

OFFICE MEMORANDUM

PPD

TO: Phil Durocher through Roger McCabe

FROM: David R. Terre

SUBJECT: Recommendations for aquatic vegetation in the Guadalupe River

RE: As requested

DATE: August 25, 1989

COORDINATION - ROUTING			
ORG	NAME	INIT	DATE
IF	ROGER McCABE	RM	8-29-
	Joyce Johnson		
	NICK Carter	TR	9-10
Dove was asked to comment on proposal to install ^{plant} vegetation ^{in the Guadalupe river.}			
RETURN: <u>Phil</u>			

The following aquatic plants have been identified in the Guadalupe River by Butler (1975), Suomela (1960), and Young et. al (1973):

- | | |
|---------------------|--|
| * Water willow | <u>Justicia</u> |
| - Smartweed | <u>Dianthera americana</u> |
| - Parrot's feather | <u>Polygonum lepathifolium</u> |
| - Water Primrose | <u>Myriophyllum heterophyllum</u> |
| - Water Primrose | <u>Ludwigia sp.</u> |
| * Cat-tail | <u>Jussiaea diffusa</u> |
| * Cat-tail | <u>Typha latifolia</u> |
| * Bulrush | <u>Typha angustifolia</u> |
| * flatsedge | <u>Scirpus sp.</u> |
| Water cress | <u>Cyperus sp.</u> |
| Alligator weed | <u>Rorippa nasturtium-aquaticum</u> |
| - Water Hyssop | <u>Alternanthera philoxeroides</u> |
| * Duck potato | <u>Bacopa monnieri</u> |
| * Pickeral weed | <u>Sagittaria platyphylla</u> |
| * Giant cutgrass | <u>Pontederia cordata</u> |
| * Spatterdock | <u>Zizaniopsis miliacea</u> |
| Water hyacinths | <u>Nuphar advena luteum</u> |
| * American lotus | <u>Eichornia crassipes</u> |
| * Sweet flag | <u>Nelumbo sp.</u> |
| * Yellow water lily | <u>Acorus sp.</u> |
| * Pondweed | <u>Nuphar americana sp.</u> |
| * Pondweed | <u>Potamogeton illinoensis</u> |
| | <u>Potamogeton natans</u> |

- native aquatic plants
 * beneficial native aquatic plants

Phil, Ch. with Joyce on these plants and, if OK, get with George Adams for address. I allow that watercress is permitted to let trout survive. They would probably be interested in seeing this one. Phil

* Sago pondweed	<u>Potamogeton pectinatus</u>
* Water nymph	<u>Najas guadalupensis</u> (S)
* Coontail	<u>Ceratophyllum demersum</u>
Non-vascular plants	Muskgrass
	Muskgrass
	Stonewort
	Scale moss
	* Blatterwort
* Blatterwort	<u>Utricularia subulata</u>
	<u>Utricularia macrorhiza</u>

Most aquatic plants do attract aquatic invertebrates which could be beneficial to trout for food. Correll and Correll (1975) cite water nymph, pondweed species and watercress as good attractors for aquatic invertebrates. These varieties have already been identified in the Guadalupe River; however, watercress is a prohibited species in the state. Management with water nymph Najas guadalupensis, or pondweeds Potamogeton sp. may provide an alternative to watercress (see descriptive information enclosed). To my knowledge, these species have not been a problem in the Guadalupe River.

Based on previous experiences I've had on trout habitat improvement projects in the State of Wisconsin and literature on this subject, the establishment of aquatic vegetation in trout streams and rivers is not always beneficial. Dense stands of aquatic vegetation can reduce stream flow thereby increasing water temperature and siltation. Since high water temperature is already known to limit over-summering of trout in our rivers, promoting growth of aquatic vegetation in these systems may be counter productive. Over-summering of trout has been documented in the Guadalupe River (White 1968).

Management geared toward establishment of terrestrial vegetation (ie shade tolerant native grasses) along the banks may be a better alternative for increasing food supply for trout. Native grasses attract insects such as grasshoppers etc., which can provide additional food for trout. Additionally grasses help stabilize banks, thereby reducing siltation. Stabilizing banks may also help increase stream flow and actually decrease water temperatures. While establishing such grasses, care should be taken not to reduce existing shade cover (tree canopy) on the Guadalupe river.

There is a wealth of information available pertaining to trout stream habitat improvement. Enclosed is a list of references which you may find useful.

References

Butler, W. D. 1975. Brown trout stocking study. Federal Aid Project F-31-R-1. Texas Parks and Wildlife Department, Austin Texas. 14pp.

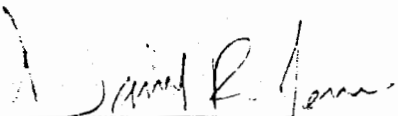
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Sincerely:



David R. Terre
Biologist III
San Marcos

enclosures

Najas L. WATER-NYMPH

Characters of the family.

The species in this genus, along with those in *Potamogeton*, are considered by knowledgeable wildlife personnel to provide the most important source of all foods for wildfowl, marshbirds and shorebirds. Ducks and other waterfowl not only eat the seeds but also the stems and leaves of most of the species. ~~The species are also considered to be good food producers for fish and to provide shelter.~~

- 1. Male and female flowers on different plants; leaves coarsely toothed; internodes and back of the leaf spiny.....1. *N. marina*.
- 1. Male and female flowers on same plant; leaves minutely denticulate; internodes and back of leaf unarmed (2)
- 2(1). Seeds dull, with distinct squarish pitted reticulations; leaves tapered for 2-3 mm. to an acute to obtuse apex.....2. *N. guadalupensis*.
- 2. Seeds apparently smooth and shining (but finely reticulate under magnification); leaves tapered from near middle to a long slender point.....
.....3. *N. flexilis*.

1. *Najas marina* L. HOLLY-LEAVED WATER-NYMPH. Fig. 50.

Plants brittle; stems branched, sometimes dichotomously so, armed with brownish spinulose teeth on the internodes; leaves linear, opposite to somewhat alternate, stiffish or recurved, to 45 mm. long and 3 mm. wide, with toothed margins and sometimes dorsally toothed on the midrib, the usually triangular teeth apiculate and 1 mm. long or more; basal leaf sheaths rounded, without teeth or rarely with a few short teeth; male and female flowers on different plants; staminate flowers 3-4 mm. long, the anther 4-celled; pistillate flowers 3-4 mm. long; stigmas 3, sometimes one shorter than the others; mature seeds ovoid, apparently tessellated in dried specimens, smooth when fresh.

In lakes and ponds, rare in s. Tex. and Ariz. (Mohave, Navajo, Pima, Santa Cruz and Yuma cos.), May-Sept.; from N.Y. to Calif., s. to Fla., Tex., Ariz., Mex. and Cuba; also Euras. and Austral.

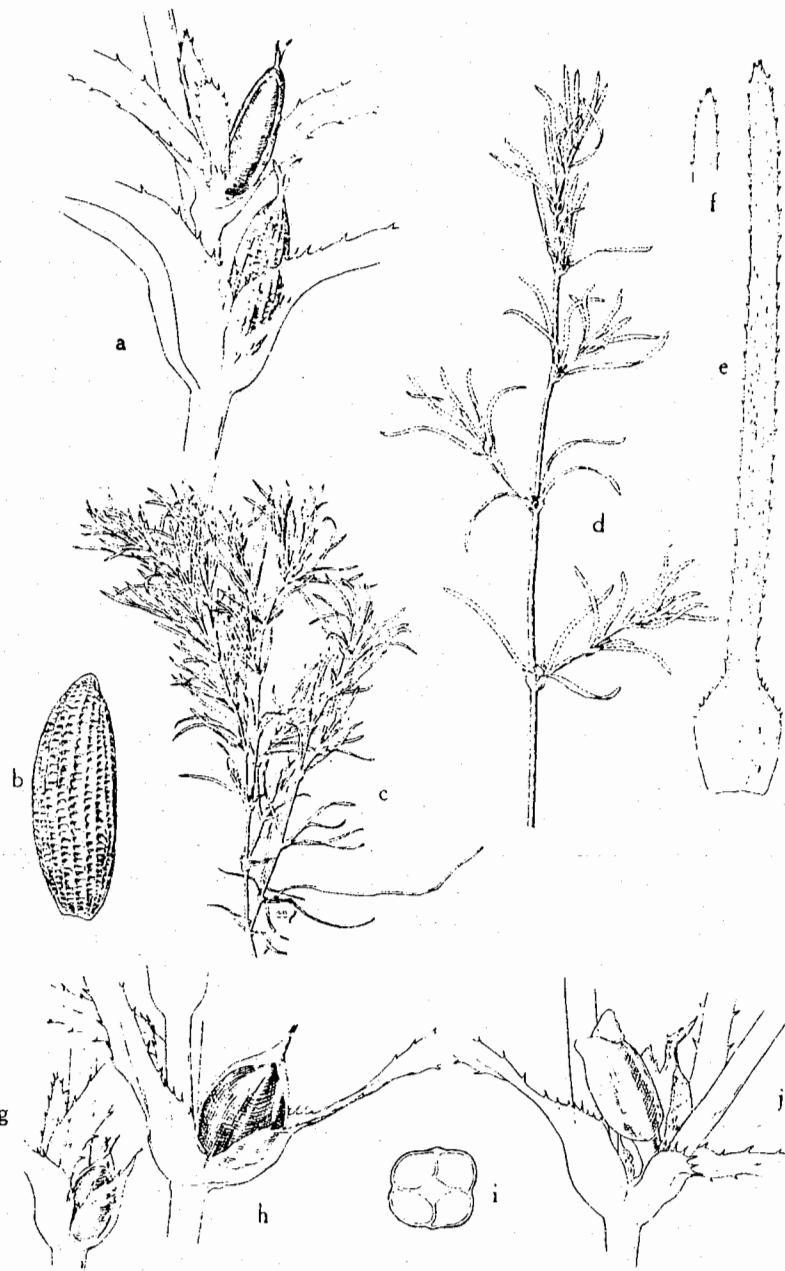
2. *Najas guadalupensis* (Spreng.) Magnus. WATER-NYMPH. Fig. 51.

Plants monoecious, flaccid; stems slender, branched, to about 6 dm. long; leaves all submerged, linear, to 25 mm. long and 2 mm. wide, tapered for 2-3 mm. to an acute to obtuse apex and usually tipped with 1 or 2 spines, the 20 to 40 marginal teeth inconspicuous or often apparently wanting; basal leaf sheaths sloping or rounded, not auriculate, spinulose; male and female flowers on same plant; staminate flowers 2-3 mm. long, the anthers 4-celled; pistillate flowers 2-3 mm. long; mature fruit crowned with 2 or 3 stigmas and usually with 1 or 2 spiny sterile stigmatic processes; seeds ellipsoid, dull, reticulate with numerous 4-sided areolae.

Attached to bottom and floating just below surface of water in ponds, lakes, springs, ditches and streams, in fresh or sometimes brackish water, often forming large mats, rather common throughout Tex. and Okla., rare in N.M. (Rio Arriba Co.) and Ariz. (Santa Cruz and Yavapai cos.), Apr.-Sept.; from Pa. w. to Ore., s. to Fla., Tex., N.M., Ariz., Mex., C.A., the W.I., Jam. and Guadeloupe.

3. *Najas flexilis* Rostkov. & Schmidt. SLENDER WATER-NYMPH. Fig. 52.

Plants monoecious; stems freely branched, slender, to 2 m. long; leaves narrowly linear, 1-3 cm. long, less than 1 mm. wide tapered from about the middle to a long slender point, thin and translucent, very minutely toothed, numerous and crowded on the upper parts of the branches, the teeth consisting of protrusions of usually 1 marginal cell; leaf sheaths with obliquely sloping shoulders, the margins bearing



Najas guadalupensis: a, young and mature pistillate flowers, borne singly in leaf-sheath axils, X 8; b, mature seed, dull but distinctly reticulate, X 16; c, habit, showing plant with threadlike crowded leaves, X $\frac{1}{2}$; d, habit, showing plant with less crowded leaves, X $1\frac{1}{2}$; e and f, leaf blade, showing marginal and apical teeth, X $6\frac{1}{2}$; g and h, young staminate flowers borne singly in leaf-sheath axils, the anthers still enveloped by the spathe, X 8; i, anther (cross section), X 12; j, mature anther at anthesis, showing ruptured spathe, X 8. (From Mason, Fig. 36).

not only from our region but from elsewhere, do not readily fall into either of these categories, although they have some characteristics attributed to one or the other of these plants. Although we would not be adverse to considering these plants as one complex entity, we have followed their traditional treatment as maintained by Fernald.

Fam. 15. Potamogetonaceae DUM. PONDWEED FAMILY

Aquatic herbs of fresh or sometimes brackish or alkaline water; leaves alternate or imperfectly opposite, those immersed thin, those above water often leathery, sheathing at the base, the sheath free or partially adnate to the petiole, flowers bisexual, small, arranged in pedunculate axillary spikes; peduncle surrounded by a sheath at the base; bracts absent; perianth comprised of 4 free rounded shortly clawed valvate segments; stamens 4, inserted on the claws of the segments; anthers extrorse, 2-celled, sessile; gynoecium of 4 sessile free 1-celled carpels; stigmas sessile or on short styles; ovule solitary, attached to the adaxial angle of the carpel, campylotropous; fruiting carpels sessile, free, 1-seeded, indehiscent, seeds without endosperm, the embryo with large "foot", the plumule enclosed by the cotyledon.

A family of two widespread genera, the following and *Greenlandia*.

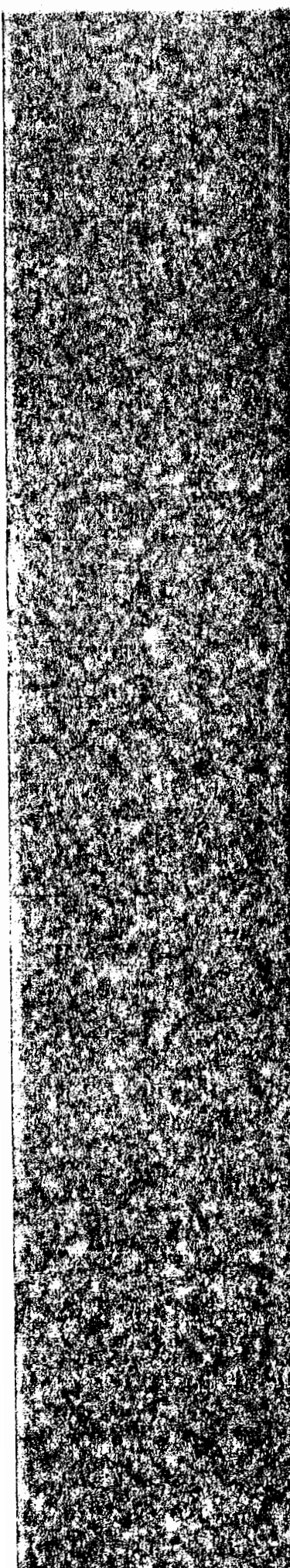
Potamogeton

Annual or perennial aquatic herbs propagated from seeds, winter-buds (hibernacula) or rhizomes; stems variable in length according to water depth, branched or unbranched, terete or flattened; leaves all submersed or with both submersed and floating blades; submersed leaves usually flaccid, sessile or petioled, linear or orbicular, acute to obtuse at apex, the margins entire to denticulate or serrate, the nerves 1 to 35; stipules fused to form a single structure with 2 midveins, arising from the axil of the stem and leaf, free or adnate to the leaf base, often sheathing the stem and sometimes with the outer margins partially fused (connate); floating leaves usually coriaceous, petioled, elliptic to ovate, euneate to rounded or cordate at base, the nerves 3 to 51, the margins entire, the stipules like those of submersed leaves but never adnate nor connate; peduncles about same diameter as stem, terete, sometimes clavate at tip; inflorescence a spike with 1 to 20 whorls of flowers, compact or moniliform, with 2 to 4 flowers in each whorl, mostly buoyed above the water surface; flowers bisexual, perianth of 4 free rounded short-clawed greenish segments; stamens 4; anthers sessile on the claws, 2-celled, extrorse; carpels 4, free, sessile; fruits dryish drupelets or achenes with spongy mesocarp and bony endocarp, one-seeded, embryo coiled, cotyledon one, endosperm absent.

A genus of 90 to 100 species found in all parts of the world, except the polar regions, but mostly in the North Temperate areas. Nearly 40 species occur in North America, all but one being indigenous; about half of these are widespread, common and often locally abundant.

Pondweeds are found primarily in shallow ponds, lakes and quiet waters of rivers and streams, and they are an important element in the ecology of such places. The achenes of all our species provide a favorite and important food for wildfowl. In addition, plant parts, especially of the more delicate species, are also eaten by wildfowl that include most waterfowl, marsh birds and shoreland. The plants are also commonly eaten by muskrats, beaver and deer. The most important species, mainly because of its tolerance to brackish water, its abundant seed production, and the edibility of its vegetative parts, is the sago pondweed (*P. pectinatus*). Most of the species provide food, shelter and shade for fish and minute animal life.

~~The sago pondweed is a common and important species that, in turn, provides food for fish.~~



beak linear, erect, to 1 mm. long; loop solid; apex of seed pointing a little above the basal end. *P. americanus* Cham. & Schlecht.

In streams and lakes throughout Okla. and Tex. to N. M. (Colfax, Sandoval and San Miguel cos.) and Ariz. (Coconino, Gila, Maricopa, Navajo and Yavapai cos.), mature fruits in late spring and summer; in much of the U. S., Can. and n. Mex.

***Potamogeton innocuus* Morong, Fig. 43.**

Rhizome buff, spotted or suffused with red; stem simple or branched, terete, 1-5 mm. in diameter; stele with the prototype, triotype or oblong-type pattern; endodermis of U-cells; interlacunar bundles in the outer interlacunar circle, sometimes a few in the next to the outer circle; subepidermal bundles present or absent; pseudohypodermis absent or of 1 cell thick; submersed leaves thin, elliptic to lanceolate, often somewhat arcuate; blades to 2 dm. long and 45 mm. wide, sessile or tapering into a petiole to 4 cm. long, acute and usually somewhat mucronate at apex; nerves 7 to 19; lacunae of 2 to 5 rows along midrib and larger nerves; margin entire or with fugacious 1-celled translucent denticles; floating leaves (often absent) more or less coriaceous, transition to submersed leaves usually gradual; blades elliptic to ovate-elliptic or oblong-elliptic, to 19 cm. long and 65 mm. wide, obtuse-mucronate at apex, cuneate or rounded at base; petioles 2-9 cm. long, shorter than the blade; nerves 13 to 29; lacunae of 2 or 3 rows of cells along midrib, sometimes obscure; stipules persistent, divergent and conspicuous, obtuse, those of the submersed leaves 1-8 cm. long and 3-12 mm. wide at base, prominently 2-keeled, with 15 to 35 finer nerves; those of the floating leaves broader; peduncles as thick as or thicker than the stem, 4-30 cm. long; spikes in anthesis compact, of 8 to 15 whorls of flowers, at maturity cylindric and crowded, 2.5-7 cm. long, 8-10 mm. thick; flowers sessile or on pedicels to 0.5 mm. long; perianth orbicular to oval, 1.3-3.2 mm. wide; anthers 0.6-2 mm. long; fruits obovate to orbicular or ovate, 2.5-3.6 mm. long (excluding beak), 2.1-3 mm. wide, the sides flat; keels prominent and acute, the dorsal strongly developed above and below, the laterals less strongly developed but often each with a projecting knob at the base; beak facial, short, erect or curved toward the back; exocarp gray-green to olive-green or brownish, sometimes reddish; endocarp with keels low but prominent or with dorsal keel thin and very weak; beak deltoid and weak, about 0.5 mm. long; loop solid; apex of seed pointing at the middle of the opposite side or between middle and base. *P. lucens* L., *P. angustifolius* Bercht. & Presl.

In quiet or flowering water of ponds, canals and rivers in s.-cen. Tex., especially on the Edwards Plateau and in the Guadalupe Mts., w. to N. M. (Eddy Co.) and Ariz. (Coconino Co.), fruiting by early May; throughout much of U.S. and Can.

A variable species due, in part, to habitat. Hybrids may occur between this species and *P. nodosus*, especially where the two are found together.

14. *Potamogeton gramineus* L. Fig. 44.

Plant from a mass of rhizomes; stems slender, occasionally fistulose, 2-15 dm. long; submersed leaves abundant, typically sessile (occasionally petioled), linear to lanceolate or oblanceolate, 3-12 cm. long, 1-15 mm. wide, acute and often with a short-attenuate tip, the stipules persistent; floating leaves on slender petioles, the blades ovate to elliptic, 1.5-7 cm. long, 1-3 cm. broad, usually shorter than petioles; stipules lanceolate, somewhat keeled, persistent, 5-30 mm. long; peduncles stout, 2-10 cm. long; spikes compact, 1-4 cm. long when mature; nutlets obovate, 1.5-3 mm. long, obscurely keeled, the beak somewhat recurved.

Ponds, lakes, marshes and sluggish streams in N.M. (San Juan and Sandoval cos.) and Ariz. (Coconino and Maricopa cos.), May-Sept.; Greenl. to Alas., s. to Pa., N. Y., Ill., Ia., N.M., Ariz. and Calif.; Euras.



Fig. 43: [REDACTED] a, habit, showing profusion of crowded leaves, conspicuous stipules and long stout peduncles, X $\frac{2}{5}$; b, part of flowering spike, X 4; c, achene, showing strong dorsal keel, smooth face and short beak, X 6; d, achene (longitudinal section), X 6. (From Mason, Fig. 20).

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14. Submersed leaves lanceolate to oblong; floating leaves mostly with fewer than 30 nerves (15)

15(14). Floating leaf blades usually cordate, rarely rounded at base, with 21 to 29 (sometimes more) veins; submersed leaves tapering rather abruptly to a sessile base or short petiole to 1.5 cm. long; mature fruit light-brown to olive-green, 3-3.5 mm. long.....10. *P. pulcher*.

15. Floating leaf blades cuneate or rounded at base, with 9 to 21 veins; submersed leaves tapering gradually to a petiole 2-13 cm. long; mature fruit usually reddish, 3.5-4 mm. long.....12. *P. nodosus*.

1. *Potamogeton latifolius* (Robbins) Morong. WESTERN PONDWEED. Fig. 31.

Rhizome creeping, rooting freely at the nodes; stem whitish, simple below, repeatedly branched above; stele of the one-bundled-type or oblong-type; endodermis of U-cells; interlacunar bundles present in the outer interlacunar circle; subepidermal bundles absent; pseudohypodermis absent or partly 1 cell thick; leaves all submersed, linear, entire, green to bronze, rather opaque, to 7 cm. long and 7 mm. wide, the apex obtuse to rounded or shortly apiculate to acutish on the upper leaves; nerves 3 to 5, with strong crossveins making a rectangular pattern; stipules prominent, 8-12 mm. long, adnate to the base of the leaf to form a broad sheath, hyaline along the margin, the free portion 1-4 mm. long; peduncles 2-25 cm. long; spikes with 4 to 6 whorls, contiguous when young but soon becoming moniliform; basal internodes 5-12 mm. long, the upper shorter, in fruit 2-4 cm. long; flowers sessile; perianth semiorbicular, slightly wider than long, to 5.2 mm. wide; anthers about 1.8 mm. long; fruits obliquely obovate, the sides convex but somewhat compressed, 3-4 mm. long, 2-4 mm. wide; dorsal keel obscure, lateral keels rounded; beak facial, slightly recurved, about 1 mm. long; exocarp olive-green to fulvous; endocarp loop solid or with a spongy area; apex of seed pointing above the basal end.

In quiet or flowing fresh or brackish water, in s.w. Tex. (Cameron, Pecos, Reeves and Val Verde cos.) and Ariz. (Mohave Co.), flowers and mature fruit from May to Sept.; rare in s.w. U.S.

2. *Potamogeton filiformis* Pers. Fig. 32.

Slender much-branched wholly submersed plant of brackish waters, with horizontal stolons bearing white tubers 1-2 cm. long; stipules adnate to leaf and sheathing the stem, the sheaths 0.4-2.2 cm. long, connate below, the tips free, scarious, 1-5 mm. long; leaves setaceous, to 12 cm. long, 0.2-0.5 mm. wide, blunt; peduncles filiform, flexuous, to 1 dm. long; spike moniliform, 1.5-5 cm. long, with 2 to 5 whorls, the upper whorls 3-12 mm. apart, the lower ones 0.7-2.5 cm. apart; connectives 0.5-1 mm. long; styles almost wanting; nutlets sessile, 2-2.7 mm. long, 1.5-2 mm. wide, rounded on back, the beak short, wartlike, nearly central.

Ponds, slow streams and ditches in N.M. (Rio Arriba Co.) and Ariz. (Pinal Co.), Apr.-Sept.; Greenl. to Alas., s. to Pa., Mich., N.M., Ariz. and Calif.; Euras., Afr. and Austral.

3. *Potamogeton peruvianus* L. SAGO PONDWEED. Fig. 33.

Rhizome creeping, much-branched, 1-1.5 mm. in diameter, bearing terminal tuberous bulbiets; stem terete or slightly compressed, about 1 mm. in diameter, mostly simple near base but abundantly branched near summit; stele with the oblong pattern or one-bundled in slender branches: endodermis of U-cells; interlacunar bundles present; subepidermal bundles present or absent; pseudohypodermis 1 or 2 cells thick; leaves all submersed, filiform to narrowly linear, entire, to 15 cm. long and 1 mm. wide, occasionally wider on robust forms, the apex tapering to a narrowly acute point (sometimes obtuse on young seedlings); nerves 1 to 3,

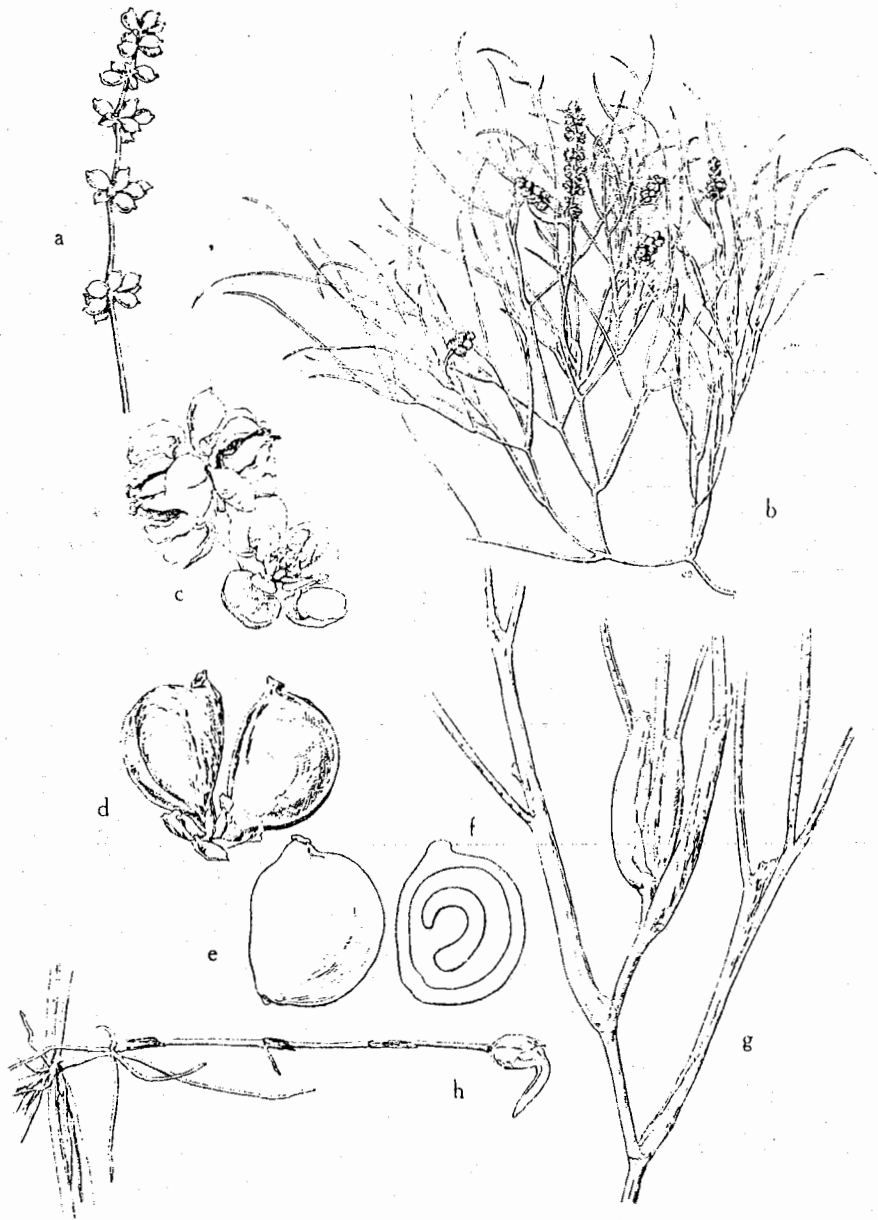


Fig. 32. *...* a, moniliform spike with mature achenes, X 1½; b, habit, showing slender branching stems and linear-filiform submersed leaves, arising from rhizome, X 2/3; c, upper flowers of spike, X 4; d and e, variation in achenes (usually obliquely ovoid, with a short wartlike beak), d, X 5½, e, X 5; f, achene (longitudinal section), X 5; g, stipules sheathing stem or loosely investing it and somewhat inflated, the linear leaf appearing to originate at the top of the sheath, X 3; h, rhizome with winter corm, X 1½. (From Mason, Fig. 14).

15. *Potamogeton natans* L. BROAD-LEAVED PONDWEED. Fig. 45.

Stems branching from a horizontal rhizome, otherwise usually simple: submersed leaves without blades, 1-3 dm. long, 0.8-2 mm. wide, rarely with a poorly developed blade, the linear stipules 6-8 cm. long; floating leaves broadly elliptic to oblong, often subcordate at base, broadly rounded at apex, 25- to 27-nerved, the petiole longer than blade, the stipules 5-12 cm. long, linear-lanceolate, membranous; spikes in the axils of floating leaves, 3-6 cm. long on stout peduncles, 1½ to 3 times as long as the spike; nutlets 3-5 mm. long, strongly keeled on the back, the lateral angles scarcely evident, the beak erect.

Marshy ponds and lakes, often brackish, in Okla. (Choctaw Co.), N. M. (San Juan and Sandoval cos.) and Ariz. (Apache and Coconino cos.), May-Sept.; Greenl. to Alas., s. to N. J., Pa., O., Ind., Ill., Ia., Neb., N.M., Ariz. and Calif.

A sterile specimen in the U. S. National Herbarium might possibly be *P. alpinus* Balbis. It was collected by R. O. Studhalter, etc. (53874) at Glacial Lake near Tres Ritos, Taos Co., New Mexico, at 9,500 ft. elevation. It is distinguished from *P. amplifolius*, which it superficially resembles, by its usually smaller, sessile, submersed leaves, more slender rhizome and usually reddish stems and peduncles. Its floating leaves, when present, are also delicate and thin with no sharp distinction between blade and petiole.

Fam. 16. Zannichelliaceae DUM. HORNED PONDWEED FAMILY

Submerged aquatic dioecious or monoecious herbs, with a slender creeping rhizome; leaves alternate or opposite or crowded at the nodes, linear, sheathing at the base, the sheaths mostly ligulate at the apex, the floral leaves sometimes reduced to sheaths; flowers minute, bisexual or unisexual, axillary, solitary or in cymes; perianth of 3 small free scales or absent; stamens 1 to 3, the anthers 1- or 2-celled and opening lengthwise; pollen globose or threadlike; gynoecium of 1 to 9 free carpels; style short or long, simple and with a capitate to peltate or spatulate stigma, sometimes 2- to 4-lobed; ovule solitary, pendulous; fruiting carpels sessile or stipitate, indehiscent; seed pendulous, without endosperm.

- Widely distributed, mainly in salt or brackish water; 3 genera and 6 species.
- 1. Pollen spheroid; carpels several, free; plants of fresh or brackish water; leaves filiform.....1. *Zannichellia*
- 1. Pollen threadlike; gynoecium 1- or 2-carpellate; plants of marine habitats (2)
- 2(1). Leaves flat, tridentate at apex; styles simple; one anther attached higher than the other.....2. *Halodule*
- 2. Leaves terete or semiterete, acute or pointed at apex; styles 2- to 4-lobed; anthers at an equal height.....3. *Cymodocea*

1. *Zannichellia* L. HORNED PONDWEED

A genus of two species, the other in Africa. Placed by some authors in the Najadaceae.

1. *Zannichellia palustris* L. COMMON POOLMAT. Fig. 46.

Submerged aquatic plant, monoecious, rooted on bottom and floating below surface of water; rhizome creeping; stem slender, simple or much-branched; leaves mostly opposite, linear-filiform, entire, to 1 dm. long, acute or almost pungent at the apex, 1-nerved; stipules scarious, free from the leaf bases, scarcely 2 cm. long; flowers unisexual, sessile, usually both kinds from the same axil, enclosed in a hyaline deciduous spathe, the perianth wanting; staminate flower consisting of



Fig. 29. — *Potamogeton heterophyllus*. a, achene (longitudinal section), X 6; b, flower, X 4; c, habit, showing the long linear submersed leaves and broadly elliptic floating leaves, and the linear-lanceolate stipules, X $\frac{2}{5}$; d, achene, showing strong keel on the back, X 6. (From Mason, Fig. 29).

TROUT Stream Habitat Improvement

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Proposed List of ~~Inhibited Aquatic Plants~~

- a) Giant Duckweed (Spirodela oligorhiza)
Family Lemnaceae
- b) Salvinia (Salvinia rotundifolia)
Family Salviniaceae
- c) Water Fern (Azolla caroliniana)
Family Salviniaceae
- d) Waterhyacinth (Eichhornia crassipes)
Family Pontederiaceae
- e) Waterlettuce (Pistia stratiotes)
Family Araceae
- f) Hydrilla (Hydrilla verticillata)
Family Hydrocharitaceae
- g) Egeria (Egeria densa)
Family Hydrocharitaceae
- h) Lagarosiphon (Lagarosiphon major)
Family Hydrocharitaceae
- i) Eurasian Watermilfoil (Myriophyllum spicatum)
Family Haloragaceae
- j) Alligatorweed (Alternanthera
philoxeroides)
Family Amaranthaceae
- k) Rooted Waterhyacinth (Eichhornia azurea)
Family Pontederiaceae
- l) Paperbark (Melaleuca quinquenervia)
Family Myrtaceae
- m) Torpedograss (Panicum repens)
Family Poaceae