

# Suppression Measures Considered for Northern Pike in Box Canyon Reservoir



Measures	Purpose of Measure	Relative Cost	Pros	Cons	Feasibility
<b>No Action</b>	Maintain high-density NP population	Low	<ul style="list-style-type: none"> <li>Temporary increased angler opportunity</li> <li>Diverse angling opportunities</li> <li>Temporary economic stimulation</li> </ul>	<ul style="list-style-type: none"> <li>Expansion of the NP population</li> <li>This measure is unacceptable to fishery managers in the Columbia basin downstream of Albeni Falls Dam due to conservation risk</li> <li>Increased predation and competition with native species</li> <li>Impacts to game fish</li> <li>Potential expansion into unoccupied waters</li> <li>Contrary to ESA recovery efforts</li> <li>Eventual stunting</li> <li>Environmental toxin bioaccumulation</li> </ul>	Low
<b>Angling Regulations</b> <ul style="list-style-type: none"> <li>Slot limits</li> <li>Maximum/1-over limits</li> </ul>	Higher quality NP in fishery by protecting large individuals and promoting the harvest of small NP	Low Low	<ul style="list-style-type: none"> <li>Maintain or increase angler effort</li> <li>Diverse angling opportunities</li> <li>Economic stimulation</li> <li>Potential for NP cannibalism to control smaller NP abundance</li> <li>Possibly effective at altering size structure of the population</li> <li>Combined with mandatory harvest or incentive may help reduce abundance of small NP</li> </ul>	<ul style="list-style-type: none"> <li>Ineffective at reducing abundance</li> <li>Current exploitation rate too low to shape size structure</li> <li>Noncompliance may result in decreased size structure</li> <li>Environmental toxin bioaccumulation</li> </ul>	Low Low/Medium
<b>Promote General Angler Harvest</b>	Increase angler exploitation of NP to decrease abundance	Low	<ul style="list-style-type: none"> <li>Angler exploitation removes a portion of population</li> <li>Public perception</li> </ul>	<ul style="list-style-type: none"> <li>Current exploitation rate too low to reduce abundance</li> <li>Environmental toxin bioaccumulation</li> </ul>	Low/Medium
<b>Angler Incentive</b> <ul style="list-style-type: none"> <li>Bounty</li> <li>Fishing contests</li> </ul>	Increase angler exploitation by offering financial reward for harvest	Low-high Low	<ul style="list-style-type: none"> <li>Maintain or increase angler effort and harvest</li> <li>Diverse angling opportunities</li> <li>Economic stimulation</li> <li>Outreach and education opportunity</li> </ul>	<ul style="list-style-type: none"> <li>Angling pressure alone is largely ineffective at reducing abundance</li> <li>Current exploitation rate too low to shape population</li> <li>May result in decreased size structure if large NP are removed</li> <li>May provide economic incentive for further illegal introductions</li> <li>Environmental toxin bioaccumulation</li> </ul>	Medium Medium
<b>Trapping</b>	Remove adult NP in spring when congregated at spawning locations	Medium-High	<ul style="list-style-type: none"> <li>Limit impact to non-target species</li> </ul>	<ul style="list-style-type: none"> <li>Trap saturation with non-target species</li> <li>Only effective soon after ice-out</li> <li>Gear and labor intensive</li> <li>Ratio of effort to number of NP removed not favorable</li> </ul>	Medium
<b>Mechanical Removal (Gill netting)</b>	Remove adult NP during spring when congregated at spawning locations	High	<ul style="list-style-type: none"> <li>Has been demonstrated as an effective method to remove large numbers of NP</li> <li>Adult NP highly susceptible to capture by gill nets</li> <li>Well designed net dimensions and timing limit bycatch of non-target species</li> </ul>	<ul style="list-style-type: none"> <li>High capital investment</li> <li>Labor intensive</li> <li>Requires several repeated, if not continual, removal events</li> <li>Public perception</li> <li>Disposal of carcasses</li> <li>Impact to non-target species</li> </ul>	High
<b>Electrofishing</b>	Remove adult and juvenile NP seasonally by boat electrofishing	High	<ul style="list-style-type: none"> <li>Limit impact to non-target species</li> <li>Effective at capturing juvenile NP in autumn/early winter whereas our gillnets are not</li> </ul>	<ul style="list-style-type: none"> <li>Labor intensive</li> <li>Requires continual maintenance</li> <li>One of the least efficient methods of capturing adult NP</li> </ul>	Medium
<b>Water Level Manipulation</b>	Maintain stable water level through the peak spawning period followed by abrupt drawdown to dewater eggs and fry	High	<ul style="list-style-type: none"> <li>Remove large portions of spawning year classes</li> <li>Drastically reduce available spawning habitat for late spawners</li> <li>Has been successfully used in some areas</li> </ul>	<ul style="list-style-type: none"> <li>Increased entrainment possible</li> <li>FERC license amendments</li> <li>Lost revenue for PUD</li> <li>Limited storage/drawdown capabilities (run-of-river)</li> <li>Potential complications due to Lake Pend Oreille and Columbia River water management</li> <li>Impacts to non-target species</li> </ul>	Unknown
<b>Sterilization</b>	Release sterile male NP with intent to have them spawn with wild females resulting in non-viable offspring.	Medium-High	<ul style="list-style-type: none"> <li>If spawning habitat were limited, could reduce successful reproduction</li> </ul>	<ul style="list-style-type: none"> <li>Spawning habitat not limited in Box Canyon Reservoir</li> <li>Must be raised in hatchery</li> <li>Only takes a small percentage of the population reproducing to rebound or maintain the population</li> <li>Increased predation potential (at least temporarily)</li> </ul>	Low
<b>Detonation Cord</b>	Kill NP with pressure waves generated by the use of explosives	Medium-high	<ul style="list-style-type: none"> <li>Has been used in Europe and Lake Davis, CA. However, less efficient than mechanical removal</li> </ul>	<ul style="list-style-type: none"> <li>Vegetation, flow, distance, area, and substrate all drastically affect the range of explosive</li> <li>Impact to non-target species</li> <li>Permitting and training required</li> <li>Ecological impact</li> </ul>	Low
<b>Spawning Habitat Barriers</b>	Prevent access to NP spawning habitat	High	<ul style="list-style-type: none"> <li>May limit reproduction especially during low water years</li> </ul>	<ul style="list-style-type: none"> <li>Boat access prohibited</li> <li>Constant maintenance</li> <li>Must be implemented annually</li> <li>Non-target species movement inhibited</li> <li>Not feasible during high water years</li> </ul>	Medium
<b>Spawning Habitat Alteration</b>	Remove vegetation in spawning and rearing habitats to lower NP production and survival	High	<ul style="list-style-type: none"> <li>Removal of vegetation by shoreline development has contributed to declines in NP abundance in their native range</li> <li>Aquatic vegetation removal programs exist on the POR</li> <li>Physical, chemical, biological options</li> </ul>	<ul style="list-style-type: none"> <li>Large percentage of vegetation removal required (&gt;10%) to be successful</li> <li>Labor intensive (continual annual removal)</li> <li>Pike often spawn in flooded terrestrial vegetation in POR</li> <li>Permits</li> <li>Long-term ecological impacts</li> <li>Non-target species impacts (fish, invertebrates, amphibians, waterfowl, mammals)</li> </ul>	Low
<b>Mainstem Electric Barriers</b>	Block downstream migration with surface to bottom electric weir	Very high	<ul style="list-style-type: none"> <li>May limit entrainment downstream</li> </ul>	<ul style="list-style-type: none"> <li>Risk of electric shock to humans</li> <li>Prevents natural migration of native species</li> <li>Infeasible to construct at this time</li> </ul>	Low
<b>Fish toxicant (piscicide)</b> <ul style="list-style-type: none"> <li>Reservoir-wide</li> <li>Localized</li> </ul>	Lethally remove NP with rotenone reservoir-wide or in localized areas (sloughs) where NP are congregated	Very high High	<ul style="list-style-type: none"> <li>Effective at removing all sizes/life stages of NP</li> </ul>	<ul style="list-style-type: none"> <li>Permitting requirements</li> <li>Severe impact to non-target species</li> <li>Reservoir-wide application logistically and cost-prohibitive</li> <li>Localized applications must be detoxified to prevent impacts to non-target organisms</li> <li>Public perception</li> <li>Short-term ecological impacts (invertebrates, zooplankton, etc.)</li> </ul>	Very Low Medium
<b>Disease/parasite introduction</b>	Introduce viral or bacterial disease or parasite of NP to cause increased mortality	Medium	<ul style="list-style-type: none"> <li>Certain diseases of NP cause very high mortality to different life stages</li> </ul>	<ul style="list-style-type: none"> <li>Potential severe impacts to non-target species</li> <li>Not likely a viable control mechanism</li> <li>Potential for biological control to become invasive or entrained, often worse than the original problem</li> <li>Research and laboratory testing required</li> </ul>	Low
<b>Stocking pike predators</b>	Plant sterile tiger muskellunge to prey on NP	Medium	<ul style="list-style-type: none"> <li>Additional angler opportunities</li> </ul>	<ul style="list-style-type: none"> <li>Another additional apex predator in the system</li> <li>Potential for backcrossing / hybridization with northern pike</li> </ul>	Low
<b>Commercial fishery</b>	Reduce abundance of NP by commercial harvest	Low	<ul style="list-style-type: none"> <li>Potential small business</li> </ul>	<ul style="list-style-type: none"> <li>Impact to non-target species</li> <li>Highly dependent on market development</li> <li>Environmental toxin bioaccumulation</li> <li>May provide economic incentive for further illegal introductions</li> </ul>	Medium/High