desvaux. (continued)

Water 4 feet deep, Panther Creek Lake, Medicine Park, Okla., May 27, 1936. James de Gruchy.

Water 18 inches, Spavinaw Lake, Spavinaw, Okla., July 7, 1936. James de Gruchy.

Water 2 feet deep, fish hatchery, Neosha, Missouri, July 5, 1936. James de Gruchy.

Chara sejuncta A. Br. Allen

Water 2 feet, Talawanda Lake No. 2, McAlester, Okla., June 19, 1936. James de Gruchy.

Chara vulgaris L.

Water 2 feet deep, fish hatchery, Tishomingo, Okla., September 6, 1936. James de Gruchy.

Chrysosplenium americanum Schwein

Shallow water, spring, 2 miles southwest of Ringwood, Okla., July 17, 1936. James de Gruchy.

Cyperus acuminatus Torr. & Hook.

Near edge of pond, near Copan, Washington Co., Okla., August 15, 1913. G. W. Stevens. (A. & M.)

Mountain slope, near Cache, Comanche Co., Okla., June 24, 1913. G. W. Stevens. (A. & M.)

Moist soil, Norman, Okla., July 7, 1919. Larkin. (A. & M.)

River near Norman, Okla., June 20, 1928. C. W. Prier.

Moist soil, shallow water, small creek 6 miles south of Heavener, Okla., June 20, 1936. James de Gruchy.

Shallow water, fish hatchery No. 4, 5 miles south of Heavener, Okla., June 20, 1936. James de Gruchy.

Cyperus erythrorhizos Muhl.

Stillwater Lake, February 6, 1937. James de Gruchy.

Cyperus strigosus L.

Water's edge, Talawanda Lake, No. 1, June 18, 1936. James de Gruchy.

Dianthera americana L.

Creek by big taxodium, McCurtain Co., Broken Bow, Okla.,
May 16, 1936. (O.U.)

Growing in water, West Cache Creek, near Headquarters,
Wichita Mts., Comanche Co., Okla., June 5, 1926.
Elbert L. Little, Jr. (O.U.)

Weedy pond-margin near Ottawa, Ottawa Co., Okla.,
August 27, 1913. G. W. Stevens. (O.U.)

12 miles west of Pawhuska, along Spring Creek, Osage
Co., Okla., July 31, 1905. A. H. Van Vleet. (O.U.)

Among rocks, bed of Caddo Creek, $\frac{1}{2}$ mile west of
Bokchito, Okla., June 18, 1919. R. E. J. (O.U.)

Damp soil, 5 miles west of Keota, Okla., W. W. Barkley.
(O.U.)

Water of creek beds, Wilburton, Okla., June 13, 1930.
O. M. Clark, (O.U.)

Granite hills, South Mill Creek, Okla., May 12, 1930.
Paul B. Sears. (O.U.)

Along Spring Creek, 12 miles west of Pawhuska, Okla.,
July 31, 1905. A. H. Van Vleet. (O.U.)

Muskogee Co., Okla., June 17, 1937. Elbert L. Little,
Jr. (O.U.)

Roadside, 5 miles west of Keota, Okla., W. W. Barkley.
(O.U.)

Roadside, 3 miles west of Keota, Okla., W. W. Barkley.
(O.U.)

Prairies to open woods, east of Norman, Okla., June,
1917. R. L. Clifton. (O.U.)

Swamps and wet lands, river bank south of Norman, Okla.,
July 3, 1919. A. H. Van Vleet. (O.U.)

Weedy pond margin, near Ottawa, Ottawa Co., Okla.,
August 27, 1913. G. W. Stevens.

Water 2 feet, Lost Lake, Medicine Park, Okla., May 27,
1936. James de Gruchy.

Water 3 feet, fish hatchery, Medicine Park, Okla.,
May 28, 1936. James de Gruchy.

Dianthera americana L. (continued)

Shallow water, Illinois river, $\frac{1}{2}$ mile east of Tahlequah, Okla., June 21, 1936. James de Gruchy.

Water 3 feet, fish hatchery, Medicine Park, Okla., May 28, 1936. James de Gruchy.

Water up to 3 feet, fish hatchery No. 4, 5 miles south of Heavener, Okla., June 20, 1936. James de Gruchy.

Shallow water, fish hatchery, 3 miles northwest of McAlester, Okla., June 19, 1936. James de Gruchy.

Diodia virginiana L.

On muddy bank of Neosho River, near Miami, Ottawa Co., Okla., August 26, 1913. G. W. Stevens. (A. & M.)

Sandy soil, 1 mile northwest of Talihina, LeFlore Co., Okla., August 2, 1933. U. T. Waterfall. (A. & M.)

Shallow water, Barron Fork Creek, 12 miles northwest of Tahlequah, Okla., June 21, 1936. James de Gruchy.

Echinochloa crus-galli (L.) Beauv.

Roadside at creek, Beckham Co., Okla., August 8, 1936. Ben Osborn. (O.U.)

Sandy roadside (found not growing in water), one-half mile north of Fort Cobb, Okla., June 20, 1936. (O.U.)

Waste place, near Olustee, Jackson Co., Okla., June 23, 1913. G. W. Stevens. (A. & M.)

Waste place, near Longdale, Blaine Co., Okla., June 9, 1913. G. W. Stevens.

On bank of Neosho River, near Miami, Ottawa Co., Okla., August 26, 1913. G. W. Stevens. (A. & M.)

Waste place, near Longdale, Blaine Co., Okla., June 9, 1913. G. W. Stevens. (A. & M.)

Water 2 feet deep, fish hatchery, Tishomingo, Okla., September 6, 1936. James de Gruchy.

Water's edge, fish hatchery, Tishomingo, Okla., September 6, 1936. James de Gruchy.

Echinodorus cordifolius (L.) Griseb.

Echinodorus cordifolius (L.) Griseb. (continued)

Clay, creekside, 5 miles east of 126 N. Husband St., Stillwater, Payne Co., Okla., July 4, 1933. (A. & M.)

Water 4 inches, Cache Creek, 2 miles southwest of Cache, Okla., May 26, 1936. James de Gruchy.

Shallow water, fish hatchery, Medicine Park, Okla., May 28, 1936. James de Gruchy.

Water 2 feet deep, fish hatchery, Tishomingo, Okla., September 6, 1936. James de Gruchy.

Water 2 feet deep, fish hatchery, Neosha, Missouri, July 5, 1936. James de Gruchy.

Echinodorus radicans (Nutt.) Engelm.

Water 18 inches, fish hatchery No. 4, 5 miles south of Heavener, Okla., June 20, 1936. James de Gruchy.

Elatine americana (Pursh) Arn.

Water up to 6 inches deep, Talawanda Lake No. 1, June 19, 1936. James de Gruchy.

Eleocharis albida Torr.

Wet soil, river, Norman, Okla., April 15, 1923. C. W. Prier. (A. & M)

Shallow water, fish hatchery, Tishomingo, Okla., September 6, 1936. James de Gruchy.

Water's edge and in water, Talawanda Lake No. 1, June 19, 1936. James de Gruchy.

Eleocharis leptos (Steud.) Sven.

Shallow water and at water's edge, Talawanda Lake No. 1, June 19, 1936. James de Gruchy.

Eleocharis mamillata

Water 6 inches deep, fish hatchery, 3 miles northwest of McAlester, Okla., June 19, 1936. James de Gruchy.

Shallow water, Panther Creek Lake, Medicine Park, Okla., May 27, 1936. James de Gruchy.

Water's edge, Durant fish hatchery, Durant, Okla., May 29, 1936. James de Gruchy.

Eleocharis obtusa (Willd.) Shultes.

On moist shore of pond, near Copan, Washington Co., Okla., August 15, 1913. G. W. Stevens. (A. & M.)

In margin of sludge pond, near Hattenville, Ottawa Co., Okla., August 30, 1913. G. W. Stevens. (A. & M.)

At margin of spring, near Tonkawa, Kay Co., Okla., August 5, 1913. G. W. Stevens. (A. & M.)

In dry sandy creek bed, Coon Creek, near Copan, Osage Co., Okla., August 18, 1913. G. W. Stevens. (A. & M.)

Low wet soils, Tahlequah, Okla., September 28, 1923. C. W. Prier. (A. & M.)

Water's edge, Panther Creek Lake, Medicine Park, Okla., May 27, 1936. James de Gruchy.

Shallow water and water's edge, Cow Skin Creek, Turkey Ford, Okla., July 6, 1936. James de Gruchy.

Shallow water, Panther Creek Lake, Medicine Park, Oklahoma, May 27, 1936. James de Gruchy.

Eleocharis palustris (L.) R. Br.

Low moist place, 15 miles southwest of Beaver City, Beaver Co., Okla., May 8, 1913. G. W. Stevens. (A.&M.)

Margin of pool at edge of Spring River, near Ottawa, Ottawa Co., Okla., August 27, 1913. G. W. Stevens. (A. & M.)

Edge of pond, near Alva, Woods Co., Okla., May 1, 1913. G. W. Stevens. (A. & M.)

By water, near Kenton, Cimmaron Co., Okla., May 13, 1913. G. W. Stevens. (A. & M.)

Low moist place, 15 miles southwest of Beaver City, Beaver Co., Okla., May 8, 1913. G. W. Stevens. (A. & M.)

At edge of pond, near Cherokee, Alfalfa Co., Okla., May 24, 1913. G. W. Stevens. (A. & M.)

By water, near Kenton, Cimmaron Co., Okla., May 13, 1913. G. W. Stevens. (A. & M.)

In pond, near Alva, Woods Co., Okla., May 1, 1913. G. W. Stevens. (A. & M.)

Eleocharis palustris (L.) R. Br. (continued)

Water's edge and in running water, 6 miles north of Watonga, Okla., May 25, 1936. James de Gruchy.

Shallow water, small creek 6 miles south of Heavener, Okla., June 20, 1936. James de Gruchy.

Eleocharis quadrangulata (Michx.) R. & S.

Water's edge, Spavinaw Lake, Spavinaw, Okla., July 7, 1936. James de Gruchy.

Shallow water, fish hatchery, Tishomingo, Okla., Sept. 6, 1936. James de Gruchy.

Water 2 feet, fish hatchery No. 4, 5 miles south of Heavener, Okla., June 20, 1936. James de Gruchy.

Elodea canadensis Michx.

Water's edge, Country Club Lake, Stillwater, Okla., July 15, 1935. James de Gruchy.

Elodea minor (Engelm.) Small

Water 2 feet deep, fish hatchery No. 3, Tahlequah, Okla., June 21, 1936. James de Gruchy.

Elodea occidentalis (Pursh) St. John

Water 3 feet deep, fish hatchery, 11 miles northeast of Cherokee, Oklahoma, July 19, 1936. James de Gruchy.

Fontinalis novae-angliae Sulliv.

Shallow water, creek bed, Pecan Springs, Medicine Park, Okla., May 27, 1936. James de Gruchy.

Gratiola virginica L.

Mud flats of creeks, McCurtain Co., Bethel, Okla., May 16, 1936. Delzie Demaree. (O.U.)

Fort Sill, Comanche Co., April 21, 1916. Mrs. J. Clemens. (O.U.)

Gratiola neglecta Torr.

Shoals, Barron Fork Creek, 12 miles northeast of Tahlequah, Okla., July 4, 1936. James de Gruchy.

Gratiola sphaerocarpa Ell.

Gratiola sphaerocarpa Ell. (continued)

Water 12 inches deep, Panther Creek Lake, Medicine Park, Okla., May 27, 1936. James de Gruchy.

Gratiola virginiana L.

Shallow water, small creek 6 miles south of Heavener, Okla., June 20, 1936. James de Gruchy.

Heteranthera dubia (Jacq.) Small

Water 10 feet deep, Spavinaw Lake, Spavinaw, Okla., July 7, 1936. James de Gruchy.

Hydrodictyon reticulatum (L.) Lagerheim

Water 4 feet, enmeshed with Potamogeton, fish hatchery No. 3, Tahlequah, Okla., June 21, 1936. James de Gruchy.

Ilysanthes anagallidea (Mx.) Robinson

On muddy creek bank, near Pawhuska, Osage Co., Okla., August 10, 1913. G. W. Stevens. (A. & M.)

On bank of riverside pool, Spring River, near Ottawa, Ottawa Co., August 27, 1913. G. W. Stevens. (A. & M.)

Water's edge, Talawanda Lake No. 1, June 19, 1936. James de Gruchy.

Ilysanthes dubia (L.) Barnhart.

Moist river bank, near Copan, Osage Co., Okla., August 17, 1913. G. W. Stevens. (O.U.)

At edge of creek, near Tonkawa, Kay Co., Okla., August 4, 1913. G. W. Stevens. (A. & M.)

Moist river bank, near Copan, Osage Co., Okla., August 17, 1913. G. W. Stevens. (A. & M.)

Shoals, Cow Skin Creek, Turkey Ford, Okla., July 6, 1936. James de Gruchy.

Water up to five inches deep, fish hatchery No. 4, 5 miles south of Heavener, Okla., June 20, 1936. James de Gruchy.

At water's edge, Stillwater, Okla., Stillwater Lake, January 5, 1934. James de Gruchy.

Moist river bank, near Miami, Ottawa Co., Okla., August 26, 1913. G. W. Stevens. (A. & M.)

Ilysanthes dubia (L.) Barnhart. (continued)

Shallow water on shoals, Barron Fork Creek, 12 miles northeast of Tahlequah, Okla., June 21, 1936. James de Gruchy.

Water's edge, fish hatchery, 11 miles northeast of Cherokee, Okla., July 19, 1936. James de Gruchy.

Water's edge, Illinois River, $\frac{1}{2}$ mile east of Tahlequah, Okla., July 4, 1936. James de Gruchy.

Iris Shrevei Small

Water's edge and in shallow water, fish hatchery, Neosha, Missouri, July 5, 1936. James de Gruchy.

Juncus acuminatus Michx.

At edge of mountain creek, near Page, Leflore Co., September 8, 1913. G. W. Stevens. (A. & M.)

Shallow water, small creek 6 miles east of Heavener, Okla., June 20, 1936. James de Gruchy.

Juncus effusus L.

Creek bed, 1 mile north of Talihina, Leflore Co., Okla., August 1, 1933. U. T. Waterfall. (A. & M.)

By water course, near Kenton, Cimmaron Co., Okla., May 13, 1913. G. W. Stevens. (A. & M.)

Shallow water, small creek 6 miles south of Heavener, Okla., June 20, 1936. James de Gruchy.

Once inundated banks, Holley Gage Lake, $3\frac{1}{2}$ miles west of Keota, Okla.; June 20, 1936. James de Gruchy.

Shallow water, Francis Lake, 2 miles north of Watts, July 4, 1936. James de Gruchy.

Water's edge, Wewoka Lake, Wewoka, Okla., June 18, 1936. James de Gruchy.

Juncus robustus (Engelm.) Coville. (Juncus nodatus Coville.)

Muskogee Co., Okla., August 25, 1927. Elbert L. Little, Jr.

Muskogee Co., Okla., September 4, 1927. Elbert L. Little, Jr.

Juncus robustus (Engelm.)

Juncus robustus (Engelm.) (continued)

In edge of sludge pond, near Hattenville, Ottawa Co., Okla., August 30, 1913. G. W. Stevens. (A. & M.)

Water's edge, Talawanda Lake No. 1, June 19, 1936. James de Gruchy.

Shallow water, small creek, 6 miles south of Heavener, Okla., June 20, 1936. James de Gruchy.

Jussiaea decurrens (Walt.) DC.

Near water, heavy wet soil, Pittsburg Co., Okla., Sept. 24, 1934. J. E. McClary. (O.U.)

Muskogee Co., Okla., Sept. 5, 1927. Elbert L. Little, Jr., (O.U.)

River bottom, Red Oak, Okla., August 12, 1930. O. M. Clark. (O.U.)

Muskogee Co., Okla., July 31, 1927. E. L. Little, Jr. (O.U.)

Creek beds, Wilburton, Okla., August 10, 1930. O. M. Clark. (O.U.)

At weedy margin of pond, near Ottawa, Ottawa Co., Okla., August 27, 1913. G. W. Stevens. (A. & M.)

Sandy creek bed, 5 miles west and 6 north of Albion, Pushmataha Co., Okla., August 21, 1932. U. T. Waterfall. (A. & M.)

In swamps, Tahlequah, Okla., August 13, 1924. C. W. Prier. (A. & M.)

Jussiaea diffusa Forskal.

Muskogee Co., Okla., September 4, 1927. Elbert L. Little, Jr. (O.U.)

Canadian River bottom, Bridgeport, Okla., July 4, 1928. I. J. Myers. (O.U.)

Near stream Camp Boulder, Wichita National Forest, Comanche Co., Okla., August 20, 1936. C. T. Eskew. (O.U.)

At edge of pond, near Copan, Washington Co., Okla., August 15, 1918. G. W. Stevens. (O.U.)

Jussiaea diffusa Forskal. (continued)

Moist soil, edge of pond, Muskogee, Okla., July 22, 1926. Elbert L. Little, Jr. (O.U.)

Near water, Pittsburg Co., Okla., September 18, 1934. J. E. McClary. (O.U.)

Muskogee Co., Okla., June 12, 1927. Elbert L. Little, Jr. (O.U.)

Cultivated field and prairie, Tulsa Co., Okla., July 17, 1928. Edith R. Force. (O.U.)

Wet ground, near Tonkawa, Okla., August 5, 1905. A. H. Van Vleet. (A. & M.)

Lake edge, 15 miles north of Stillwater, Payne Co., Okla., July 1, 1934. W. W. Rey. (A. & M.)

In water, Yost Lake, 7 miles northeast of Stillwater, Payne Co., Okla., July 11, 1935. E. Miller. (A. & M.)

In edge of mountain creek, near Cache, Comanche Co., Okla., June 25, 1913. G. W. Stevens. (A. & M.)

In pond, Owen Park Lake, June 28, 1930. G. E. Tenney. (A. & M.)

At edge of pond, near Copan, Washington Co., August 15, 1913. G. W. Stevens. (A. & M.)

At edge of water, Illinois River, $\frac{1}{2}$ mile east of Tahlequah, Okla., June 21, 1936. James de Gruchy.

Lemna cyclostasa (Ell.) Chev.

In creek, near Doby Springs, Harper Co., Okla., May 5, 1913. G. W. Stevens. (A. & M.)

Lippia cuneifolia (Torr.) Steud.

Wet roadside, near Ashley, Alfalfa Co., Okla., May 24, 1913. G. W. Stevens. (A. & M.)

Moist roadside, near Tonkawa, Kay Co., Okla., June 23, 1913. G. W. Stevens. (A. & M.)

Bare moist roadside, near Shattuck, Ellis Co., Okla., May 20, 1914. R. L. Clifton. (A. & M.)

Lamont, Okla., Chas. Cowen. (A. & M.)

Lippia lanceolata Michx.

Arbuckle Mts., Murray Co., Davis, Okla., June 3, 1936.
Delzie Demaree. (O.U.)

Bottoms of North Canadian River, Oklahoma Co., Oklahoma
City. July 16, 1936. Delzie Demaree. (O.U.)

4 miles southeast of Granite, Greer Co., Okla., July 5,
1931. Rotha Bull. (O.U.)

Muskogee Co., Okla., June 12, 1927. Elbert L. Little, Jr.
(O.U.)

Shallow water, 5 miles west of Norman, Okla., August 4,
1928. Fred A. Barkley. (O.U.)

South of Crescent, Logan Co., Okla., July 24, 1935.
Sister Constance Grace. (O.U.)

Moist places, June. Mildred Hibbard. (O.U.)

Muskogee Co., Okla., June 18, 1927. Elbert L. Little, Jr.
(O.U.)

Very moist ground, 5 miles southeast of Miami, Okla.,
July, 1928. Celeste Whaley. (O.U.)

Wet or moist places, west of the bridge, McClain Co.,
Okla., June 20, 1919. Perkinson. (O.U.)

Moist soil, east of Norman, July 16, 1919. Perkinson.
(O.U.)

Yost Lake, Stillwater, Payne Co., Okla., July 5, 1916.
C. D. Learn. (A. & M.)

Near creek, 5 miles northwest of Cashion, Kingfisher Co.,
Okla., June 31, 1934. Helen Long. (A. & M.)

Damp sandy clay, 5 miles east of Stillwater, Payne Co.,
Okla., July 16, 1933. U. T. Waterfall. (A. & M.)

Low place roadside, near Granite, Greer Co., Okla., June
17, 1913. G. W. Stevens. (A. & M.)

At edge of creek, near Tonkawa, Kay Co., Okla., August 5,
1913. G. W. Stevens. (A. & M.)

Shallow water and at water's edge, Cow Skin Creek, Turkey
Ford, Okla., July 6, 1936. James de Gruchy.

Water's edge, 2 miles southwest of Ringwood, Oklahoma,
July 17, 1936. James de Gruchy.

Lippia lanceolata Michx. (continued)

Water 8 inches, small creek 8 miles west of Broken Bow, Okla., May 31, 1936. James de Gruchy.

Lippia nodiflora (L.) Michx.

Comanche Co., Fort Sill, Okla., June 24, 1916. Mrs. J. Clemens. (O.U.)

Dry pastures, pasture southwest of Norman, Oklahoma, Bayliff. (O.U.)

4 miles southeast of Granite, Greer Co., Okla., July 5, 1931. Rotha Bull. (O.U.)

South Canadian River near Norman, in sandy soil, June 23, 1922. R. E. Jeffs. (O.U.)

On Cimarron, near Yale, Okla., July 21, 1905. A. H. Van Vleet. (O.U.)

Low moist places, south of Norman, Okla., July 17, 1914. R. L. Clifton. (O.U.)

Water's edge and in shallow water, $1\frac{1}{2}$ miles southwest of Perkins, Okla., June 25, 1936. James de Gruchy.

Lophotocarpus calycina (Engelm.)

Water 1 foot, Lake Latonka, Medicine Park, Okla., May 27, 1936. James de Gruchy.

Lycopus virginicus L.

Shallow water, small creek 6 miles south of Heavener, Okla., June 20, 1936. James de Gruchy.

Ludwigia alternifolia L.

At edge of creek, near Pawhuska, Osage Co., Okla., August 11, 1913. G. W. Stevens. (O.U.)

Mountain slues and creeks, north Wilburton, Okla., June 13, 1930. Ora M. Clark. (O.U.)

Common in black jacks, east of Tecumseh, Okla., July 11, 1905. A. H. Van Vleet. (O.U.)

Tecumseh, Okla., July 23, 1933. Bot. 306 Class. (O.U.)

Sand, edge of corn field, Experiment Farm, Oxford, Granville Co., Okla., July 31, 1936. Murray F. Buell. (O.U.)

Ludwigia alternifolia L. (continued)

Muskogee Co., Okla., August 28, 1927. Elbert L. Little, Jr., (O.U.)

Woods, South of Tecumseh, Okla., September 7, 1932. Elizabeth Ducker Barkley. (O.U.)

Wet swamps and creeks, Wilburton, Okla., June 13, 1930. O. M. Clark. (O.U.)

Ludwigia palustris (L.) Ell.

Muddy ditch, near Rogers, Okla., August, 1905. A. H. Van Vleet. (O.U.)

On wet dam of sludge pond, near Hattenville, Ottawa Co., Okla., August 30, 1913. G. W. Stevens.

Along shore or on rocky bank of mountain stream, Arbuckle Mountains, Murray Co., Okla., November 6, 1936. Milton Hopkins. (O.U.)

At edge of creek, near Pawhuska, Osage Co., Okla., August 9, 1913. G. W. Stevens. (O.U.)

4 miles southwest of Norman, Shallow water, June 20, 1928. Fred A. Barkley. (O.U.)

Bar Pits, Latimer Co., Okla., August 11, 1930. O. M. Clark. (O.U.)

Muskogee Co., Okla., August 25, 1927. Elbert L. Little, Jr. (O.U.)

Muskogee Co., Okla., September 4, 1927. Elbert L. Little, Jr. (O.U.)

Muskogee Co., Okla., September 1, 1927. Elbert L. Little, Jr., (O.U.)

Sandy creek bed, 5 miles west and 6 north of Albion, Pushmataha Co., Okla., August 19, 1932. U. T. Waterfall. (A. & M.)

At edge of creek, near Cache, Comanche Co., June 25, 1913. G. W. Stevens. (A. & M.)

On wet dam of sludge pond, near Hattenville, Ottawa Co., Okla., August 30, 1913. G. W. Stevens. (A. & M.)

At edge of creek, near Pawhuska, Osage Co., Okla., August 9, 1913. G. W. Stevens. (A. & M.)

Ludwigia palustris (L.) Ell. var americana (DC.) Fern. & Grisb.

Shallow water and floater, small creek 6 miles south of Heavener, Okla., June 20, 1936. James de Gruchy.

Lythrum alatum Pursh.

1.5 miles south Stillwater, Payne Co., Okla., July 25, 1916. C. D. Learn. (A. & M.)

Sand along Cimarron River, near Ripley, Payne Co., Okla., July 14, 1916. C. D. Learn. (A. & M.)

Moist roadside, near Hopeton, Woods Co., Okla., July 9, 1913. G. W. Stevens. (A. & M.)

On rocky bottom of dry water course by Spring River, near Ottawa, Ottawa Co., Okla., August 29, 1913. G. W. Stevens. (A. & M.)

Moist roadside, near Hopeton, Woods Co., Okla., July 9, 1913. G. W. Stevens. (A. & M.)

Water's edge, fish hatchery, Neosha, Missouri, July 5, 1936. James de Gruchy.

Marsilea quadrifolia L.

Northwest of Stillwater, Okla., October 24, 1926. H. I. Featherly. (A. & M.)

Shallow water, Boomer Lake, 2 miles north of Stillwater, Okla., June 25, 1935. James de Gruchy.

Macuillamia rotundifolia (Michx.) Raf.

Shallow water, up to 10 inches, floater, Talawanda Lake No. 1, McAlester, Okla., June 19, 1936. James de Gruchy.

Mentha piperita L.

Moist soil, Miami, Okla., Celeste Whaley. (O.U.)

Cultivated, O.U. Drug Garden, May 1, 1930. Robert L. Gowan. (O.U.)

Wasteland, Norman, Okla., July 15, 1928. Fred A. Barkley. (O.U.)

Shallow water, 1 mile east of Westville, Okla., July 4, 1936. James de Gruchy.

Mentha spicata L.

Spring bog, 1 mile west of Doalter, Cotton Co., Okla., August 15, 1934. George J. Goodman. (O.U.)

Moist places, east of Tahlequah, Okla., June 30, 1924. Bailey and Burdett. (A. & M.)

Moist fields and waste places, Tahlequah, Okla., C. W. Prier. (A. & M.)

Cultivated sandy clay loam, Stillwater, Payne Co., Okla., July 15, 1934. Helen Long. (A. & M.)

Sandy soil, 5 miles west and 6 miles north of Albion, Pushmataha Co., Okla., July 26, 1932. U. T. Waterfall. (A. & M.)

Water's edge, 2 miles southwest of Ringwood, Okla., July 17, 1936. James de Gruchy.

Shallow water, fish hatchery, Tahlequah, Okla., July 4, 1936. James de Gruchy.

Myriophyllum heterophyllum Michx.

Water 5 feet deep, Acme Mine Pond, Picher, Okla., July 6, 1936. James de Gruchy.

Water 2 feet deep, Barron Fork Creek, 12 miles northeast of Tahlequah, Okla., July 4, 1936. James de Gruchy.

Myriophyllum proserpinacoides

Water 2 feet deep, fish hatchery, Medicine Park, Okla., May 28, 1936. James de Gruchy.

Myriophyllum scabratum Michx.

Ardmore, Carter Co., Okla., April 8, 1936. Ben Osborn. (O.U.)

Fort Sill, Comanche Co., Okla., May 15, 1916. Mrs. J. Clemens. (O.U.)

In mountain creek, near Cache, Comanche Co., Okla., June 25, 1913. G. W. Stevens. (O.U.)

In road side sludge pond, near Hattenville, Ottawa Co., Okla., August 30, 1913. G. W. Stevens. (O.U.)

In pond, near Doby Springs, Harper Co., Okla., May 5, 1913. G. W. Stevens. (A. & M.)

Myriophyllum spicatum L.

Water 15 feet deep, Prices' Falls Lake, Davis, Okla.,
May 29, 1936. James de Gruchy.

Najas flexilis (Willd.) Rostk. & Schmidt

Water 2 feet deep, Tishomingo fish hatchery, Tishomingo,
Okla., September 6, 1936. James de Gruchy.

Najas quadalupensis (Spreng.) Morong

Water 3 feet deep, Yost Lake, Stillwater, Okla., July
12, 1936. James de Gruchy.

Water 4 feet deep, fish hatchery, No. 3, Tahlequah,
Okla., June 21, 1936. James de Gruchy.

Water 3 feet deep, Panther Creek Lake, Medicine Park,
Okla., May 27, 1936. James de Gruchy.

Water 4 feet deep, fish hatchery No. 3, Tahlequah,
Okla., June 21, 1936. James de Gruchy.

Water 3 feet deep, fish hatchery, 11 miles northeast of
Cherokee, Okla., July 10, 1936. James de Gruchy.

Water 4 feet deep, 2 miles southwest of Ringwood, Okla.,
July 17, 1936. James de Gruchy.

Nelumbo lutea (Willd.) Pers.

8 miles west of Walters, Cotton Co., Okla., July 2,
1934. Bot. 306 Class. (O.U.)

In large sludge pond, near Hattenville, Ottawa Co.,
Okla., August 29, 1913. G. W. Stevens. (A. & M.)

On muddy flats left by retreating pond, near Panama,
Leflore Co., September 5, 1913. G. W. Stevens. (A. & M.)

Water 4 feet deep, Merrimac Lake, Merrimac, Okla.,
July 15, 1935. James de Gruchy.

Nepeta hederaceae (L.) Trevisan

Moist ground, spring, 2 miles southwest of Ringwood,
Okla., July 17, 1936. James de Gruchy.

Nymphaea advena Ait.

Fourch Moline River, Wilburton, Okla., August 11, 1930.
O. M. Clark. (O.U.)

Nymphaea advena Ait. (continued)

Fourch Moline River, Wilburton, Okla., August 11, 1930.
O. M. Clark. (O.U.)

In water, Enderlin, July 26, 1911. H. F. Bergman. (O.U.)

Quiet water mountain stream, 5 miles northeast of
Quinton, Okla. W. W. Barkley. (O.U.)

In shallow water, southwest of Broken Bow, Okla., May
15, 1930. Paul B. Sears. (O.U.)

Growing in small inlet to Salt Creek, Finley, Okla.,
June 20, 1919. R. E. Jeffs. (O.U.)

Still stretches, streams, north Wilburton, Okla., June
13, 1930. Ora M. Clark. (O.U.)

Pool in rock creek, 2 miles west of Talihina, Leflore
Co., Okla., August 4, 1933. U. T. Waterfall. (A. & M.)

In water, 1 mile northeast of Antlers, Pushmataha Co.,
Okla., April 27, 1934. Reynold Dahms. (A. & M.)

Rocky shoal, 3 miles north of Idabel, Okla., May 30,
1936. James de Gruchy.

Water 3 feet deep, Mountain Fork River, Eagletown,
Okla., May 31, 1936. James de Gruchy.

Pastinaca sativa L.

Water's edge and in running water, 6 miles north of
Watonga, Okla., May 25, 1936. James de Gruchy.

Penthorum sedoides L.

Sandy creek bed, 5 miles west, 6 miles north of Albion,
Pushmataha Co., Okla., August 20, 1932. U. T. Water-
fall. (A. & M.)

On creek bank at water's edge, near Tonkawa, Kay Co.,
Okla., August 5, 1913. G. W. Stevens. (A. & M.)

Water's edge, fish pond, Stillwater, Okla., October 15,
1936. James de Gruchy.

Polygonum hydropiper L.

On a small creek, June 20, 1936. C. T. Eskew. (O.U.)

Muskogee Co., Okla., June 21, 1927. Elbert L. Little,
Jr. (O.U.)

Polygonum hydropiper L. (continued)

Growing in edge of water, West Cache Creek, Wichita National Forest, Comanche Co., Okla., October 10, 1936. C. T. Eskew. (O.U.)

At edge of Creek, near Tonkawa, Kay Co., Okla., August 4, 1913. G. W. Stevens. (O.U.)

Wet low ground, Pittsburg Co., Okla., September 22, 1934. J. E. McClary. (O.U.)

Woody copse, 5 miles south of Norman, Cleveland Co., Okla., June 15, 1936. H. D. Stacy. (O.U.)

Moist sand, low, Pittsburg Co., Okla., October 5, 1934. J. E. McClary. (O.U.)

Low sandy bottom, 16 miles east of Binger, Okla., January 3, 1928. (O.U.)

Creek banks, bank of Boggy Creek Canadian River, July 3, 1928. I. J. Myers. (O.U.)

Near stagnant pool, west of Norman, Okla., K. Personert. (O.U.)

Moist soil, near creek, $\frac{1}{2}$ mile east of stadium. Bayliff. (O.U.)

At edge of creek, near Tonkawa, Kay Co., Okla., August 4, 1913. G. W. Stevens. (A. & M.)

Low, swampy woods, near Tulsa, Tulsa Co., Okla., August 19, 1930. G. E. Tenney. (A. & M.)

Water's edge, fish hatchery, Tishomingo, Okla., September 6, 1936. James de Gruchy.

Shallow water, fish pond, Stillwater, Okla., October 15, 1936. James de Gruchy.

Water's edge, covered at high water level, creek bank, 5 miles south of Sapulpa, Okla., July 3, 1936. James de Gruchy.

Polygonum hydropiperoides Michx. Small

On shady side of store building, in Okesa, Osage Co., Okla., August 15, 1913. G. W. Stevens. (O.U.)

Polygonum hydropiperoides (L.) Opiz.

Marshy bank, June 27, 1928. Lamar, Okla., H. P. Marlin. (O.U.)

Persicaria pennsylvanica

Rich soil, Edmond, Okla., July 10, 1931. Chas. C. Smith.
(O.U.)

Polygonum hydropiperoides Michx.

North of Winding Stairs Mts., July 1, 1919. R. E. J.
(O.U.)

River bottom, Canadian River, October 1, 1917. Shultz
and Sawyer. (O.U.)

Granite hills, south of Mill Creek, Okla., May 12, 1930.
Paul B. Sears. (O.U.)

Wet slues, east Gowen, Okla., June 11, 1930. Ora M. Clark.
(O.U.)

Gowen, Okla., May 12, 1930. O. M. Clark. (O.U.)

On shady side of store building, in Okesa, Osage Co.,
Okla., August 15, 1913. G. W. Stevens. (A. & M.)

Clay loam, 2 miles southwest of Stillwater, Payne Co.,
Okla., September 17, 1935. Irene Watkins.

Bank and shallow water, Spavinaw Lake, Spavinaw, Okla.,
July 7, 1936. James de Gruchy.

Water 2 feet deep, Lost Lake, Medicine Park, Okla., May
27, 1936. James de Gruchy.

Once inundated banks, Holley Gage Lake, $3\frac{1}{2}$ miles west of
Keota, Okla., June 20, 1936. James de Gruchy.

Persicaria lapathifolia (L.) S. F. Gray.

Dock-leaved or Pale Persicaria. Waste places near S., $3\frac{1}{2}$
miles southwest of Norman, Okla., October 10, 1926. Elbert
L. Little, Jr. (O.U.)

Polygonum lapathifolium L.

4 miles north Reed, Greer Co., Okla., September 9, 1931.
Rotha Bull. (O.U.)

Southeast of Shawnee, Okla., August 12, 1932. Fred A.
Barkley. (O.U.)

Creek bank, Pittsburg Co., Okla., September 22, 1934.
J. E. McClary. (O.U.)

Polygonum lapathifolium L. (continued)

Wet soil, creek $\frac{1}{2}$ mile east of Norman, May 22, 1927. F. L. Hambrick. (O.U.)

Wet places, Wilburton, Okla., O. M. Clark. June 12, 1930. (O.U.)

Muskogee Co., Okla., September 5, 1927. Elbert L. Little, Jr. (O.U.)

Muskogee Co., Okla., September 11, 1927. Elbert L. Little, Jr. (O.U.)

Wet places, east of Binger, 15 miles, July 3, 1928. I. J. Myers. (O.U.)

Low sandy bottom, 15 miles east Binger. R. E. Berry. July 3, 1928. (O.U.)

Muskogee Co., Okla., June 12, 1927. Elbert L. Little, Jr. (O.U.)

North Canadian River, Okla., July 16, 1936. Delzie Demaree. (OU.)

At edge of pond, near Alva, Woods Co., Okla., July 14, 1913. G. W. Stevens. (O.U.)

At margin of creek near Fair Valley, Woods Co., Okla., July 14, 1913. G. W. Stevens. (O.U.)

Polygonum lapathifolium L.

River bed, sandy loam, 15 miles southeast of Stillwater, Payne Co., Okla., October 23, 1930. Nathalie Roberts. (A. & M.)

Damp soil, 5 miles east of 126 North Husband St., Stillwater, Payne Co., Okla., July 4, 1933. U. T. Waterfall. (A. & M.)

Along margin of Salt Fork River, near Alva, Woods Co., September 20, 1913. G. W. Stevens. (A. & M.)

At edge of pond, near Alva, Woods Co., Okla., July 14, 1913. G. W. Stevens. (A. & M.)

At edge of Lake Ivanhoe, near Shattuck, Ellis Co., Okla., October 11, 1913. G. W. Stevens. (A. & M.)

At margin of creek, near Fairvalley, Woods Co., Okla., July 10, 1913. G. W. Stevens. (A. & M.)

Polygonum lapathifolium L. (continued)

At edge of Lake Ivanhoe, near Shattuck, Ellis Co., Okla.,
October 11, 1913. G. W. Stevens. (A. & M.)

Polygonum longistylum Small

In waste places, southwest of Norman, Okla., September
14, 1920. R. E. Jeffs. (O.U.)

Wet ground, Pittsburg Co., Okla., September 24, 1934.
J. E. McClary. (O.U.)

Damp sand, field between Stillwater and Tourist Park,
Payne Co., Okla., July 16, 1933. U. T. Waterfall.
(A. & M.)

Water's edge, fish hatchery, Tishomingo, Okla., Septem-
ber 6, 1936. James de Gruchy.

Shallow water and at water's edge, Grand River, 2 miles
east of Fairland, Okla., July 6, 1936. James de Gruchy.

Water's edge and in shallow water, $1\frac{1}{2}$ miles northwest of
Perkins, Okla., June 25, 1936.

Polygonum muhlenbergii Wats.

At edge of pond, near Copan, Washington Co., Okla.,
August 15, 1913. G. W. Stevens. (A. & M.)

Water's edge, had been covered at high water, Talawanda
Lake No. 2, McAlester, Oklahoma, June 19, 1936. James
de Gruchy.

Polygonum persicarioides

Perennial Prairie Smart weed. Prairie near water in
moist ground, 2 miles south of Jenkins, Okla., May 20,
1927. M. Fielder. (O.U.)

Bed of Canadian River, under bridge, near Norman, Cleve-
land Co., Okla., August 26, 1934. Jack Engleman. (O.U.)

Polygonum pennsylvanicum L.

Bottom of shaded ravine, 5 miles east of Norman, Cleve-
land Co., Okla., September 14, 1934. George J. Goodman.
(O.U.)

Moist soil, on west Eufaula, Norman, Okla., May 1, 1919.
Perkinson. (O.U.)

Polygonum pennsylvanicum L.

1 mile south Ladessa, Greer Co., Okla., August 16,
1931. Rotha Bull. (O.U.)

Near water, 2 miles north Norman, Okla., June 17, 1936.
C. T. Eskew, (O.U.)

Roadside, west Washita Co., Retrop, Okla., August 20,
1936. C. T. Eskew.

West campus 2 blocks, sandy soil, Norman, Okla., July
12, 1928. I. J. Myers. (O.U.)

Muskogee Co., Okla., September 5, 1928. Elbert L.
Little, Jr. (O.U.)

In moist soil near pond, prairie, $\frac{1}{2}$ mile south of campus,
Norman, Okla., September 19, 1926. Elbert L. Little,
Jr. (O.U.)

Low ground, Norman, Okla., west of campus, July 12,
1928. R. E. Berry. (O.U.)

Muskogee, September 11, 1927. Elbert L. Little, Jr.
(O.U.)

Gaines River bottom, Gowen, Okla., August 10, 1930.
O. M. Clark. (O.U.)

Norman, Okla., October 2, 1926. Elbert L. Little, Jr.
(O.U.)

Moist sand, Pittsburg Co., Okla., September 22, 1934.
J. E. McClary. (O.U.)

Roadside ditch near Norman, Cleveland Co., Okla.,
August 27, 1934. Jack Engleman. (O.U.)

Moist creek bank, Cotton Co., Okla., July 14, 1934.
Glenn E. Pottz. (O.U.)

1 mile south of Ladessa, Greer Co., Okla., August 16,
1931. Rotha Bull. (O.U.)

Gaines River bottom, Latimer Co., Okla., O. M. Clark.
August 10, 1930. (O.U.)

Water's edge, Tourists' Park Creek, Stillwater, Okla.,
June 25, 1936. James de Gruchy.

Water's edge, Thatcher Pond, Stillwater, Okla.,
June 25, 1936. James de Gruchy.

Polygonum pennsylvanicum L. (continued)

Gaines River bottom, Latimer Co., Okla., August 10, 1930.
O. M. Clark. (O.U.)

Waste place, near Alva, Woods Co., Okla., September 20,
1913. G. W. Stevens. (A. & M.)

Low moist place in wheat field, near Hopeton, Woods Co.,
Okla., July 12, 1913. G. W. Stevens. (A. & M.)

Waste place, near Page, Leflore Co., Okla., June 20,
1914. G. W. Stevens. (A. & M.)

Stillwater, Okla., October 5, 1925. H. I. Featherly.
(A. & M.)

Low moist place in wheat field, near Hopeton, Woods Co.,
Okla., July 12, 1913. G. W. Stevens. (A. & M.)

Open place at edge of creek, near Tonkawa, Kay Co., Okla.,
August 5, 1913. G. W. Stevens. (A. & M.)

Water's edge, Ross Lake, 5 miles east of Muskogee, Okla.,
July 3, 1936. James de Gruchy.

Polygonum persicaria L.

Canadian River, wet meadow under bridge, east bank, 5
miles south of Norman, Cleveland, Okla., October 16,
1936. Mildred Hawkins. (O.U.)

Fields, south of campus, July. Mildred Hibbard. (O.U.)

Pittsburg Co., Okla., September 19, 1934. J. E. McClary.
(O.U.)

Swampy land, 1 mile south of town, May 26, 1927. Maurine
Babb. (O.U.)

Waste places, south of Norman, June. Mildred Hibbard.
(O.U.)

Swampy conditions or in water, South Jenkins, 6 blocks
south of campus, May 2, 1927. M. Fielder. (O.U.)

Pontederia cordata L.

Edge of water, 7 miles southeast of Miami, Okla., August,
1928. Celeste Whaley.

Water 2 feet deep, fish hatchery No. 3, Tahlequah, Okla.,
June 21, 1936. James de Gruchy.

Potamogeton americanus C. & S.

In edge of creek, near Page, Leflore Co., Okla., June 20, 1914. O. W. Blakley. (A. & M.)

Along edge of still creek, near Cache, Comanche Co., Okla., June 25, 1913. G. W. Stevens. (A. & M.)

Shallow water, small creek 6 miles south of Heavener, Okla., June 20, 1936. James de Gruchy.

Water 2 feet, 1 mile below Prices' Falls Lake, Davis, Okla., May 29, 1936. James de Gruchy.

Water 3 feet deep, Cache Creek, 2 miles southwest of Cache, Okla., May 26, 1936. James de Gruchy.

Water 2 feet deep, Yost Lake, Stillwater, Okla., July 12, 1936. James de Gruchy.

Water 2 feet deep, mill pond, Idabel, Okla., May 30, 1936. James de Gruchy.

Water 2 feet deep, Merrimac Lake, June 25, 1934. James de Gruchy.

Water's edge, Indian Creek, 4 miles south of Woodward, Okla., July 18, 1936. James de Gruchy.

Water 6 feet deep, Spavinaw Lake, Spavinaw, Okla., July 7, 1936. James de Gruchy.

Potamogeton crispus L.

Water 4 feet deep, fish hatchery, Medicine Park, Okla., May 28, 1936. James de Gruchy.

Water 2 feet deep, Barron Fork Creek, 12 miles northeast of Tahlequah, Okla., July 4, 1936. James de Gruchy.

Water 5 feet deep, fish hatchery No. 3, Tahlequah, Okla., June 21, 1936. James de Gruchy.

Water 2 feet deep, Cow Skin Creek, Turkey Ford, Okla., July 6, 1936. James de Gruchy.

Potamogeton dimorphus Raf.

In large sludge overflow pond, near Hattenville, Ottawa Co., Okla., August 20, 1913. G. W. Stevens. (O.U.)

In quiet place in creek, near Cache, Comanche Co., Okla., June 25, 1913. G. W. Stevens. (O.U.)

Potamogeton dimorphus Raf. (continued)

Water 3 feet deep, Lake Austin, Pittsburg, Okla.,
May 31, 1936. James de Gruchy.

Potamogeton foliosus Raf.

In still pond, near Waynoka, Woods Co., Okla., July 24,
1913. G. W. Stevens. (O.U.)

In large sludge overflow pond, near Hattenville, Ottawa
Co., Okla., August 30, 1913. G. W. Stevens. (O.U.)

Water 2 feet deep, Cow Skin Creek, Turkey Ford, Okla.,
July 6, 1936. James de Gruchy.

Water 2 feet deep, Barron Fork Creek, 12 miles north-
east of Tahlequah, Okla., July 4, 1936. James de Gruchy.

Water 2 feet deep, Francis Lake, 2 miles north of Watts,
Okla., July 4, 1936. James de Gruchy.

Water 18 inches deep, fish hatchery, Neosha, Missouri,
July 5, 1936. James de Gruchy.

Potamogeton foliosus Raf. var. Macellus Fern.

Fort Sill, Comanche Co., Okla., Mrs. J. Clemens.
May 3, 1916. (O.U.)

Potamogeton hybridus Michx.

Water 4 feet deep, fish hatchery, 3 miles northwest of
McAlester, Okla., June 19, 1936. James de Gruchy.

Shallow water, small creek, 6 miles south of Heavener,
Okla., June 20, 1936. James de Gruchy.

Water 2 feet deep, Panther Creek Lake, Medicine Park,
Okla., May 27, 1936. James de Gruchy.

Potamogeton lucens L.

Floating, protected water, Lake Latonka, Medicine Park,
Okla., May 27, 1936. James de Gruchy.

Water 2 feet deep, fish hatchery, Tishomingo, Okla.,
September 6, 1936. James de Gruchy.

Potamogeton pectinatus L.

Water 4 feet deep, fish hatchery, Medicine Park, Okla.,
May 28, 1936. James de Gruchy.

Potamogeton pectinatus L. (continued)

Water 3 feet deep, fish pond 11 miles northeast of Cherokee, Okla., July 19, 1936. James de Gruchy.

Water 4 feet deep, Tourists' Park Creek, Stillwater, Okla., June 30, 1936. James de Gruchy.

Potamogeton pusillus L.

In quiet place in creek, near Cache, Comanche Co., Okla., June 25, 1913. G. W. Stevens. (O.U.)

In edge of pond, near Pawhuska, Osage Co., Okla., August 11, 1913. G. W. Stevens. (A. & M.)

In quiet place in creek, near Cache, Comanche Co., Okla., June 25, 1913. G. W. Stevens. (A. & M.)

Water 4 feet deep, 2 miles southwest of Ringwood, Okla., July 17, 1936. James de Gruchy.

Water 6 feet deep, Spavinaw Lake, Spavinaw, Okla., July 7, 1936. James de Gruchy.

Water 4 feet deep, Spavinaw Lake, Spavinaw, Okla., July 7, 1936. James de Gruchy.

Water 3 feet deep, fish hatchery, 11 miles northeast of Cherokee, Okla., July 19, 1936. James de Gruchy.

Water 4 feet deep, Prices' Falls Lake, Davis, Okla., May 29, 1936. James de Gruchy.

Proserpinaca palustris L.

On rocky bed of dried up creek, near Page, Leflore Co., September 8, 1913. G. W. Stevens. (O.U. and A. & M.)

Radicula nasturtium-aquaticum (L.) Britten & Rendle

Sandy loam soil near spring, 6 miles northwest of Keystone, Pawnee Co., Okla., June 9, 1934. A. C. Brodell. (A. & M.)

In water, Camp Garland, Mayes Co., Okla., May 5, 1934. Reynold Dahms. (A. & M.)

Shallow water, 1 mile east of Westville, Okla., July 4, 1936. James de Gruchy.

Shallow water, small spring, 2 miles northeast of Woodward, Okla., July 18, 1936. James de Gruchy.

Radicula nasturtium-aquaticum (L.) Britten & Rendle (continued)

Running water, 12 inches deep, below fish hatchery,
Medicine Park, Okla., May 28, 1936. James de Gruchy.

Radicula palustris (L.) Moench.

Near Arkansas River, 5 miles northeast of Muskogee,
Okla., July 7, 1925. Elbert L. Little, Jr. (O.U.)

Wet places, Gaines River, east of Gowen, Okla., May 5,
1930. Ora M. Clark. (O.U.)

Moist soil, bed of Canadian River, south of Norman,
Okla., May 21, 1921. R. E. Jeffs. (O.U.)

Low wet ground, $\frac{1}{2}$ mile north of Wyandotte, Okla.,
Celeste Whaley. (O.U.)

Muskogee Co., Okla., September 2, 1928. Elbert L.
Little, Jr. (O.U.)

Low ground, between Norman, Okla., and Noble, Okla.,
July 2, 1928. Louis Martin. (O.U.)

Clay loam, 9 miles south and 2 miles east of Stillwater,
Payne Co., Okla., June 26, 1934. A. C. Brodell. (A. & M.)

Water 8 inches, probably sprouted at low water,
Panther Creek Lake, Medicine Park, Okla., May 27, 1936.
James de Gruchy.

Water 10 inches deep, probably developed at low water,
fish hatchery, Medicine Park, Okla., May 28, 1936.
James de Gruchy.

Ranunculus aquatilis L.

Water 18 inches deep, Boy Scout Lake, 9 miles west and
3 miles south of Ringwood, Okla., July 18, 1936. James
de Gruchy.

Water 3 feet deep, Cache Creek, 2 miles southwest of
Cache, Okla., May 26, 1936. James de Gruchy.

Water 18 inches, fish hatchery, 11 miles east of
Cherokee, Okla., July 19, 1936. James de Gruchy.

Ranunculus aquatilis L. var. capillacea DC.

Water 3 feet deep, 2 miles west of Broken Bow, Okla.,
May 21, 1936. James de Gruchy.

Ranunculus Cymbalaria Pursh.

Edge of creek, 15 miles southwest of Beaver City, Beaver Co., Okla., May 8, 1913. G. W. Stevens. (O.U. and A. & M.)

Dam site, August 23, 1931. Rotha Bull. (O.U.)

At edge of pond, near Doby Springs, Harper Co., May 5, 1913. G. W. Stevens. (A. & M.)

Creek bed, below dam at Clinton Lake, Clinton, Okla., May 25, 1936. James de Gruchy.

Rotala ramosior (L.) Koehne.

Damp sand, creekside, 5 miles north and 2 south of Albion, Pushmataha Co., Okla., August 20, 1932. U. T. Waterfall. (A. & M.)

On mud at Pond margin, near Copan, Washington Co., Okla., August 15, 1913. G. W. Stevens. (A. & M.)

At muddy edge of pool, by Spring River, near Ottawa, Ottawa Co., Okla., August 27, 1913. G. W. Stevens. (A. & M.)

Shallow water, Barron Fork Creek, 12 miles northeast of Tahlequah, Okla., June 21, 1936. James de Gruchy.

Running water, 1 foot deep, below Prices' Falls Lake, Davis, Oklahoma, May 29, 1936. James de Gruchy.

Shoals, Cow Skin Creek, Turkey Ford, Okla., July 5, 1936. James de Gruchy.

Ruppia maritima L.

Saline pond near Cimmaron River, near Fairvalley, Woods Co., June 1, 1913. G. W. Stevens. (A. & M.)

In saline pond, near Hornbeck's, Harper Co., Okla., May 3, 1913. G. W. Stevens. (A. & M.)

In brackish pond, near Fairvalley, Woods Co., Okla., May 2, 1913. G. W. Stevens. (A. & M.)

Rynchospora corniculata (Lam.) Gray

Shallow water, fish hatchery, 3 miles northwest of McAlester Okla., June 19, 1936. James de Gruchy.

Sagittaria graminea J. G. Small

Along creeks and pools, west of Red Oak, Okla., June 13, 1930. Ora M. Clark. (O.U.)

On rocky bed of dried-up mountain creek, near Page, Leflore Co., Okla., September 8, 1913. G. W. Stevens. (A. & M.)

Water 18 inches deep, fish hatchery No. 4, 5 miles south of Heavener, Okla., June 20, 1936. James de Gruchy.

Water 2 feet deep, Durant fish hatchery, Durant, Okla., May 29, 1936. James de Gruchy.

Sagittaria lancifolia L.

Water 10 inches, Cache Creek, 2 miles southwest of Cache, Okla., May 26, 1936. James de Gruchy.

Shallow water, fish hatchery, 3 miles northwest of McAlester, Okla., June 19, 1936. James de Gruchy.

Sagittaria latifolia Willd.

In mud at edge of pond, near Ottawa, Ottawa Co., Okla., August 27, 1913. G. W. Stevens. (A. & M.)

In edge of pond, near Alva, Woods Co., Okla., July 14, 1913. G. W. Stevens. (A. & M.)

Water's edge, Wewoka Lake, Wewoka, Okla., June 18, 1936. James de Gruchy.

Samolus ebracteatus HBK.

In grass at edge of pond, between Canton and Seiling, Dewey Co., Okla., June 11, 1913. G. W. Stevens. (A. & M.)

Grassy edge of pond, near Granite, Kiowa Co., Okla., June 17, 1913. G. W. Stevens. (A. & M.)

In moist grassy place by pond, near Fairvalley, Woods Co., Okla., July 10, 1913. G. W. Stevens. (A. & M.)

In moist place, river valley, near Alva, Woods Co., Okla., October 2, 1913. G. W. Stevens. (A. & M.)

Samolus floribundus HBK.

At edge of pond, near Alva, Woods Co., Okla., May 28, 1913. G. W. Stevens. (O.U. and A. & M.)

Samolus floribundus HBK. (continued)

Along small stream in ravine bottom, McClain Co., Okla.,
June 17, 1934. George J. Goodman. (O.U.)

Devil's Canyon, Canadian, Co., Okla., September 26,
1936. E. H. Little. (O.U.)

At edge of spring, near Cleo, Major Co., Okla., June 8,
1913. G. W. Stevens. (O.U. and A. & M.)

Near the Red River, Harmon Co., Okla., December 16,
1933. George J. Goodman & Fred Barkley. (O.U.)

In a spring, 4 miles north of Reed, Greer Co., Okla.,
July 13, 1931. Rotha Bull. (O.U.)

Marshy area, 1 mile south of Hochatown road, McCurtain
Co., Okla., June 6, 1930. Elbert L. Little, Jr. and
Charles E. Olmsted, Oklahoma Forest Service. (O.U.)

In moist ground, Cleveland Co., Okla., June 16, 1903.
W. E. Bruner. (O.U.)

Muskogee Co., Okla., June 15, 1937. Elbert L. Little,
Jr. (O.U.)

Kendrick, Okla., July 19, 1905. A. H. Van Vleet. (O.U.)

Low wet soil, Canadian River bottom, south of Norman,
Okla., May 22, 1921. R. E. Jeffs. (O.U.)

1 mile west and 2.5 miles north of Stillwater, Payne
Co., Okla., September 18, 1930. Leila Powers. (A. & M.)

At edge of lake, near Shattuck, Ellis Co., Okla.,
October 11, 1913. G. W. Stevens. (A. & M.)

Edge of pond, 3 miles north of Stillwater, Payne Co.,
Okla., September 17, 1930. Nathalie Roberts. (A. & M.)

On moist creek bank, near Pawhuska, Osage Co., Okla.,
August 9, 1913. G. W. Stevens. (A. & M.)

Wet bank, Dripping Springs, near Ottawa, Ottawa Co.,
Okla., August 27, 1913. G. W. Stevens. (A. & M.)

At the edge of cool mossy banks, 6 miles north of
Watonga, Okla., May 25, 1936. James de Gruchy.

Saururus cernuus L.

Muskogee Co., Okla., July 19, 1929. E. L. Little. (O.U.)

Saururus cernuus L. (continued)

At wet grassy edge of pond in woods, near Ottawa, Ottawa Co., Okla., August 27, 1913. G. W. Stevens. (O.U.) (A. & M.)

Shallow water, near Wyandotte, Okla., July, 1928. Celeste Whaley. (O.U.)

Slues of Red River bottom, south of Tom, Okla., June 15, 1930. Ora M. Clark, (O.U.)

Wet soil, Tahlequah, Okla., July 1, 1924. Prier. (A. & M.)

Water's edge, small creek, 5 miles south of Idabel, Okla., May 30, 1936. James de Gruchy.

Water 18 inches, Spavinaw Lake, Spavinaw, Okla., July 7, 1936. James de Gruchy.

Scirpus americanus Pers.

Low place in oats field, near Cleo, Major Co., Okla., June 8, 1913. G. W. Stevens. (A. & M.)

Fresh water along r.r. near Norman, Okla., May 16, 1923. C. W. Prier. (A. & M.)

Sand-bar at edge of creek, near Waynoka, Major Co., Okla., May 23, 1913. G. W. Stevens. (A. & M.)

Edge of Redhorse Lake, near Fairvalley, Woods Co., Okla., April 29, 1913. G. W. Stevens. (A. & M.)

In sandy bottom of dry creek, near Hollis, Harmon Co., Okla., June 21, 1913. G. W. Stevens. (A. & M.)

Sand-bar by river, near Purcell, McClain Co., Okla., April 20, 1913. G. W. Stevens. (A. & M.)

Edge of creek, near Buffalo, Harper Co., Okla., May 3, 1913. G. W. Stevens. (A. & M.)

In low moist place by r.r. near Alva, Woods Co., Okla., July 7, 1913. G. W. Stevens. (A. & M.)

In sand at edge of creek, near Hornbeck's, Woods Co., Okla., May 3, 1913. G. W. Stevens. (A. & M.)

Water's edge and in running water, 6 miles north of Watonga, Okla., May 25, 1936. James de Gruchy.

Scirpus americanus Pers. (continued)

Water 8 inches, below dam at Altus Lake, Lugert, Okla., May 26, 1936. James de Gruchy.

Water 4 feet deep, Panther Creek Lake, Medicine Park, Okla., May 27, 1936. James de Gruchy.

Scirpus californicus C. A. Meyer

Water 3 feet, fish hatchery No. 3, Tahlequah, Okla., June 21, 1936. James de Gruchy.

Water 4½ feet deep, extending 6 foot above water, Chickasaw Lake, 3 miles southeast of Ardmore, Okla., May 29, 1936. James de Gruchy.

Scirpus lineatus Michx.

Water's edge, Lost Lake, Medicine Park, Okla., May 27, 1936. James de Gruchy.

Scirpus Torreyi Olney

Water's edge, fish hatchery No. 5, 11 miles northeast of Cherokee, Okla., July 19, 1936. James de Gruchy.

Shallow water, Woodward Lake, ½ mile southeast of Woodward, Okla., July 18, 1936. James de Gruchy.

Scirpus validus Vahl.

Shallow water, fish hatchery, Neosha, Missouri, July 5, 1936. James de Gruchy.

Swamps, river south of Norman, May 6, 1923. C. W. Prier. (A. & M.)

Low place in oats field, near Cleo, Major Co., Okla., June 8, 1913. C. W. Stevens.

Sium suave Walt.

Moist ground, small spring, 2 miles northeast of Woodward, Okla., July 18, 1936. James de Gruchy.

Sparganium americanus Nutt.

Shallow water, small creek 6 miles south of Heavener, Okla., June 20, 1936. James de Gruchy.

Spirodela polyrrhyza (L.) Schleid.

On spring-fed pond, near Alva, Woods Co., Okla., May 29, 1913. G. W. Stevens. (O.U. and A. & M.)

Water's edge, Barron Fork Creek, 12 miles northeast of Tahlequah, Okla., July 4, 1936. James de Gruchy.

Thalia dealbata Roscoe

Water 18 inches deep, fish hatchery No. 3, Tahlequah, Okla., June 21, 1936. James de Gruchy.

Typha angustifolia L.

Swampy places, south of Norman, Okla., Mildred Hibbard. (O.U.)

Edge of still pools or old channels of South Canadian River, $3\frac{1}{2}$ miles southwest of Norman, Okla., October 10, 1926. Elbert L. Little, Jr. (O.U.)

Muskogee Co., Okla., July 21, 1929. Elbert L. Little, Jr. (O.U.)

In low moist place by r.r. near Alva, Woods Co., Okla., July 7, 1913. G. W. Stevens. (A. & M.)

Typha latifolia L.

4 miles north of Reed, Greer Co., Okla., June 8, 1931. Rotha Bull. (O.U.)

Low place by r.r track near Alva, Woods Co., Okla., May 31, 1913. G. W. Stevens. (O.U. and A. & M.)

Shallow water at edge of artificial lake, 2 miles west of Muskogee, Okla., August 8, 1926. Elbert L. Little, Jr. (O.U.)

Pond, south of Tecumseh, Okla., September 7, 1932. Elizabeth Ducker Barkley. (O.U.)

In marshes and swampy places, South Canadian River bottoms, south of Norman, Okla., June 23, 1922. R. E. Jeffs. (O.U.)

Edge of still pools or old channels of South Canadian River, $3\frac{1}{2}$ miles southwest of Norman, Okla., October 10, 1926. Elbert L. Little, Jr. (O.U.)

Edge of stream, near Hollis, Harmon Co., Okla., October 2, 1936. Milton Hopkins. (O.U.)

Typha latifolia L. (continued)

2 miles north of Stillwater, Payne Co., Okla., July 3, 1934. W. W. Rey. (A. & M.)

Silt and sand, 5 miles south of Bristow, Creek Co., Okla., July 4, 1935. W. L. Spears. (A. & M.)

In sludge pond, near Hattenville, Ottawa Co., Okla., August 30, 1913. G. W. Stevens. (A. & M.)

Utricularia biflora Lam.

In quiet creek, near Cache, Comanche Co., Okla., June 26, 1913. G. W. Stevens. (O.U. and A. & M.)

On muddy margin of drying-up pool, near Ottawa, Ottawa Co., August 27, 1913. G. W. Stevens. (O.U. and A. & M.)

Water 2 feet deep, Panther Creek Lake, Medicine Park, Okla., May 27, 1936. James de Gruchy.

Vallisneria spiralis L.

Water 2 feet deep, Durant fish hatchery, Durant, Okla., May 29, 1936. James de Gruchy.

Verbesina alba L.

Little River, August 22, 1903. A. H. Van Vleet. (O.U.)

At edge of pond, $\frac{1}{2}$ mile south of Norman, Okla., October 3, 1926. Elbert L. Little, Jr. (O.U.)

Water 2 feet deep, fish hatchery, Tishomingo, Okla., September 6, 1936. James de Gruchy.

At edge of water, Illinois River, $\frac{1}{2}$ mile east of Tablequah, Okla., James de Gruchy.

Veronica peregrina L.

Mud flats, Caddo Co., Okla., April 26, 1936. Delzie Demaree. (O.U.)

Prairie, near Norman Hospital, Norman, Okla., April 26, 1936. Breed. (O.U.)

Roadside, near Norman, Okla., April 16, 1928. Miss Gilmore. (O.U.)

7 miles northeast of Mangum, Greer Co., Okla., April 30, 1931. Rotha Bull. (O.U.)

Veronica peregrina L.

Low waste place, near Crusher Spur, Murray Co., Okla.,
April 14, 1913. G. W. Stevens. (O.U.) (A. & M.)

Loam soil, 4 miles west of Stillwater, Payne Co., Okla.,
April 11, 1934. Reynold Dahms. (A. & M.)

Damp waste soil, 3 miles north of Stillwater, Payne Co.,
Okla., April 7, 1935. Faustine Clark. (A. & M.)

Sandy field, Bethany, Okla. Co., Okla., May 25, 1920.
Francis W. Pennell. (A. & M.)

Old alfalfa field, Davis, Murray Co., Okla., April 29,
1926. F. M. R. (A. & M.)

In moist places, Tahlequah, Okla., April 15, 1925.
C. W. Prier. (A. & M.)

Moist waste place, near Alva, Woods Co., Okla., May 1,
1913. G. W. Stevens. (A. & M.)

At edge of creek, near Kenton, Cimmaron Co., Okla.,
May 13, 1913. G. W. Stevens. (A. & M.)

Shoals, Barron Fork Creek, 12 miles northeast of
Tahlequah, Okla., July 4, 1936. James de Gruchy.

Wolffia columbiana Karst.

With Lemna cyclostasa in Stink Creek, near Tonkawa, Kay
Co., Okla., August 5, 1913. G. W. Stevens. (O.U. and
A. & M.)

Floating on water, protected water, fish hatchery No. 3,
Tahlequah, Okla., June 21, 1936. James de Gruchy.

Zannichellia palustris L.

In shallow stream 15 miles southwest of Beaver City,
Beaver Co., Okla., May 8, 1913. G. W. Stevens.
(O.U. and A. & M.)

In running creek, near Doby Springs, Harper Co., Okla.,
May 5, 1913. G. W. Stevens. (A. & M.)

Water 2 feet deep, Barron Fork Creek, 12 miles north-
east of Tahlequah, Okla., July 4, 1936. James de Gruchy.

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INDEX

SCIENTIFIC NAMES

ACANTHACEAE	125
Acorus	58
Calamus	58
ALISMACEAE	30
Alisma	30
Plantago-aquatica	30
Ammannia	92
auriculata	92
coccinea	93
ARACEAE	58
ARALIACEAE	104
Berula	105
erecta	105
CALLITRICHACEAE	90
Callitriche	90
heterophylla	90
Carex	42
Frankii	42
Castalia	79
Sp. - hybrid.	79
odorata	80
tuberosa.	81
Cephalanthus	126
occidentalis	126
CERATOPHYLLACEAE	78
Ceratophyllum	78
demersum	78
CHARACEAE	10
Chara	10
fragilis.	10
sejuncta.	11
vulgaris.	12
Chrysosplenium.	89
americanum	89
CISTACEAE	91
COMPOSITAE	128
CRASSULACEAE	88
CRUCIFERAE	86
CYPERACEAE.	42
Cyperus	43
acuminatus	43
erythrorhizos	44
strigosus	45
Dianthera	125
americana	125
Diodia	127
virginiana	127
Echinochloa	41
crusgalli	41

cordifolius	31
radicans	32
Elatine	91
americana	91
Eleocharis	46
albida	46
leptos	47
mamilliata	48
obtusa	49
palustris	50
quadrangulata	51
Elodea	37
canadensis	37
minor	38
occidentalis	39
FONTINALACEAE	13
Fontinalis	13
novae-angliae	13
GRAMINEAE	41
Gratiola	117
neglecta	117
sphaerocarpa	118
virginiana	119
HALORAGIDACEAE	100
Heteranthera	62
dubia	62
HYDROCHARITACEAE	37
Hydrodictyon	9
reticulatum	9
Ilysanthes	120
anagallidea	120
dubia	121
INDACEAE	67
Iris	67
Shrevei	67
JUNCACEAE	64
Juncus	64
acuminatus	64
effusus	65
robustus	66
Jussiaea	96
decurrens	96
diffusa	97
LABIATAE	113
LEMNACEAE	59
Lemna	59
trisolca	59
LENTIBULARIACEAE	124
Lippia	110
cuneifolia	110
lanceolata	111
nodiflora	112
Lophotocarpus	33
calycinus	33

Lycopus	113
virginicus	113
Ludwigia	98
alternifolia	98
palustris	99
LYTHIACEAE	92
Lythrum	94
alatum	94
MARANTACEAE	68
MARSILEACEAE	14
Marsilea	14
quadrifolia	14
Macuillamia	122
rotundifolia	122
Mentha	115
piperita	115
spicata	116
Myriophyllum	100
heterophyllum	100
proserpinacoides	101
scabratum	102
spicatum	103
NAIDADACEAE	18
Najas	18
flexilis	18
guadalupensis	19
Nelumbo	82
lutea	82
Nepeta	114
hederacea	114
Nymphaea	83
advena	83
NYMPHAEEACEAE	80
ONAGRACEAE	96
Pastinaca	106
sativa	106
Penthorum	88
sedoides	88
PUPERACEAE	69
Polygonum	71
Hydropiper	71
hydropiperoides	72
lapathifolium	73
longistylum	74
Muhlenbergii	75
pennsylvanicum	76
persicaria	77
PONTEDERIACEAE	62
Pontederia	63
cordata	63
Potamogeton	20
americanus	20
crispus	21
dimorphus	22
foliosus	23
hybridus	24

<i>lucens</i>	25
<i>pectinatus</i>	26
<i>pusillus</i>	27
PRIMULACEAE	108
<i>Proserpinaca</i>	104
<i>palustris</i>	104
<i>Radicula</i>	86
<i>Nasturtium-aquaticum</i>	86
<i>palustris</i>	87
RANUNCULACEAE	84
<i>Ranunculus</i>	84
<i>aquatilis</i>	84
<i>Cymbalaria</i>	85
<i>Rotala</i>	95
<i>ramosior</i>	95
RUBIACEAE	126
<i>Ruppia</i>	28
<i>maritima</i>	28
<i>Rynechospora</i>	52
<i>corniculata</i>	52
<i>Sagittaria</i>	34
<i>graminea</i>	34
<i>lancifolia</i>	35
<i>latifolia</i>	36
<i>Salix</i>	69
<i>sp. and others</i>	69
<i>Samolus</i>	108
<i>ebracteatus</i>	108
<i>floribundus</i>	109
<i>Saururus</i>	70
<i>cernuus</i>	70
SAXIFRAGACEAE	89
<i>Scirpus</i>	53
<i>americanus</i>	53
<i>californicus</i>	54
<i>lineatus</i>	55
<i>Torreyi</i>	56
<i>validus</i>	57
SCROPHULARIACEAE	117
<i>Sium</i>	107
<i>suave</i>	107
SPARGANIACEAE	17
<i>Sparganium</i>	17
<i>americanus</i>	17
<i>Spirodela</i>	60
<i>polyrhiza</i>	60
<i>Thalia</i>	68
<i>dealbata</i>	68
<i>Typha</i>	15
<i>angustifolia</i>	15
TYPHACEAE	15
<i>Typha</i>	16
<i>latifolia</i>	16
UMBELLIFERAE	105
<i>Utricularia</i>	124
<i>biflora</i>	124

Vallisneria	40
spiralis	40
VERBENACEAE	110
Verbesina	128
alba	128
Veronica	123
peregrina	123
Wolffia	61
columbiana	61
Zannichellia	29
palustris	29

Typist - Helen Massey