PURPLE LOOSESTRIFE CONTROL EFFORTS OF THE GREAT LAKES INDIAN FISH AND WILDLIFE COMMISSION 1988 - 1989

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Administrative Report 89 - 13
December 1989

GREAT LAKES INDIAN FISH
& WILDLIFE COMMISSION
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INTRODUCTION

The purpose of this report is to present the results of 2 years of purple loosestrife (Lythrum salicaria) control and experimental work conducted in Fish Creek Sloughs, to recommend a specific loosestrife control strategy in Fish Creek Sloughs and to develop a general loosestrife control strategy for implementation in northern Wisconsin.

Purple loosestrife is an exotic perennial plant which was introduced from Europe in the early 1800's and was established along the eastern seaboard by the 1830's (Thompson et al. 1987). Loosestrife is well adapted to its new environment, and it spread rapidly westward along canals and waterways. It is an aggressive plant which out-competes all other vegetation in wetlands and, if left untreated, will eventually completely dominate any wetland area. Although specific, quantifiable data is lacking, there can be no doubt that loosestrife infestations in wetland ecosystems can cause serious ecological damage. Thompson et al. (1987) state that "the replacement of native wetland plant community by a monospecific stand of an exotic weed does not need a refined assessment to demonstrate that an ecological disaster has occurred".

Wetlands remain vestiges of some of the only undisturbed ecosystems containing the native composition of flora and fauna left on the continent. These habitats are being rapidly degraded and lost through filling for agriculture and development throughout North America. Their protection is essential.

As early as 1959 loosestrife was observed to degrade the quality of water bird production sites (McKeon 1959) and to reduce the quantity of desirable wetland food plants (Smith 1959). Rawinski and Malecki (1984) concluded that serious ecological consequences appear to result from purple loosestrife colonization of wetlands. These authors cite loss of open water, loss of mud flats for foraging shore birds and a reduction in the quantity of valuable wildlife food plants as observed consequences.

The first record of loosestrife in Wisconsin was in 1940 (Stuckey 1980). By 1985 loosestrife had been established throughout Wisconsin and was on its way to colonizing the arid western U.S. (Thompson et al. 1987). In 1985 there were

approximately 1700 known populations of loosestrife in Wisconsin (Lets Lose Loosestrife 1986). Most of the larger, well developed stands were located in the southern portion of the state, but in 1989 loosestrife continues its spread northward.

Recognizing the adverse impact that purple loosestrife has on wetland ecosystems, the Wisconsin Legislature designated all members of the genus Lythrum as nuisance weeds (AB 141, 1987). This legislation prohibits the sale or cultivation of loosestrife and mandates that the Wisconsin Department of Natural Resources (WDNR) make reasonable efforts to implement control methods on public lands as soon as practicable. In addition, AB 141 calls for research to determine alternative methods to contain and control loosestrife in the most ecologically sound manner. Finally, the legislation suggests that WDNR conduct a pilot project using employees or other persons to engage in labor intensive efforts to control loosestrife on all public lands.

To be consistent with the mandates of AB 141, and because of the importance in effectuating loosestrife control in northwestern Wisconsin before control becomes impossible, the Great Lakes Indian Fish and Wildlife Commission undertook a pilot project which attempted to research and implement an effective loosestrife control program in Fish Creek Sloughs in Ashland and Bayfield Counties.

FISH CREEK SLOUGHS EFFORTS

Study Area

The Fish Creek Sloughs is located on the border of Ashland and Bayfield Counties at the extreme southern end of the Chequamegon Bay of Lake Superior. The 835 acre Sloughs supports and provides spawning habitat for many species of fish, some of which are highly sought after by state and tribal fishermen. For this reason the Sloughs is designated as a fishery management area by WDNR.

The Fish Creek Sloughs is home to numerous mammals and reptiles and is of particular value to bird life. It is a nesting area for native wetland birds and provides a rest stop for migrating shorebirds and waterfowl.

Loosestrife is scattered throughout the Sloughs area but is most heavily concentrated south of the Long Bridge near the wooded areas along the south end and along the western border of the Sloughs and in the cove just north of the Long Bridge (Fig. 1). The area of the Terwilliger Creek inlet has a new concentration of loosestrife first observed in 1989. No loosestrife is found in the area south of Short Bridge but

a small population was observed on the highway shoulder near Short Bridge.

Methods

The effectiveness of two control techniques was investigated in 1988 and 1989 through the establishment of 3 pairs of experimental plots. Each plot was located along a waterway south of Long Bridge. The plots were 5 meters by 8 meters with the long side aligned parallel to the waterway. The plots were located in loosestrife stands which were visually observed to be moderately dense with seedlings, single stemmed plants and plants with multiple stems present. Each plot was marked with permanent markers for easy location during the following years.

One plot of each pair was treated with the a 20% concentrated mixture of the herbicide Rodeo (tm) using a sponge bottle applicator on plant stem cross sections. The other plot of each pair was treated with the hand pull or digging technique. All plants in both plots were treated.

The number of plants and the number of stems per plant were counted in each plot and the time required to treat or pull the loosestrife was measured. The time required to remove the hand pulled plants and the tops of cut plants from the wetland and to dispose of these plants was not recorded and, thus, the control time statistic is underestimated.

The year following treatment each plot was revisited to determine the extent of loosestrife survival and recolonization. All seedlings were counted separate from mature plants. Mature plants were those that had multiple stems per plant or single stemmed plants which were flowering near the end of July.

Results

The number of plants in each plot, before treatment, ranged from 13 to 62 or from 0.33 plants/m^2 to 1.55 plants/m^2 (Table 1). The number of stems per plant ranged from 6.4 to 16.7 which yielded a range of 200 to 800 stems per plot. This provided a situation where control techniques could be evaluated through a range of plant and stem densities.

Table 1. Loosestrife abundance and control times required for hand pulling and herbicide treatment techniques on three experimental sites in Fish Creek Sloughs, 1988.

Plot	No. of Plants	Plant Density	No. of Stems	Mean Stems per Plant	Stem Density	Control Time
1A	42	1.05 p/m^2	702	16.71 s/p	17.55 s/m^2	0.18 min/stem
1B	62	1.55 p/m^2	397	6.40 s/p	9.93 s/m^2	0.19 min/stem
2A	33	0.83 p/m^2	213	6.45 s/p	5.33 s/m^2	0.14 min/stem
2B	56	1.40 p/m^2	801	14.3 s/p	20.0 s/m^2	0.15 min/stem
3A	25	0.63 p/m^2	214	8.56 s/p	5.35 s/m^2	0.16 min/stem
3B	13	0.33 p/m^2	201	15.5 s/p	5.03 s/m^2	0.16 min/stem

Plot A of each pair was controlled with hand pulling.
Plot B of each pair was treated with herbicide.

Although the time required to treat each plot varied widely, when the time was standardized on a per stem basis it ranged only from 0.14 to 0.19 minutes/stem. There was little difference between plots A and B in any treatment pair in terms of control time per stem treated.

If the time required to remove and dispose of hand pulled loosestrife and the tops of cut loosestrife was added to the control time it would increase the time required to treat the hand controlled plot substantially, while not greatly increasing the time required to treat the herbicide plot to any great extent. Whether that time increase would create a significant difference in treatment time cannot be determined.

The density of loosestrife in the test plots in 1989, 1 year after treatment, ranged from 0 plants/m^2 to 1.4 plants/m^2 (Table 2). An estimate of seedling numbers was made as well in 1989 and results show that the number of seedlings ranged from 0 to 200 seedlings per plot. Most of the seedlings were located at the high water mark at the edge of the plots. Those plot pairs which had exposed, sandy soil along the water's edge (i.e. plots 1a, 1b and 3a) tended to have more seedlings present than those plot pairs with little exposed soil.

Table 2. Loosestrife abundance in experimental sites of Fish Creek Sloughs 1 year after treatment, 1989.

Plot	No. of Seedlings	Seedling Density	No. of Mature Plants	Mature Plant Density
1A	200	5.0 p/m^2	56	1.4 p/m^2
1B	100	2.5 p/m^2	50	1.25 p/m^2
2A	10	0.25 p/m^2	9	0.23 p/m^2
2B	25	0.63 p/m^2	33	0.83 p/m^2
3A	50	1.25 p/m^2	0	0 p/m^2
3B	0	0 p/m^2	0	0 p/m^2

Control efforts reduced the density of mature loosestrife plants in all plots except plot 1B where plant density was high and digging was the control technique. Where plant density had been high (density > 1 p/m^2) and the control technique was chemical applications, plant density was reduced. Where plant densities were low (density < 0.5 p/m^2) or moderate (density > 0.5 p/m^2 and < 1.0 p/m^2) both control techniques reduced overall mature plant density.

Table 3. Comparison of pretreatment mature plant densities with post-treatment seedling and mature plant densities in 3 experimental site in Fish Creek Sloughs, 1988 - 1989.

Plot	Pretreatment Plant Density	Post-treatment Seedling Density	Post-treatment Plant Density
1A	1.05 p/m^2	5.0 s/m^2	1.4 p/m^2
1B	1.55 p/m^2	2.5 s/m^2	1.25 p/m^2
2A	0.83 p/m^2	0.25 s/m^2	0.23 p/m^2
2B	1.40 p/m^2	0.63 s/m^2	0.83 p/m^2
3A	0.63 p/m^2	1.25 s/m^2	0 p/m^2
3B	0.33 p/m^2	0 s/m^2	0 p/m^2

The abundance of seedlings in each plot in 1989 did not appear to follow any pattern of mature plant density or treatment technique. Plots with exposed soils at the high water mark tended to have greater seedling abundance in 1989 than plots with little exposed soil.

Conclusion

Digging or hand pulling should not be conducted in areas of loosestrife density greater than 1 plant/m^2 as this technique in dense stands may increase the mature plant density. It is likely that when dense stands are subjected to digging or hand pulling roots are broken and pieces of these roots remain in the ground ready to resprout the following year. Dense stands should be treated with chemical herbicide.

Either digging or treating with herbicide can effectively reduce plant density in low or moderately dense loosestrife stands, although the time required to remove hand pulled plants from the wetland may reduce the efficiency of this technique in moderately dense stands. Seedlings should be hand pulled because of the proliferation of seedlings and the inefficiency of treating these plants with sponge bottle applicators.

Department of Transportation Activities

In the spring of 1989 the Wisconsin Department of Transportation (DOT) approached GLIFWC to implement a cooperative control project within the DOT right-of-way along US Highway 2 through Fish Creek Sloughs.

The cooperative agreement called for 3 weeks of labor by a 3 person team to hand pull and chemically treat loosestrife within the highway right-of-way. Young plants (i.e. seedlings and plants less than 3 years old) were hand pulled and removed from the Sloughs. Mature plants (those older than 3 years) were treated with a concentrated solution of Rodeo(tm) using a sponge bottle applicator.

A total of 10 acres of right-of-way was treated, although loosestrife was scattered intermittently throughout the right-of-way. Most of the work occurred in the immediate vicinity of Long Bridge. A dense stand of 1 - 2 acres along the west bank north of Long Bridge was chemically treated. The shoreline and sand bars along this bank was subjected to intensive hand pulling. All loosestrife was eliminated from this site. Effectiveness of this control effort will be evaluated in the summer of 1990.

Work progressed east from Long Bridge with chemical applications only. All mature loosestrife plants growing in the right-of-way from Long Bridge east to Short Bridge were treated.

Chemically treated areas were revisited 2 - 3 weeks after treatment. All treated plants appeared to have been killed. Stems were brown and leaves were falling. In some of the more dense stands of treated loosestrife bare ground was apparent. The dense loosestrife was the only vegetation in the area and, once killed, no vegetation was left.

In other areas where loosestrife plants were growing in dense stands of herbaceous vegetation, the herbicide appeared to have killed those plants growing in the area immediately surrounding the loosestrife causing a burn-out circle. After reviewing application procedures with loosestrife control workers, it was apparent that not enough care was taken to

separate the loosestrife plant from the native vegetation. Either more care should be taken when applying herbicide or an herbicide specific to dicots should be used in this situation in the future.

There were several areas which contained a large number of loosestrife seedlings. Chemical treatment of these areas was impossible using a low impact method such as a sponge applicator. Hand pulling was used in this instance. Because the plants were young and growing in sand they were easily pulled and it appears as if control was highly successful.

Control efforts in the DOT right-of-way through Fish Creek Sloughs were generally effective. Mature plants which were chemically treated were killed. Hand pulled areas were effectively cleared of loosestrife. We must wait until 1990 to evaluate the extent of recolonization of controlled areas, especially in the areas of exposed soils.

Based on the amount of loosestrife removed in 1989 with $2600.00 provided by DOT (see Appendix A.) and the amount of loosestrife remaining to control, it would require $8,000.00/year for 5 years to effectively eliminate the threat of loosestrife domination of Fish Creek Sloughs.

Wisconsin Conservation Corps Efforts in Fish Creek Sloughs

The Wisconsin Conservation Corps (WCC) has been a major contributor in the purple loosestrife control efforts in Fish Creek Sloughs. In 1988 a total of 28 WCC crew members contributed 224 person hours of labor to purple loosestrife control. In 1989, 36 crew members contributed 328 hours of loosestrife control. The total two year loosestrife control commitment by WCC in Fish Creek Sloughs has been 552 person hours of work.

Because of WCC policy which prohibits the use of pesticides by WCC crews, their contribution has been in hand pulling and digging. In 1988 crews were assigned to dense stands of mature plants and instructed to dig them out and remove the plants from the wetland. This proved to be a time consuming and extremely arduous task.

In 1989 crews were assigned to areas of younger plants with the same instructions to dig and remove plants. This proved to be a much more effective use of their time. A larger area was treated and, based on test plot results, this type of treatment was much more effective in reducing plant density than digging of mature plants.

PROPOSED LOOSESTRIFE CONTROL STRATEGY FOR FISH CREEK SLOUGHS

The abundance of purple loosestrife must be reduced in Fish Creek Sloughs. The direct threat of loosestrife dominance in the Sloughs is to the displacement and elimination of a native wetland community and reduced value of the Sloughs to plants, fish, birds and other wildlife species. The elimination of a native wetland community in Fish Creek Sloughs would severely impact the availability of high quality habitat to many migratory and non migratory species.

However, in addition to the loss of the Fish Creek Sloughs itself, loosestrife domination of Fish Creek would also threaten other wetlands in the Chequamegon Bay area and some islands of the Apostle Islands National Lakeshore.

Kakagon Sloughs, located at the northeast end of Chequamegon Bay is the largest, most undisturbed wetland on the south shore of Lake Superior and is listed on the National Registry of Natural Areas. It contains the largest bed of wild rice on Lake Superior, and possibly the largest bed in the State of Wisconsin. It is home to numerous wetland bird species and is a major stopping point for migratory birds. The loosestrife and its seeds in Fish Creek Sloughs are a direct threat to this pristine wetland.

The seeds from Fish Creek Sloughs loosestrife population also have the ability to reach, and colonize, areas on the Apostle Islands National Lakeshore. Some purple loosestrife has been found on the south side of Long Island, which serves as the barrier between Chequamegon Bay and Lake Superior.

Purple loosestrife in Fish Creek Sloughs comprises 5 - 10 percent of the vegetative cover of this wetland. Thompsom Thompsom (1987) presents data from the Montezuma National Wildlife Refuge which indicates that after loosestrife represents more than 10 - 20 percent of the plant biomass in an area complete dominance of that area by loosestrife occurs very rapidly, within 10 years. There is very little time to counter the loosestrife threat in Fish Creek Sloughs, but there is some time.

The strategy which should be adopted in Fish Creek Sloughs is the three C's strategy, containment, control and cleanup.

The first phase of this strategy is containment. The spread of loosestrife throughout the Sloughs should be halted. This would involve the control of loosestrife where it has yet to be established in large multi-plant stands. Mostly seedlings and younger plants (less than 3 years old) would be removed in this stage. Some of the exposed sand bars and the high water levels of the waterways would be

subjected to containment work. Most, if not all, of the containment activities would be hand pulling, digging or raking of loosestrife. No chemical applications of herbicides would be used in this phase. This work would take place on the fringe of the area occupied by loosestrife.

The second phase of this strategy is control of established stands of loosestrife. This phase would target loosestrife stands which have been established and are comprised of many mature plants which form a solid stand of loosestrife. This control effort would take place in the vicinity of Long Bridge, in the cove north of Highway 2, along the southern and western edge of the Sloughs near the hardwood stands and in some scattered pockets closer to Long Bridge. This control effort would require the application of herbicide to the loosestrife.

Herbicide, preferably a dicot specific chemical, would be applied in a low impact manner using a sponge bottle applicator. Mature plants would be cut just below the flowers and the concentrated solution of the herbicide applied to the cross section of the exposed stems. This is the technique which has the least effect on the surrounding vegetation if performed properly.

The third phase of this strategy is the clean-up phase. After containment and control is completed there will remain a substantial supply of seeds present capable of recolonizing the area. The clean-up phase will involve a continued effort of hand pulling seedlings which will undoubtedly germinate after the control phase. In this phase a crew of workers would survey the Sloughs annually, identify areas of recolonization and remove these young plants. In addition to this seedling removal, scattered mature plants which will have escaped detection should be removed before they form a dense stand of mature plants.

Purple loosestrife will never be completely eliminated from Fish Creek Sloughs and that is not the intent of this control strategy. Rather the intent is to eliminate the possibility of complete dominance of loosestrife in that ecosystem. There is certainly no danger of a few scattered loosestrife plants present in Fish Creek Sloughs, this would only add to the diversity of the system, and is desirable. The dominance of loosestrife in the Sloughs, however, would reduce and eventually eliminate the diversity of the system and this would be undesirable.

PROPOSED PURPLE LOOSESTRIFE CONTROL STRATEGY FOR NORTHERN WISCONSIN

There is no doubt that the elimination or even substantial reduction in loosestrife populations in the State of Wisconsin is impossible. Even a significant reduction in the distribution and abundance of loosestrife in northern Wisconsin is unlikely. However, some advances are possible if they are well thought out and properly planned.

The first step in the planning of a loosestrife control strategy is to identify and prioritize target loosestrife populations for control efforts. Since it is time consuming and expensive to effectuate a control program, high priority areas should be considered first.

Loosestrife grows under a wide range of environmental conditions. It can thrive in road side ditches, old fields, along stream and river banks and in wetland areas. When considering the prioritization of control areas, the factors which should be included in such considerations are: the uniqueness of the ecosystem, the threat loosestrife poses to the proper functioning and integrity of the ecosystem and the chances of success of the control program.

Purple loosestrife grows in a wide array of environments, not all of which necessitate control, if evaluated by the above criteria. Certainly old fields and roadside ditches are not what one would consider as unique ecosystems. In addition, these areas are already replete with exotic, introduced species. Loosestrife does not appear capable of completely dominating, to the exclusion of all other vegetation, these less critical habitats.

Wetlands, on the other hand, are a theatend habitat. Wetlands are being lost due to drainage and filling at an alarming rate throughout the continent. These unique and valuable ecosystems provide numerous benefits to the natural environment. They act as filters for clean water, provide food and cover to numerous species, including game, non-game and rare species and the wetlands which continue to exist are the last of the continents relatively undisturbed ecosystems.

Purple loosestrife has the capability of turning a diverse, healthy, properly functioning wetland into a nearly monotypic stand, with almost a complete loss of diversity and hence stability. Even if loosestrife provided valuable food and cover to plants, wildlife and fish species the conversion of a diverse wetland into a monospecific stand would be undesirable ecologically.

Wetlands are unique and diminishing ecosystems in North America. Purple loosestrife threatens the composition, stability and proper functioning of these sensitive areas.

It is for these reasons that loosestrife control must be concentrated in the wetland types.

Not all wetlands are suitable loosestrife control areas. Those wetlands in which loosestrife dominates the vegetative biomass are beyond help, given our very limited knowledge of effective control techniques. When evaluating a wetland as to its suitability as a loosestrife control area the percent of the plant biomass composed of loosestrife must be estimated. Those areas with greater than 20% loosestrife should not be considered, based on the information presented by Thompson et al. (1987) indicating that loosestrife domination of an area occurs just a few years after it reaches 20% of the plant biomass of that area. At this point an enormous seed bank has been established and loosestrife is on the verge of exponential expansion throughout the wetland. There is very little anyone can do to prevent this from occurring.

Once wetlands are identified as suitable for loosestrife control the "Three C" procedures outlined for Fish Creek Sloughs should be employed to reduce the loosestrife threat to those wetlands.

CONCLUSIONS

The presence of loosestrife in northern Wisconsin represents a threat to the integrity and proper functioning of wetland ecosystems in the region. The U.S. Fish and Wildlife Service has adopted a policy which calls for no net loss of wetlands. This policy is particularly aimed at the filling of wetlands for development and drainage of wetlands for agriculture. However, the displacement of the native flora and fauna in a wetland by loosestrife colonization can be just a detrimental to the wetland as the placing of fill into the wetland.

The complete elimination of purple loosestrife from the State of Wisconsin is impossible. It is possible to stop its advance and prevent the damage from becoming worse, especially in the northern part of the state. By identifying priority wetlands for control and by carefully planning control efforts it is possible to stop the spread of this exotic plant before it reaches the uncontrollable, epidemic proportions found on the east coast. It is hoped that this document will assist in that effort.

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Appendix A. Cost break down of expenditures encurred during the DOT sponsored work on U.S. Highway 2 right-of-way through Fish Creek Sloughs, 1989.

Wages	-	$1,837.50
Fringe Benefits	-	$ 234.84
Vehicle Mileage and boat costs	-	$ 194.11
Supplies	-	$ 216.79
Total Costs	-	$2,483.24

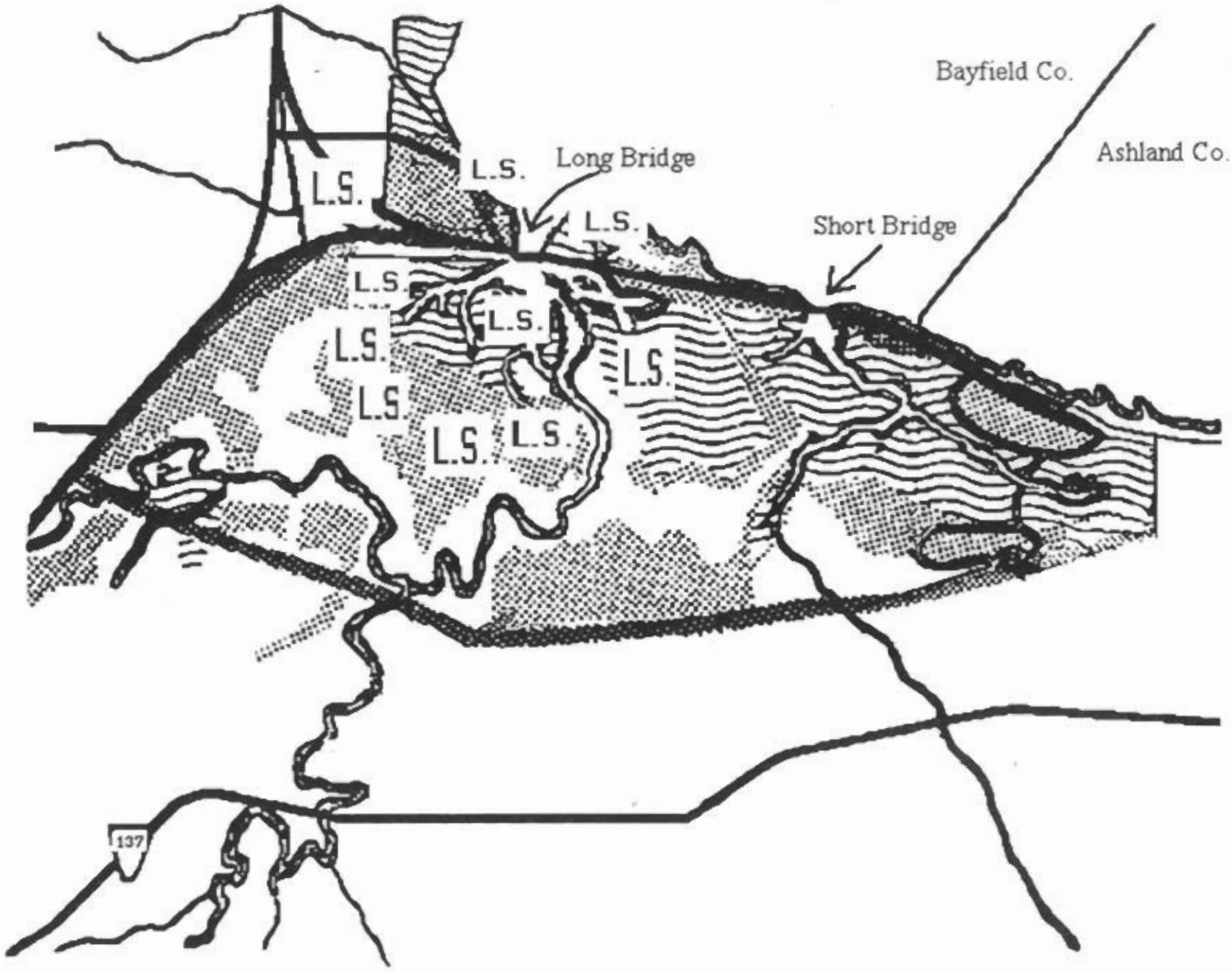

Figure 1. Map of Fish Creek Sloughs showing purple loosestrife locations (L.S.)