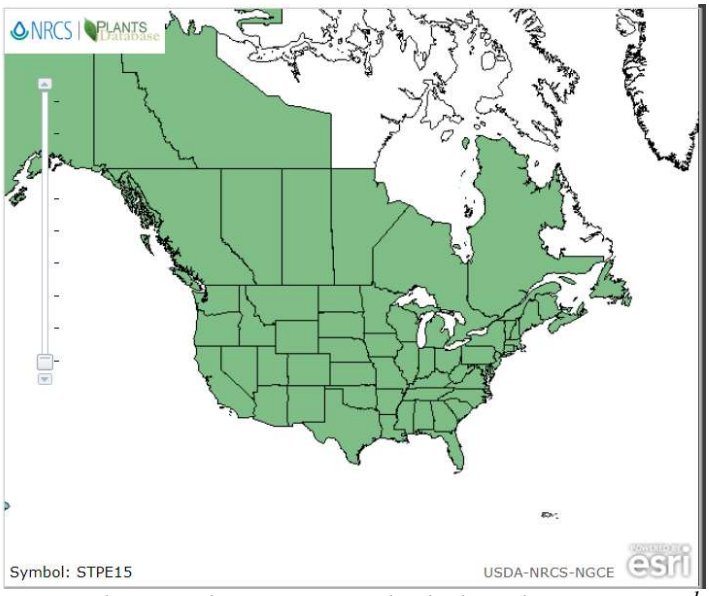
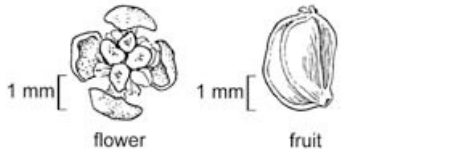
Plant Propagation Protocol for Stuckenia pectinata (L.) Böerner
ESRM 412 – Native Plant Production
Protocol URL: https://courses.washington.edu/esrm412/protocols/*STPE15.pdf*

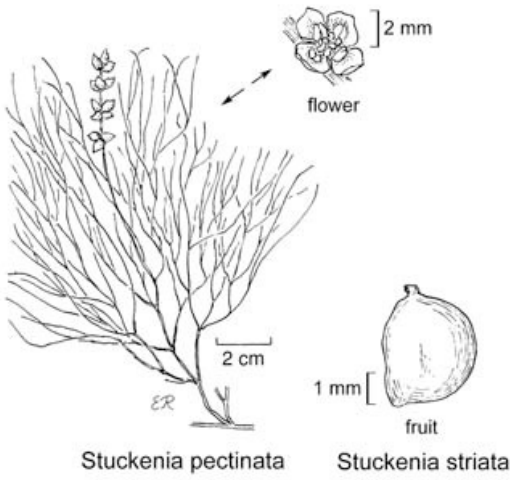


Map indicating locations in which this plant is native.[1]

Images of Sago Pondweed[4]



Stuckenia filiformis subsp. alpina



Sketch of plant, fruit, and flowers.[5]

TAXONOMY	
Plant Family	
Scientific Name	*Potamogetonaceae*
Common Name	Pondweed family
Species Scientific Name	
Scientific Name	*Stuckenia pectinate* (L.) Böerner
Varieties	
Sub-species	
Cultivar	
Common Synonym(s)	Previously known as: *Stuckenia pectinatus,* and *Potomogeton pectinatus*[2] *Coleogeton pectinatus*[2] *Potomogeton interruptus*[2] *Potomogeton latifolius*[2] *Potomogeton flabellatus*[2] *Potomogeton columbianus*[2]
Common Name(s)	Broadleaf pondweed Duck grass Eelgrass

	Fennel Pondweed Foxtail Indian grass Old-fashioned bay grass Pondgrass Potato moss Wild celery Fennel-leaved water milfoile[3] Poker grass Pochard grass String weed Sago false pondweed[4]
Species Code (as per USDA Plants database)	STPE15
GENERAL INFORMATION	
Geographical range	[please refer to image above] Specifically to WA, this plant can be found in the following counties: Wahkiakum, Skamania, Klickitat, King, Snohomish, Skagit, Whatcom, Okanogan, Chelan, Douglas, Grant, Ferry, Stevens, Spokane, Whitman, Adams, and Walla Walla[1] Commonly found throughout North America and Eurasia[7]
Ecological distribution	Can be found in shallow to moderately deep bodies of water that are permanent[*2] Sago can quickly inhabit newly flooded areas and invade shallow waters that have relatively strong wave actions[3] Commonly found in ponds, lakes, marshes and streams[5] *permanency here is determined by locations in which water is absent for not more than 3 months
Climate and elevation range	15 to 7185 ft[6] Annual precipitations: 14-67in[6] Typically found in bodies of water less than 2.5m deep[2] Can be found in locations from sea level up to 4,900 m above sea level[2]
Local habitat and abundance	Found in submerged, floating-leaved, and emergent communities[3] Often confused with *Potamogeton filiformis* Pers (Slender-leaved pondweed) and *Potamogeton vaginatus* Turcz (Sheathing pondweed) as they look similar upon brief inspection. These plants must be examined at the sheaths, flowers, and fruits in order to distinguish them.[8] *Ruppia maritima* (widgeongrass) has similar shape of leaves. However, the sheath is observed to be completely fused to the leaf and have different shaped fruits.[8]
Plant strategy type / successional stage	Sago is tolerant of a wide range of conditions: brackish, alkaline or nutrient-rich water[8] Tolerates strong waves and currents due to its long roots and rhizomes[9]

	Less abundant in higher rainfall and lower salinities (specifically for fresh bodies of water)[9] Tolerates high pH, high salinity, but does not grow well in waters with high turbidity[2] Sensitive to frost damage[3]
Plant characteristics	Long, thread-like leaves that spread out in a fan.[9] With leaves submerged underwater.[4] This aquatic plant is a herbaceous perennial[7] that emerges from slender rhizomes. The stems grow up to 4 dm long, branching dichotomously for a majority of its length and are often described as thread-like branches.[7, 8] Average descriptions of leaves for Sago pondweed: 2-15 cm in length with 1mm width.[8] Leaves have pointed tips with 1-3 veins.[8] Sago pondweed flowers with 2-7 whorls in spikes (1-3 cm long) and are usually found floating horizontally just beneath the water.[8] Sago fruit is 3-5mm long, plump, rounded, and become reddish-brown in color when ripened.[8] The long, straight roots have thin rhizomes.[9] Distinct characteristics of sago pondweed is bushy clusters of leaves that grow alternately on the stem, and have white bayonets at the base of the leaves.[9] Sago pondweed predators are migratory waterfowl, who feed on the entire plant due to the seeds and tubers being rich in nutrients.[9] Possible pests are bacteria and fungi, which cause diseases. Potentially responsible for declining sago population or deformities in the plant.[2] Sago pondweed is also considered to be a noxious weed, specifically for recreational purposes and irrigation.[2]
PROPAGATION DETAILS	
Ecotype	Sago pondweed collected Delta Marsh, Manitoba[10]
Propagation Goal	Plants
Propagation Method	Vegetative: Starchy tubers[11] *can also be propagated via seed, but a majority is vegetatively from starchy tubers [11]
Product Type	Propagules
Stock Type	
Time to Grow	For Druplets: 14 months[2] For tubers: 2-12 months[6]
Target Specifications	For turion to develop several shoots and rhizomes (one study averaged 11 shoots and 2 rhizomes per plant)[3]
Propagule Collection Instructions	Storage of turions is up to four years if diffed in paraffin.[2] Can also be stored in low temperature water, or packed in layers of strew or moss.[2] Turions can survive up to a year in exposed mud.[3]

Propagule Processing/Propagule Characteristics	Solid, scaly, and carbohydrate-rich vegetative propagules.[3]
Pre-Planting Propagule Treatments	Turions can be either dormant or non-dromant.[3] The dormant propagules are called hibernaculae, requiring preconditioning controlled via light and temperature prior to germination.[3]
Growing Area Preparation / Annual Practices for Perennial Crops	If conducting green house growth: utilize liquid media.[2] If growing in house, utilize vessels of stoneware, wood, plastic, fiberglass, or glass.[3] Liquid media of choice can either be natural (collected water) or artificially compounded liquid media with bottom substrates.[3] Tap water and garden soil can also be used.[3] Typically does not need to be outplanted as they will naturally propagate.
Establishment Phase Details	Turions, consisting of two internodes, peak in development in late summer/early fall. Most sago reproduces naturally through turions that simultaneously develop extensive rhizomes while sending up shoots.[3] Through the rhizomes, leafy shoots can be produced.
Length of Establishment Phase	Maximum germination and growth of turions occurs at specific temperature range of 15-26C.[3] Cold preconditioning is required for good germination.[3] Typically takes up to 24 days to grow – the study concluded showed that 8.8 leaves per plant was grown with 4.9 roots per plant.[3]
Active Growth Phase	Within 30 days, a turion can develop up to 11 shoots and 2 rhizome.[3] Turion carbohydrate reserves are depleted after 3 weeks.[3] However, turions can also continue to grow for several years.[3]
Length of Active Growth Phase	Turions can vary between 10 to 110 days in culture to germinate.*[3] *this is dependent on the age of the turion. The younger it is, the less time it takes to germinate.
Hardening Phase	Unknown
Length of Hardening Phase	Growth occurs until early Fall, as plants act as perennials, going dormant for the winter.[2, 3]
Harvesting, Storage and Shipping	Not applicable
Length of Storage	Not applicable as propagules are often produced at the outplanting sight.
Guidelines for Outplanting / Performance on Typical Sites	Not applicable. No details found in studies, as studies done were comparing artificial liquid growth to those growing in their natural environment.
Other Comments	If propagating from druplets: store the druplets in wet or dry conditions. To break dormancy, place them in water at temps just above freezing. It have been studied and illustrated that germination is best when the druplets are dried for three months, ripening them for

	14 months, and then placing them in tap water at room temp before placing them in freshwater.[2]
INFORMATION SOURCES	
References	1. (n.d.). Retrieved May 27, 2020, from https://plants.sc.egov.usda.gov/core/profile?symbol=CAPE10 2. Plant Guide for Sago Pondweed (Stuckenia pectinata (L) Boerner. (n.d.). Retrieved May 27, 2020, from https://plants.usda.gov/plantguide/pdf/pg_stpe15.pdf 3. Kantrud, H. A. (1990). *Sago pondweed (Potamogeton pectinatus L.): a literature review*. Washington, D.C.: United States Department of the Interior, Fish and Wildlife Service. 4. Stuckenia pectinata (L.) Boerner. (n.d.). Retrieved May 27, 2020, from https://gobotany.nativeplanttrust.org/species/stuckenia/pectinata/ 5. (n.d.). Retrieved May 27, 2020, from https://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=80427 6. Plant Characteristics and Associations. (n.d.). Retrieved May 27, 2020, from https://www.calflora.org/entry/plantchar.html?crn=2 7. Burke Herbarium Image Collection. (n.d.). Retrieved May 27, 2020, from http://biology.burke.washington.edu/herbarium /imagecollection/taxon.php?Genus=Stuckenia&Species=pectinate 8. Potamogeton pectinatus (sago pondweed) and Potamogeton filiformis (slender-leaved pondweed) and Potamogeton vaginatus (sheathing pondweed): Aquatic Plant Identification Manual for Washington's Freshwater Plants: Washington State Department of Ecology. (n.d.). Retrieved May 27, 2020, from https://fortress.wa.gov/ecy/gisresources/lakes/AquaticPlantGuide /descriptions/potpec.html 9. Sago Pondweed. (n.d.). Retrieved May 27, 2020, from https://www.chesapeakebay.net/S=0/fieldguide/critter/sago_pondweed 10. Anderson, M. G. (1978). Distribution and Production of Sago Pondweed (Potamogeton Pectinatus L.) on a Northern Prairie Marsh. *Ecology*, *59*(1), 154–160. doi: 10.2307/1936642 11. Anderson, M. G. (1978). Distribution and Production of Sago Pondweed (Potamogeton Pectinatus L.) on a Northern Prairie Marsh. *Ecology*, *59*(1), 154–160. doi: 10.2307/1936642
Other Sources Consulted	
Protocol Author	Erika Allen
Date Protocol Created or Updated	05-27-2020