BENEFITS OF PRODUCED WATER TO AQUATIC AND TERRESTRIAL WILDLIFE: OVERVIEW AND CASE STUDY

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Overview

- The establishment of new wetland areas and improvement of aquatic habitat through the application of produced water will significantly increase biological diversity .
- Over time, the function and value of these newly-created wetland areas and aquatic habitats are no less valuable than natural ones.

Benefits

- Water can benefit wildlife in a number of ways, both directly and indirectly and these major benefits include

Direct Benefits

- Drinking
- As habitat – many species such as waterfowl and fish live in or on the water

Indirect Benefits

- The production of food
- The production of cover

Benefits

- Because many areas of oil and gas production in WY have a naturally semi arid climate and suffer periodic drought conditions, the addition of produced water to these parched landscapes has produced benefits to wildlife that are both immediate and pronounced.
- The lack of water in general, and during drought in particular, is stressful to wildlife and can threaten their survival.
- The surface discharge of produced water in these areas can provide an alternative water source for wildlife during stressful drought periods and help to alleviate limiting conditions caused by lack of water.

Evaluating Benefits

- Five criteria have been used to evaluate the benefits of produced water discharges to wildlife:
  - Enhancing existing habitat for wildlife
  - Creating new habitat for wildlife
  - Increasing wildlife populations
  - Allowing existing wildlife populations to disperse
  - Benefiting both resident and migratory wildlife populations

Wyoming Species

- A large number of mammals, birds, reptiles, amphibians, and fish occur within the areas in Wyoming where oil and gas is produced:
  - Big Game (Wild Ungulates)
  - Upland Game Birds
  - Raptors
  - Waterfowl and Shorebirds
  - Perching Birds
  - Other Mammals
  - Reptiles and Amphibians
  - Fish

CASE STUDY: POISON SPIDER CREEK

- Tributary of North Platte River West of Casper.
- Untreated Water From Producing Oil Wells Is Discharged To The Creek.

POISON SPIDER CREEK

- Classification Of Tributary Receiving Effluent Was Changed During Last Triennial Review to Add Aquatic Life Use.
- Result: More Stringent Water Quality Standards.
- Some Parameters Exceeded These Chronic Water Quality Standards.

Alternative Ways to Meet Water Quality Standards

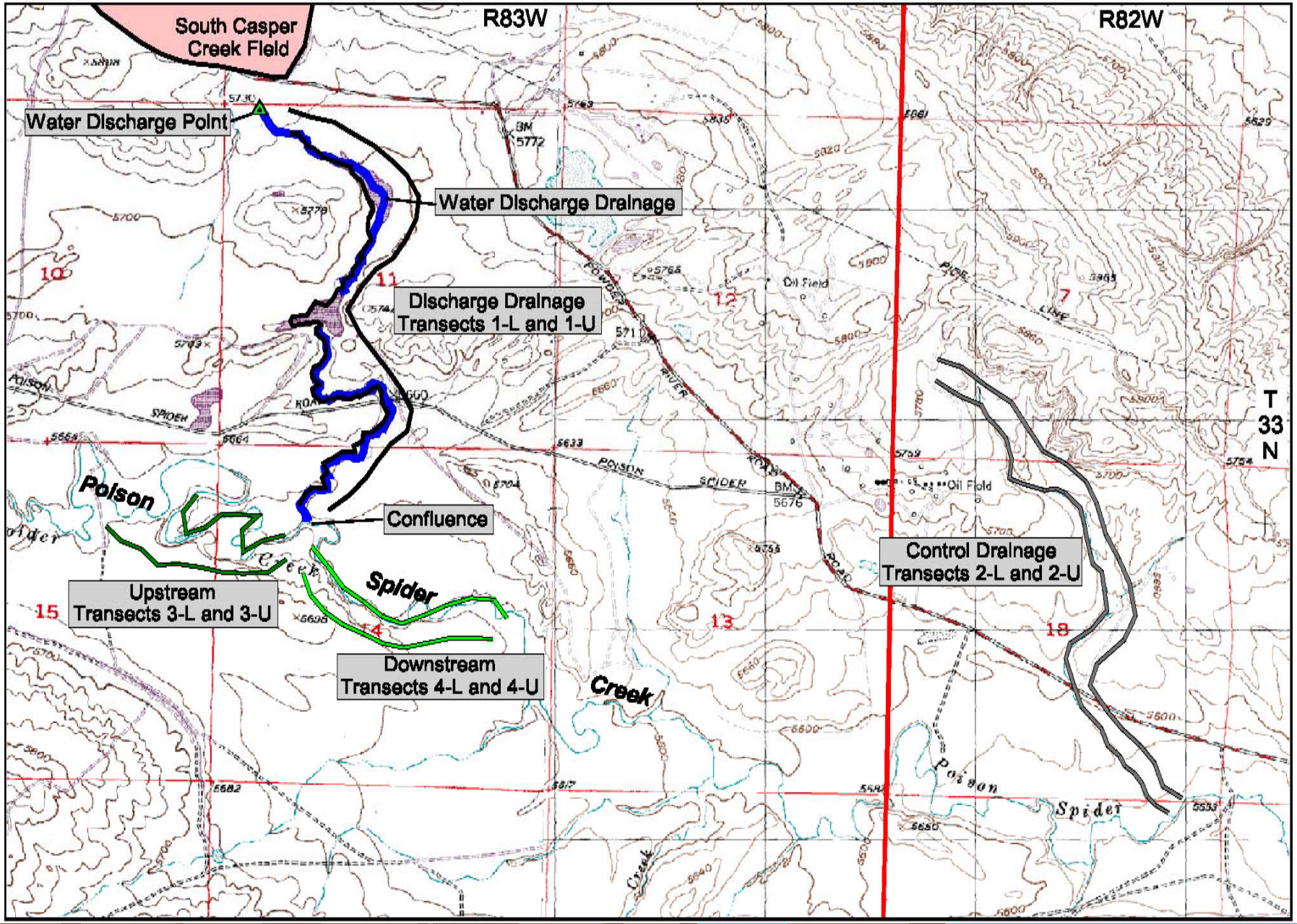
- Treat Discharge
- Stop Discharging: Re-inject Water
- Conduct Use Attainability Analysis and Develop Attainable, Site-Specific, Water Quality Standards.

The Use Attainability Analysis Answered the Following Questions:

- Was the Aquatic Life Use Being Attained?
- Was the Produced Water Adversely Impacting Fish and Invertebrates in the Creek?
- If Water Quality Standards Could Not be Met, What Would be the Impacts to Aquatic and Terrestrial Life of Removing Produced Water from the Creek?
- Were Site-Specific Water Quality Standards Appropriate for the Creek?

Terrestrial Habitat

- The South Casper Field, located in Natrona County, Wyoming has continuously discharged produced water into a tributary of Poison Spider Creek since the early 1920's.
- The water flows for approximately 3,320 meters (10,890 feet) along the tributary from the discharge point before emptying into Poison Spider Creek.
- As a result, stable wetland wildlife habitats have been established, which are unique in this arid shrub-steppe habitat type.
- In order to determine the effects of the discharge water on wildlife, surveys were performed by Hayden-Wing Associates (HWA) during the summer of 2003 as part of a use attainability analysis for submittal to the Wyoming Department of Environment Quality.



Locations of wildlife survey transects, the South Casper Creek Field, and the drainage carrying discharge water from the oil field.

Figure 4. Transect 2-L. Control drainage or natural drainage that is without a source of supplemental water. (September 2003)

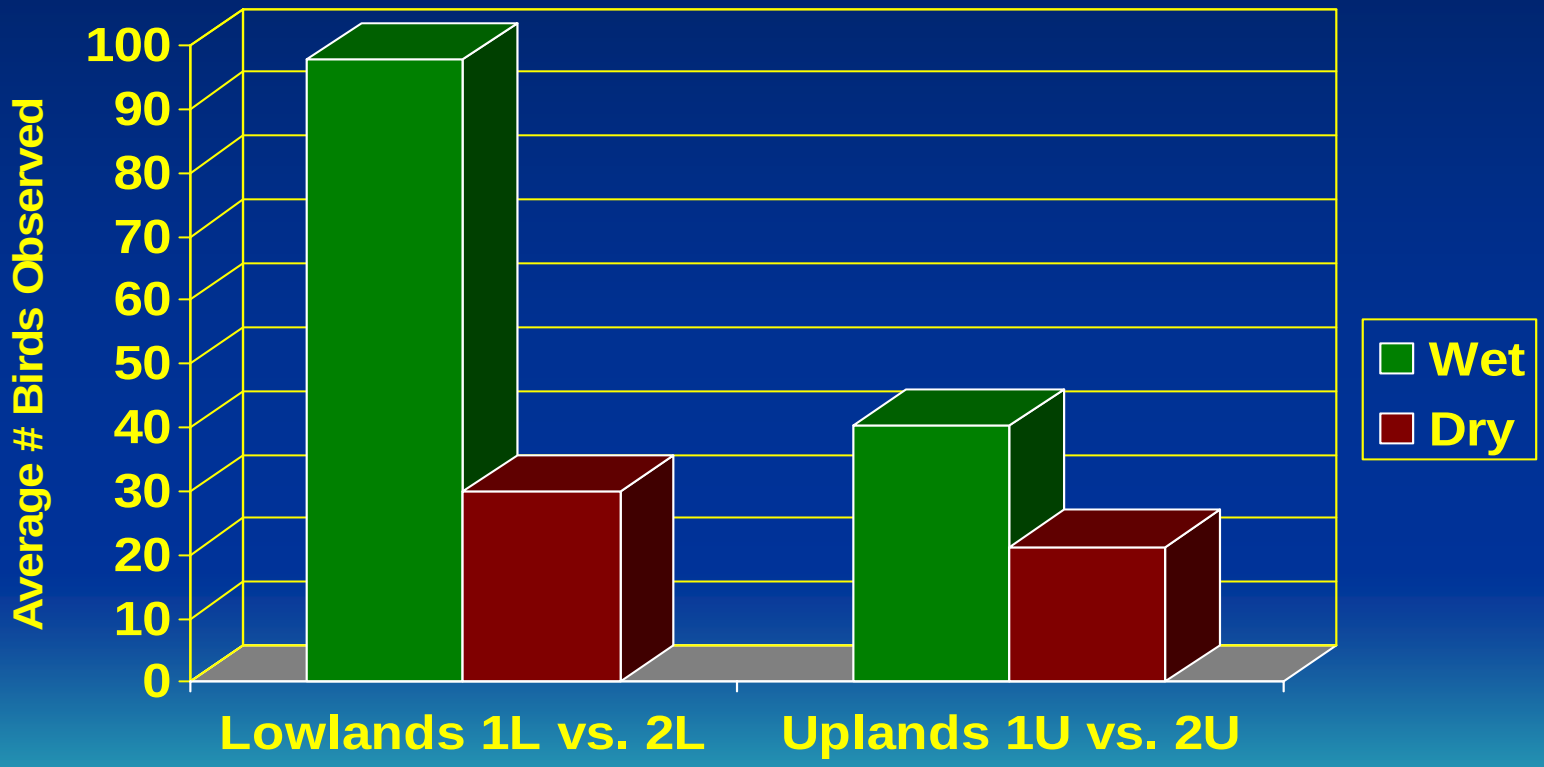
Figure 3. Transect 1-L. Water discharge drainage between South Casper Creek Field discharge point and Poison Spider Creek. (July 2003)

Comparison Between Wet and Dry Drainages

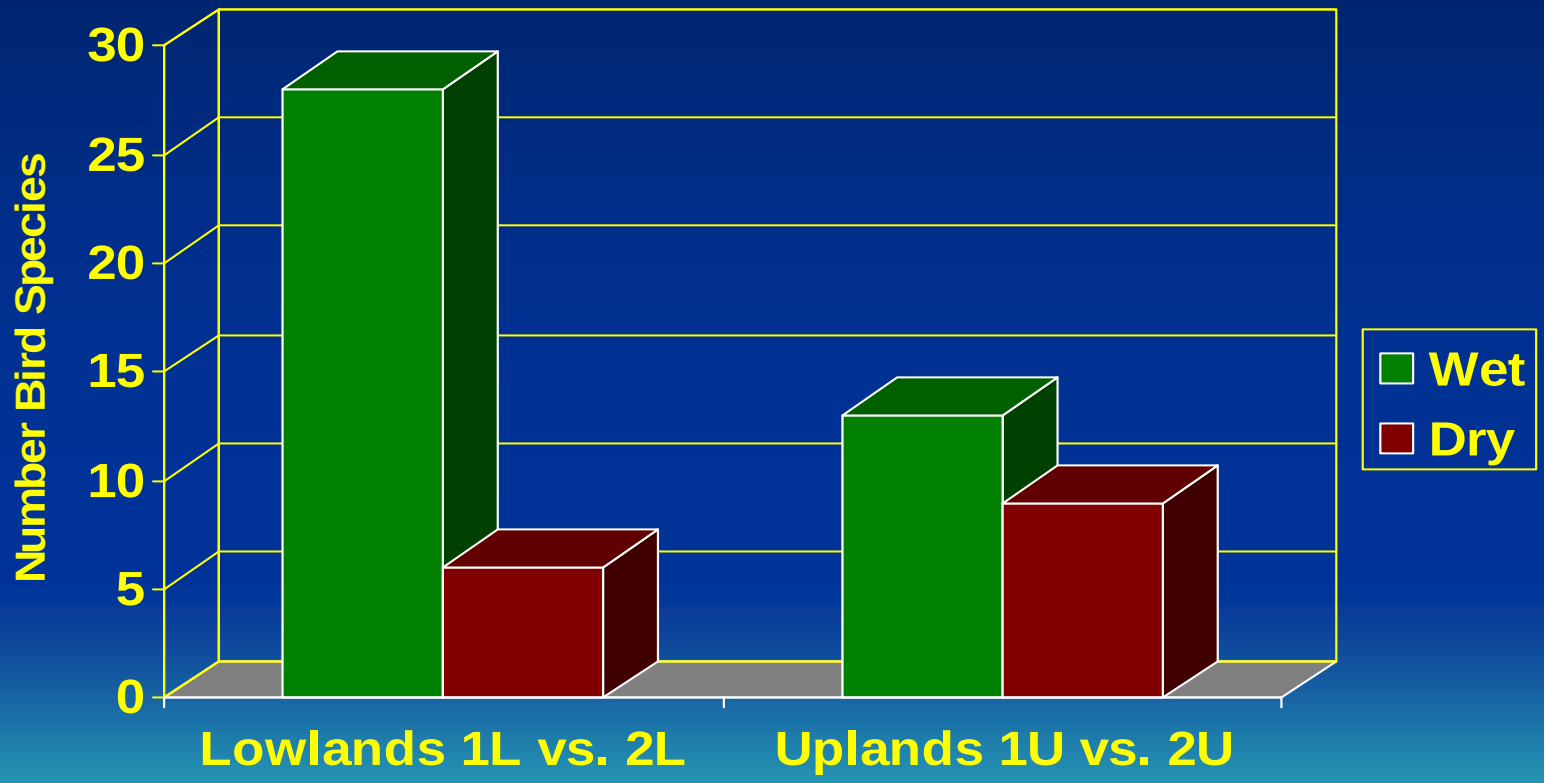
Transect 1-L.

Transect 2-L.

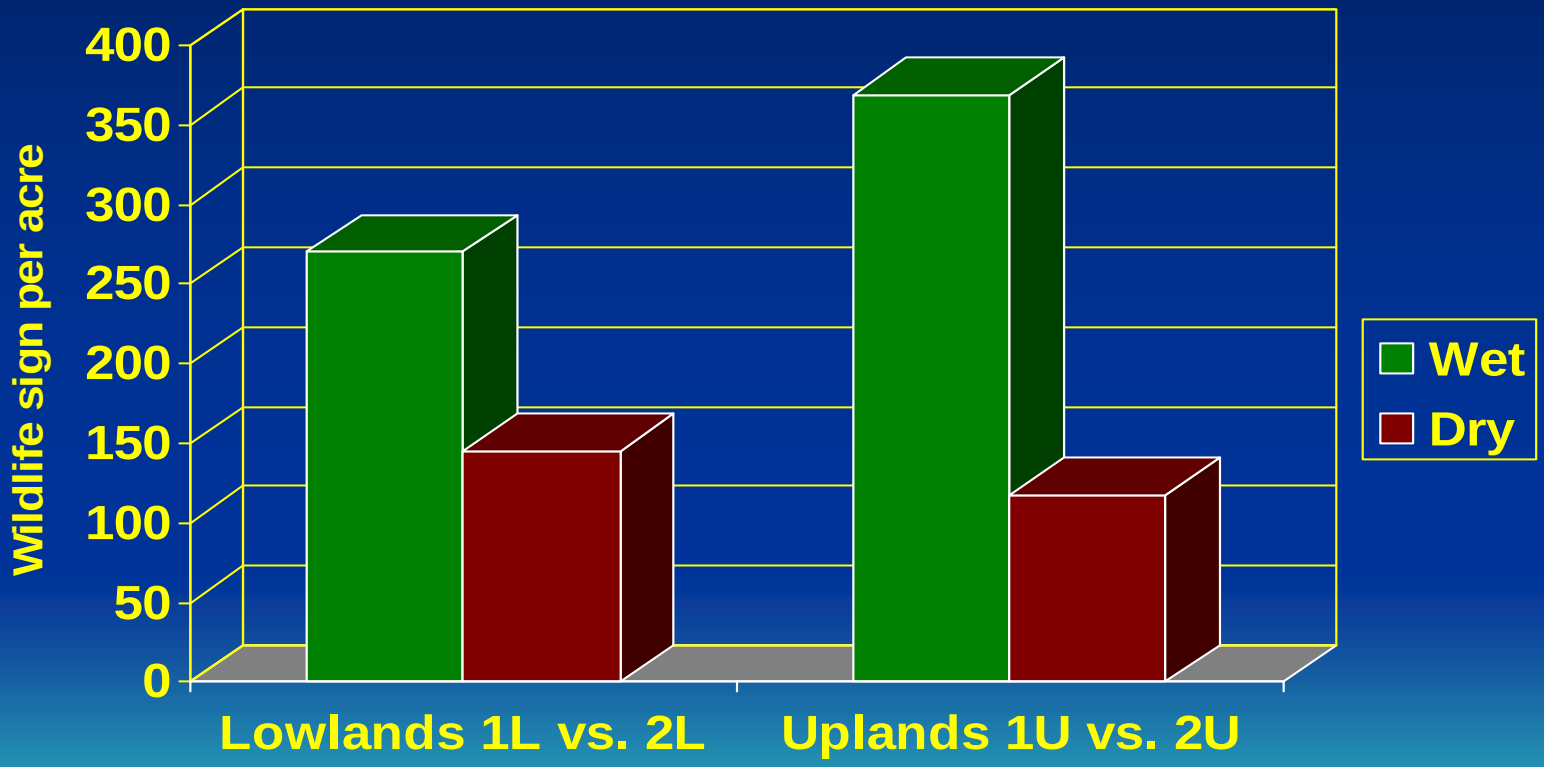
Comparison of average number of birds observed along the South Casper Creek Field water discharge tributary (transects 1L and 1U) and the control drainage (transects 2L and 2U) during August 2003



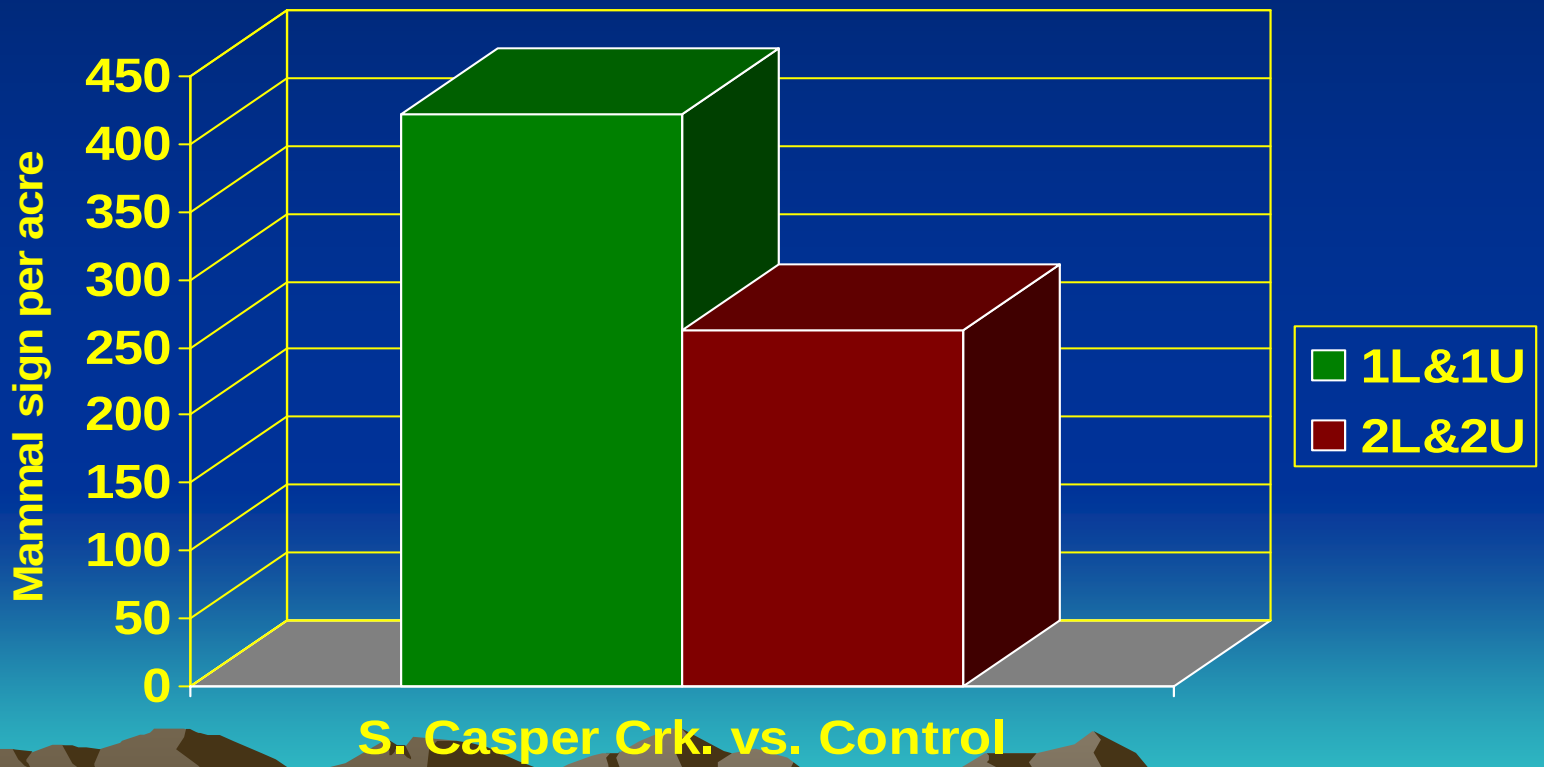
Comparison of number of bird species observed along the South Casper Creek Field water discharge tributary (transects 1L and 1U) and the control drainage (transects 2L and 2U) during August 2003



Comparison of wildlife (bird and mammal) sign density along the South Casper Creek Field water discharge tributary (transects 1L and 1U) and the control drainage (transects 2L and 2U) during August 2003



Comparison of total mammal sign density along the South Casper Creek Field water discharge tributary (transects 1L and 1U combined) and the control drainage (transects 2L and 2U combined) during August 2003

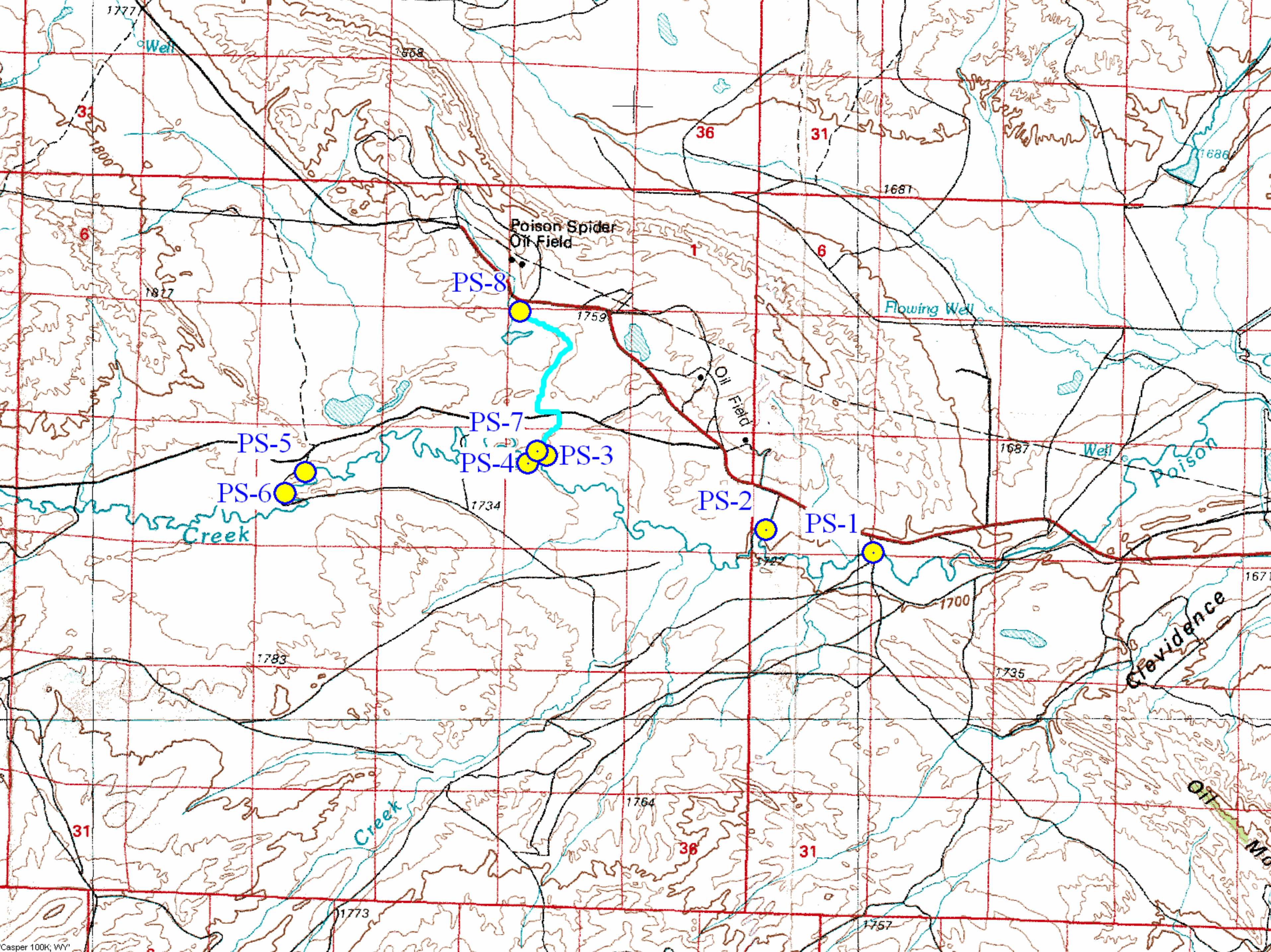


WILDLIFE CONCLUSIONS

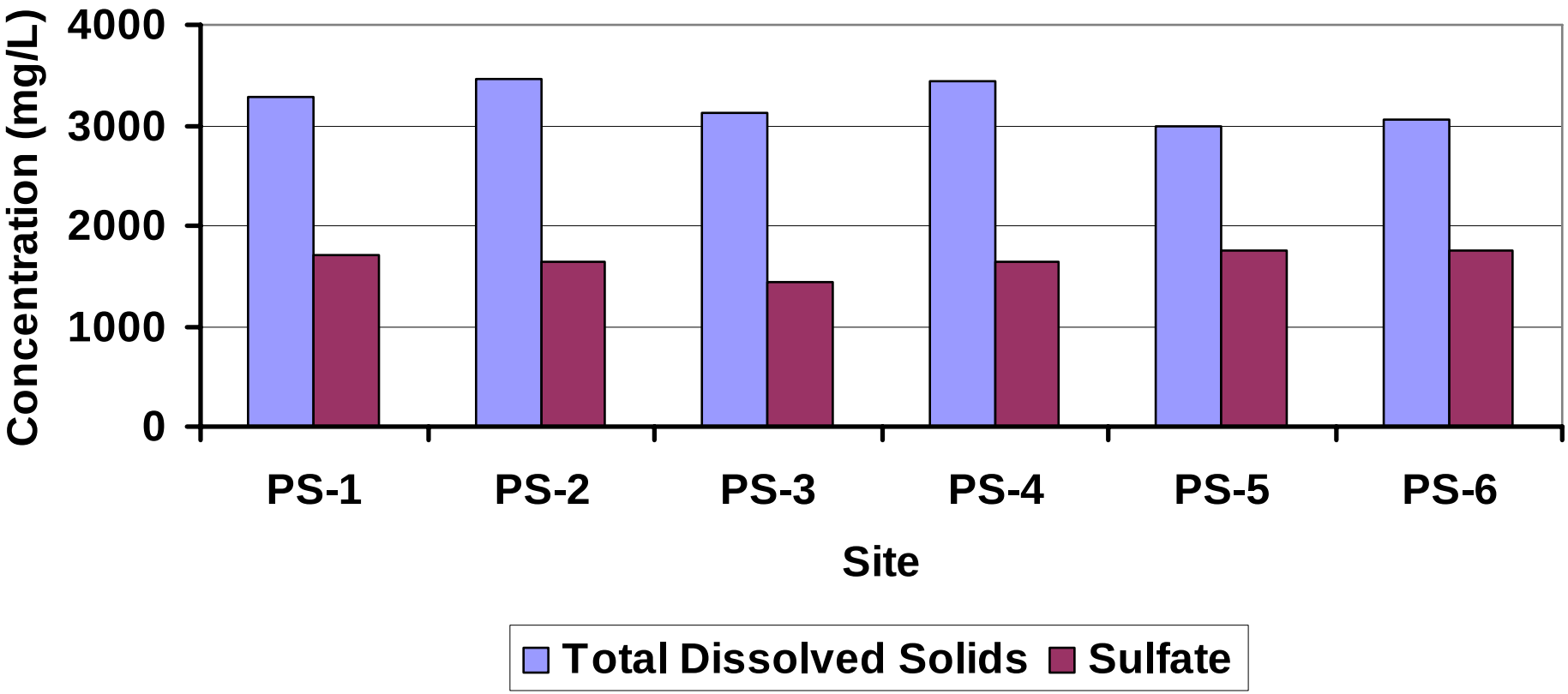
- All Wildlife Values Were Higher In the Discharge Drainage.
- Eliminating the Discharge Would Have Negative Impacts on Wildlife.

AQUATIC HABITAT: PARAMETERS SAMPLED

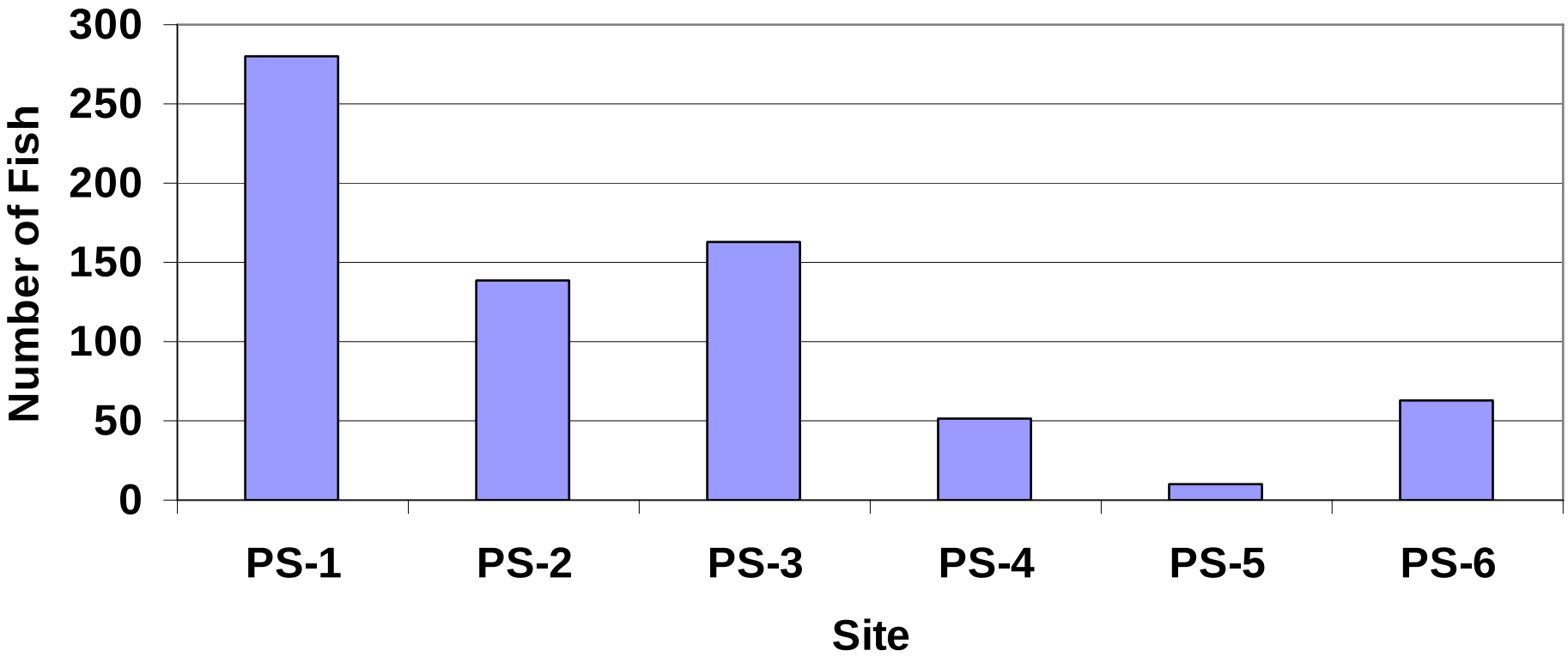
- Fish Numbers and Species.
- Macroinvertebrate Numbers and Species.
- Water Quality.
- Habitat Quality.
- Discharge Rate.


Poison Spider
Oil Field
PS-8
PS-7
PS-5
PS-6
PS-4
PS-3
PS-2
PS-1
Oil Field
Flowing Well
Well
Poison
Creek
Clevidence
1759
1734
1722
1700
1687
1681
1686
1817
1783
1764
1735
1773
1757
1800
36
31
6
1
'Casper 100K; WY'

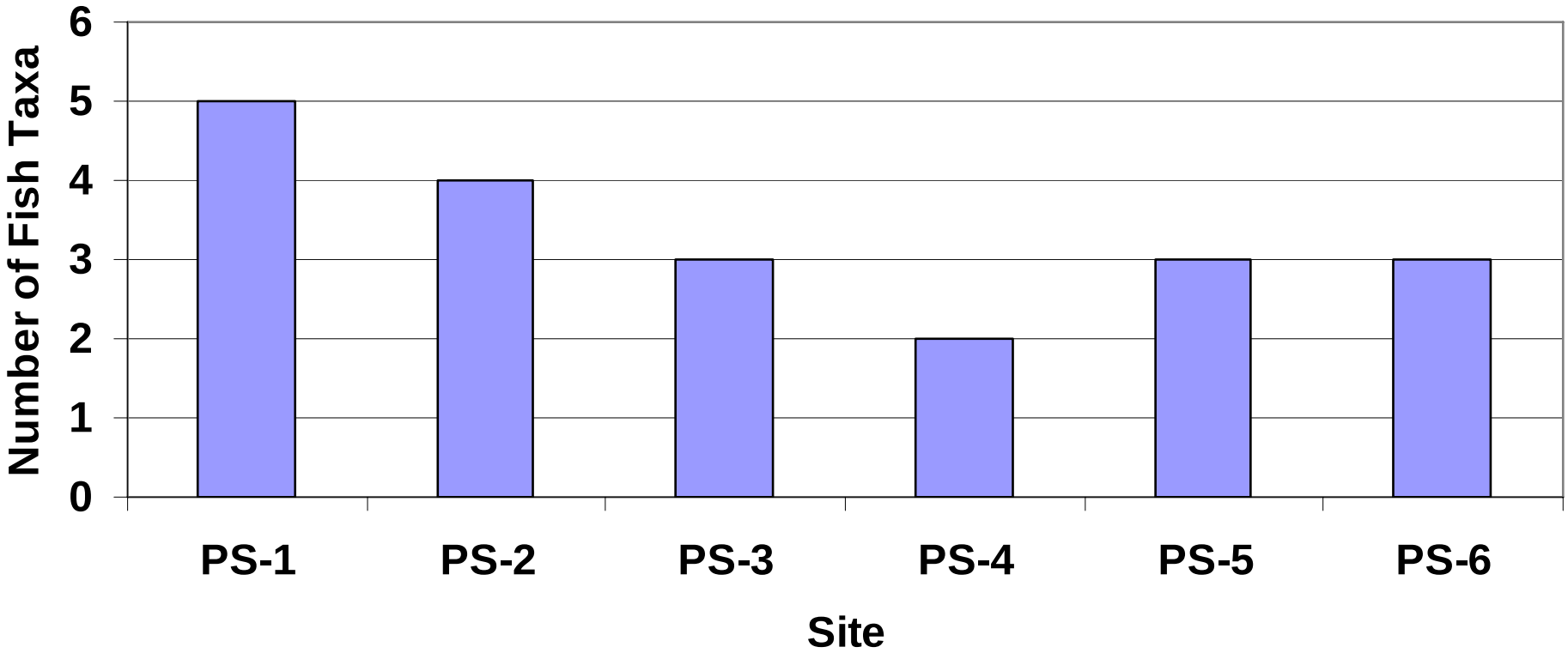
Effects on Water Quality



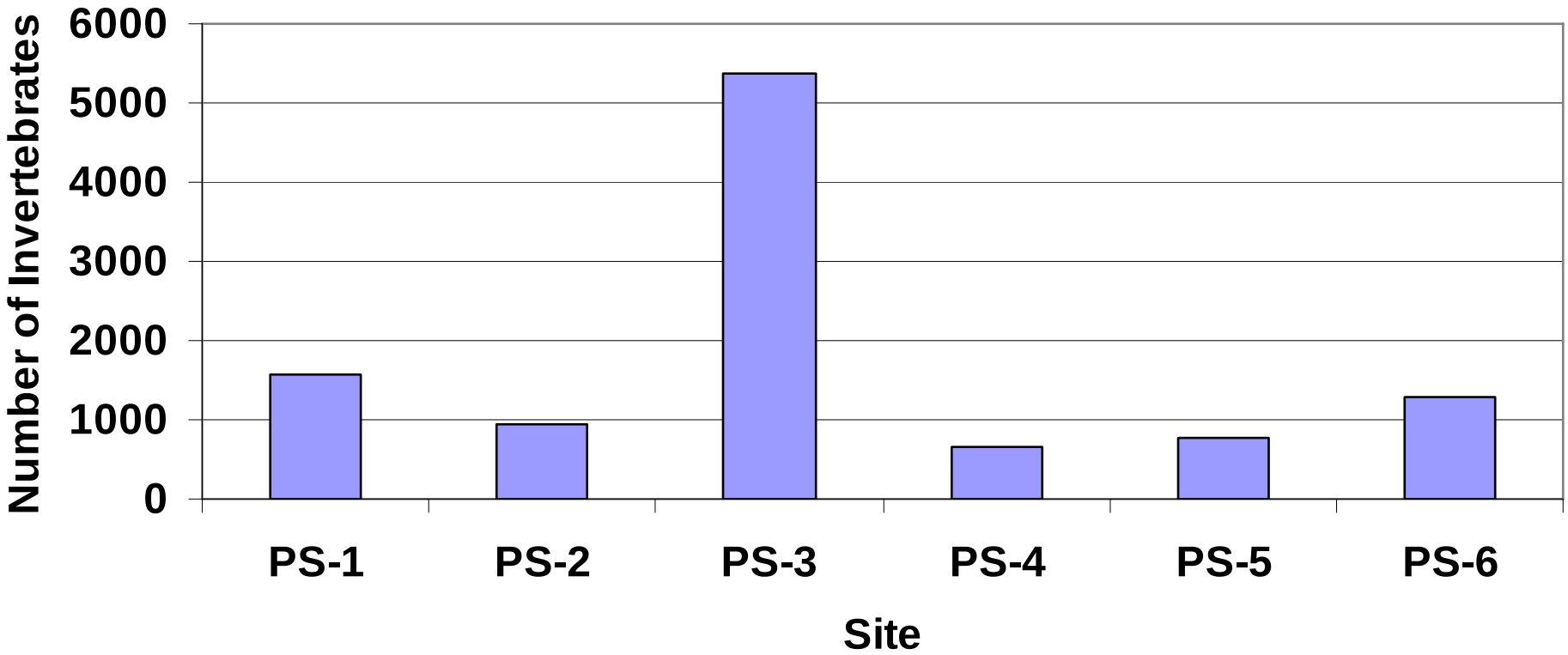
Effects on Numbers of Fish



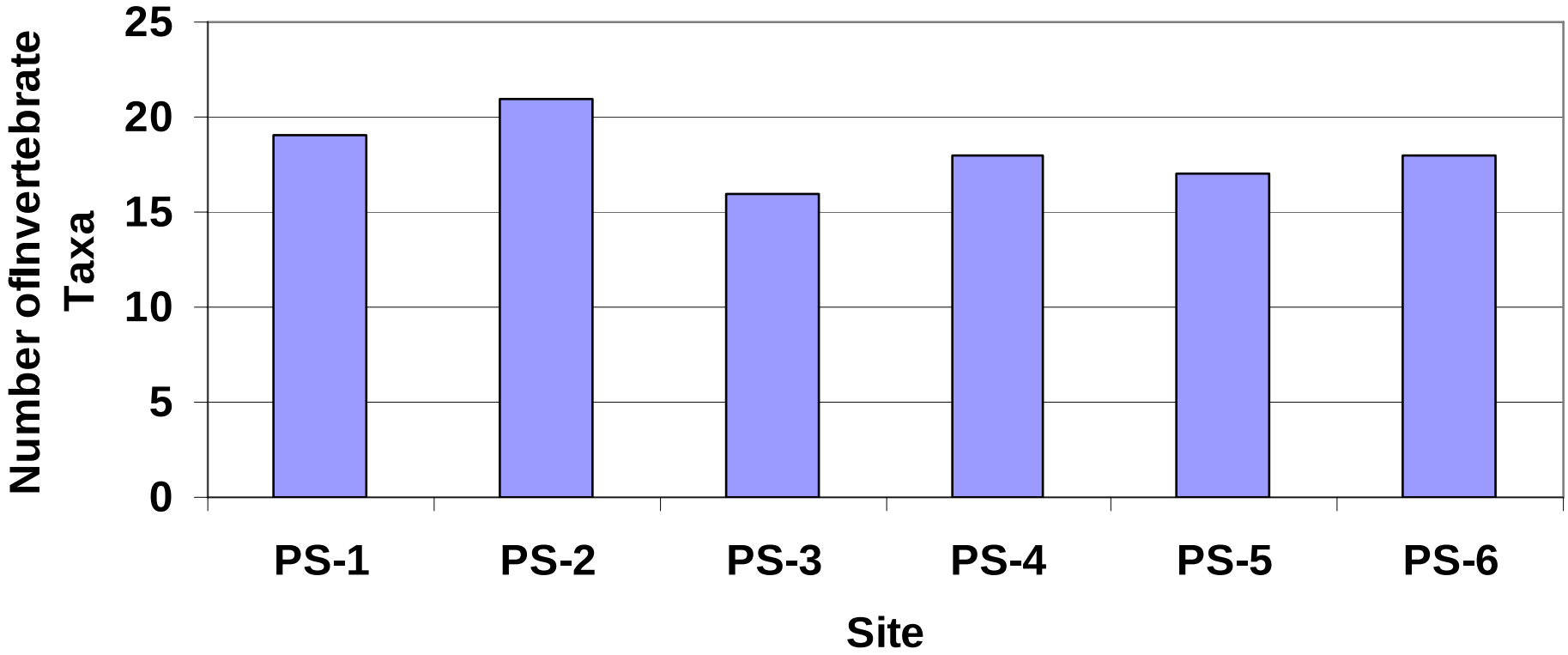
Effects on Numbers of Fish Species



Effects on Numbers of Macroinvertebrates



Effects on Numbers of Macroinvertebrate Species



AQUATIC CONCLUSIONS

- Effects of Produced Water on Fish:
  - Higher Numbers of Fish Downstream than Upstream.
  - Numbers of Species Present at Downstream Sites Were Equal To Or Greater Than Those Present At Upstream Sites.
  - Similar Species Were Present at Upstream and Downstream Sites.
- Effects Of Water Quality on Macroinvertebrates: No Significant Upstream vs. Downstream Differences in Numbers of Individuals or Numbers of Species.

AQUATIC CONCLUSIONS

- The Produced Water Has Positive Ecological Benefits on Aquatic Life in Poison Spider Creek.

- Eliminating the Produced Water Discharge Would Have Adverse Effects on Fish and Macroinvertebrates in Poison Spider Creek.

Other Benefits of Produced Water