

To neglect the study of laws and regulations is a sure sign that the Officer is slipping. The hunter or fisherman will quickly lose confidence in an Officer who has but a scant knowledge of the laws he is empowered to enforce.

The Enforcement Officer must know the reasons for arrests, tactics of arrest, and then the proper court procedure following the arrest. This includes the identifying, collecting, and preserving of evidence for use in court. In short, he must know his job from "A to Z," whether he is making a speech before a group, doing routine patrol work, or presenting a case in court.

It matters not whether a Conservation Officer is on or off duty—if he knows his job and does it, has a code of ethics including loyalty to his fellow workers, and strives to increase his professional knowledge he will be an asset to his Department. There is no place for routine law enforcement work.

Thank you.

TECHNICAL FISHERIES SESSION

A PRE-IMPOUNDMENT FISHERY STUDY OF NORTH BAY AND ASSOCIATED WATERS, BAY COUNTY, FLORIDA

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INTRODUCTION

A proposed impoundment in Bay County, Florida will create a 5,000-acre body of fresh water in a portion of North Bay, presently a salt water bay connected with the Gulf of Mexico. The primary purpose of the impoundment is to provide water for domestic and industrial use in the county, but it should also provide excellent sport fishing. In order to better formulate plans for future fish management, the Florida Game and Fresh Water Fish Commission initiated a pre-impoundment investigation. This was conducted by the Commission's Lake and Stream Survey and Fish Management Investigations Projects and financed by Federal Aid through the Dingell-Johnson Act.

The field work, conducted from December 1956 into February 1957, consisted of fish population studies and water quality analyses.

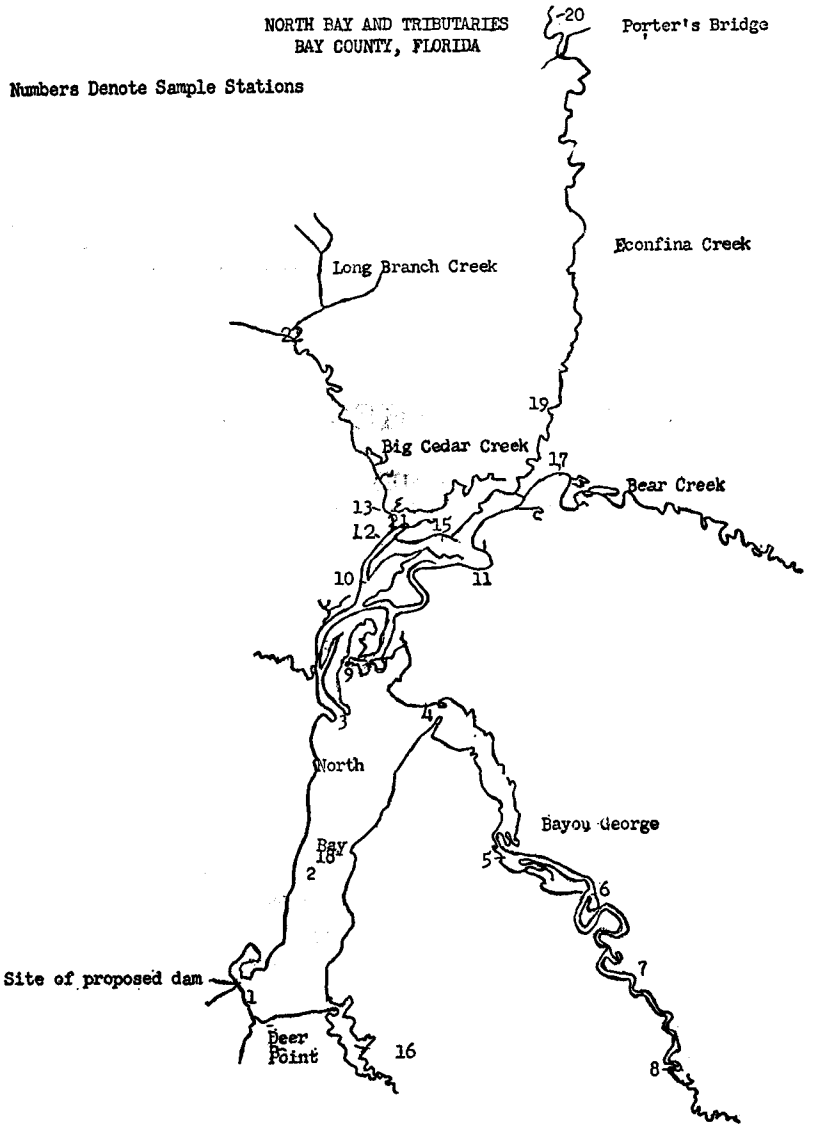
DESCRIPTION

The area includes North Bay and its tributaries: Bayou George, and Bear, Econfina, and Cedar Creeks. Impoundment of these waters is proposed by the construction of a dam across North Bay at Deer Point. From the site of the proposed dam to the mouths of the tributaries North Bay presently encompasses about 1,200 acres. It is a tidal estuary with a mud bottom and averages 4 to 5 feet in depth.

The watershed of the tributaries consists of flood plains which are mostly lowland river swamps with occasional high bluffs cut by the meandering streams. The vegetation types are lower coastal pine flatwoods, high pine and turkey oak sand hills, and high hammock lands. The head of North Bay is bounded by deltas which support an extensive *Juncus* marsh. Bayou George and Cedar Creeks are sluggish slow-moving streams with currents noticeable only at low tide; the sand and mud bottoms have a vegetable detritus overlay; depths vary from 3 to 10 feet and the water is stained and brackish a good distance upstream. Econfina is spring-fed, clear, fast-flowing fresh water creek over most of its course; depths are 3 to 10 feet near the mouth; and the bottom is of sand and limestone in its upper reaches. Bear Creek has a noticeable current, is slightly stained, and is brackish near the mouth; the bottom is chiefly sand; and depths are 3 to 12 feet.

NORTH BAY AND TRIBUTARIES
BAY COUNTY, FLORIDA

Numbers Denote Sample Stations



METHODS

Gill nets, rotenone, explosives, and an otter trawl were used in sampling the fish populations of North Bay and its tributaries.

Total alkalinity was determined from measurements of phenolphthalein and methyl orange alkalinities. The pH was taken by the colorimetric method. Salinities were determined by the Mohr method.

Weights of fishes were recorded in pounds and tenths of pounds.

Fresh water game fish referred to in this report are members of the family Centrarchidae and Esocidae. Other fresh water fishes listed are considered in the category "rough fish." Those listed as marine fishes spend the greater part of their life cycle in brackish or salt water (including the American eel which begins life in the ocean).

Fish population studies and water quality analyses were made at representative stations on North Bay and its tributaries (see Map, page . . .).

WATER QUALITY

North Bay is a tidal estuary modified by the influx of fresh water from several streams. North Bay and Bayou George are about one-fifth as salty as sea water, while Econfina Creek, the largest stream entering it, is fresh. Table I shows salinity, alkalinity, and pH values determined for each station.

TABLE I
WATER QUALITY TABLE OF NORTH BAY AND ASSOCIATED WATERS
Salt Water Stations

<i>Location</i>	<i>Avg. NaCl</i>	<i>Avg. M. O. A.</i>	<i>Av. pH</i>
North Bay—Station 2.....	7,900 p.p.m.	60.5 p.p.m.	8.4
Bayou George—Station 4.....	7,200 p.p.m.	67.0 p.p.m.	8.2
Bayou George—Station 7.....	8,500 p.p.m.	.....	7.9
Bear Creek—Station 9.....	7,800 p.p.m.	.....	8.1
Cedar Creek—Station 10.....	2,100 p.p.m.	53.0 p.p.m.	7.9
Cedar Creek—Station 21.....	9,370 p.p.m.	69.0 p.p.m.	7.5
Average for All Stations.....	6,520 p.p.m.	62.4 p.p.m.	8.0
Fresh Water Stations			
Bear Creek—Station 11.....	65 p.p.m.	.....	7.0
Cedar Creek—Station 22.....	6 p.p.m.	35.0 p.p.m.	7.3
Econfina Creek—Station 19.....	9 p.p.m.	45.5 p.p.m.	7.5
Econfina Creek—Station 20.....	2 p.p.m.	56.0 p.p.m.	7.8
Average for All Stations.....	20.5 p.p.m.	45.5 p.p.m.	7.4

Averages shown are from the results of water samples taken at the surface and at bottom depths.

Station locations are shown on the map, page . . .

FISH POPULATIONS

As could be expected, marine fishes were found to predominate in the waters of high salinity, and fresh water species comprised the large majority of the fish taken from the fresh water streams of North Bay.

Joseph (1956) stated, "The longnose gar is one of the few fresh water fishes which is able to survive in high saline waters." At the time of the year these studies were made (December-February), this gar was present in large numbers in brackish waters. In view of the above and since it was found to move freely between brackish and fresh waters, the gar is excluded in one of the treatments of the total fish populations presented in Table II.

TABLE II
Salt Water Stations

	<i>Avg. NaCl</i>	<i>No.</i>	<i>Lbs.</i>	<i>% Composition</i>	
				<i>No.</i>	<i>Lbs.</i>
Marine Fishes.....	6,520 p.p.m.	420	69.2	84.0	13.0
Fresh Water Fishes.....	6,520 p.p.m.	82	448.3	16.0	87.0
Without Longnose Gar					
Fresh Water Fishes.....	6,520 p.p.m.	4	1.1	1.0	.2
Fresh Water Stations					
Marine Fishes.....	20.5 p.p.m.	65	3.5	5.0	3.0
Fresh Water Fishes.....	20.5 p.p.m.	747	97.6	95.0	97.0
Without Longnose Gar					
Fresh Water Fishes.....	20.5 p.p.m.	741	73.6	83.0	79.0

The principal commercial marine species in order of decreasing numerical abundance were: mullet, pinfish, sea catfish, speckled trout, silver perch, and redfish. These relative amounts are expected to fluctuate during the year. At spawning time mullet and redfish move into the open Gulf waters, while speckled trout move into the inner bays (Gunter, 1945 and 1950). Pinfish probably move into open deep waters to spawn.

Some of the less abundant species, as the naked and largemouth gobies and hogchokers are believed to spawn in water of low salinity under certain conditions (Moody, unpublished data; Joseph and Yerger, 1956).

Large numbers of fresh water game fishes were found in waters of low salinity, and they decreased in abundance with increasing salinities. Game fish species included largemouth bass, shellcrackers, stumpknockers, bluegills, and warmouth. Spotted suckers and small non-game fishes comprised the major part of the rough fish population.

DISCUSSION AND SUMMARY

After the impoundment is completed, the salinity of the waters of the inner bay will gradually diminish. Good populations of fresh water game fishes already exist in areas of low salinity in the region. With decreasing salinity, the marine fishes should decline in number and the fresh water fishes should increase. Lake George in the St. Johns River has an excellent population of fresh water game fishes. Salinities range from 300 to 800 p.p.m. (Luethy, 1956). Bluegill reproduction occurred in Lake Maggiore, St. Petersburg, Florida, at a salinity of 620 p.p.m. (Moody, unpublished data). The fresh water game fishes already existing in the fresh water streams will expand into North Bay as the salinity falls. No supplementary game fish stocking should be necessary. It is predicted that the population of longnose gar will be unaffected by impoundment. The gar by their predatory activities may be beneficial to the area by reducing the numbers of the more prolific species.

Sixty-one species of fishes were collected from North Bay and its tributary streams. Thirty-four species were fresh water fishes and 27 were marine. The combined brackish water stations yielded 31 species, of which 27 were marine and four were fresh water species. Thirty-seven species of fishes were collected from the fresh water stations. These were broken down into six marine and 31 fresh water species.

Fishes taken from the salt water stations in North Bay and its tributaries are recorded in Tables III to VI. Tables VII to IX show fishes collected from the fresh water stations. Table X gives the species and common names of the fishes taken during this investigation.

TABLE III
Salt Water Station (Station 2)
North Bay

Species	No.	Wt.	% Composition	
			No.	Wt.
Longnose Gar	16	91.7	7.5	83.0
Striped Mullet *	49	4.8	23.0	4.3
Menhaden *	4	.9	1.9	.8
Sea Catfish *	7	7.4	3.3	6.7
Speckled Trout *	5	4.5	2.3	4.0
Pinfish *	35	.8	16.4	.7
Anchovy *	27	.1	12.8	.1
Hogchoker *	1	..	.5	..
American Eel *	4	..	1.9	..
Longnose Killifish *	19	.1	8.9	.1
Gulf Killifish *	3	..	1.4	..
Diamond Killifish *	1	..	.5	..
Freshwater Glass-Minnow *	36	.2	16.9	.2
Largemouth Goby *	3	..	1.4	..
Glut Herring *	1	..	.5	..
Tonguefish *	2	..	.9	..
TOTAL	213	110.5	100.1	99.9
Marine Fish	197	18.8	93.0	17.0
Fresh Water Fish	16	91.7	7.5	83.0
Shrimp	3	...	..	..

* Marine Species.

TABLE IV
Salt Water Stations (Stations 4 and 7)
Bayou George

Species	No.	Wt.	% Composition	
			No.	Wt.
Longnose Gar	7	53.0	5.1	74.1
Striped Mullet *	3	1.6	2.2	2.3
Speckled Trout *	6	6.7	4.4	9.4
Menhaden *	4	1.1	2.9	1.5
Redfish *	2	3.3	1.5	4.6
Sea Catfish *	5	4.7	3.7	6.6
Silver Perch *	8	.3	5.8	.4
Common Jack *	1	..	.7	..
Pinfish *	13	.4	9.9	.6
Anchovy *	69	.2	50.4	.3
Pipefish *	1	..	.7	..
Diamond Killifish *	1	..	.7	..
Gulf Killifish *	1	..	.7	..
Spotfin Killifish *	1	..	.7	..
Largemouth Goby *	3	..	2.2	..
Needlefish *	1	.1	.7	.1
Freshwater Glass-Minnow *	11	.1	8.0	.1
TOTAL	137	71.5	100.3	100.0
Marine Fish	130	18.5	94.9	25.9
Fresh Water Fish	7	53.0	5.1	74.1

* Marine Species.

TABLE V
Salt Water Station (Station 9)
Bear Creek

Species	No.	Wt.	% Composition	
			No.	Wt.
Longnose Gar	17	82.6	44.7	86.3
Gizzard Shad	1	.7	2.6	.8
Sea Catfish *	13	12.2	34.2	12.7
Silver Perch *	5	.2	13.2	.2
Hogchoker *	1	..	2.6	..
Sea Robin *	1	..	2.6	..
TOTAL	38	95.7	99.9	100.0
Blue Crab *	1	.1	..	..
Shrimp *	1	..	..	..
TOTAL	2	.2	..	..
Marine Fish	20	12.4	53.0	13.0
Fresh Water Fish	18	83.3	47.0	87.0

* Marine Species.

TABLE VI
Salt Water Stations (Stations 10 and 21)
Cedar Creek

<i>Species</i>	<i>No.</i>	<i>Wt.</i>	<i>% Composition</i>	
			<i>No.</i>	<i>Wt.</i>
Longnose Gar	38	219.9	33.3	91.7
Shellcracker	2	.2	1.8	.1
Speckled Trout *	5	4.1	4.3	1.7
Menhaden *	4	1.3	3.5	.5
Sea Drum *	1	.4	.9	.2
White Catfish	1	.2	.9	.1
Striped Mullet *	27	11.7	23.7	4.9
Common Mojarra *	33	1.4	29.0	.6
Silver Perch *	2	.2	1.8	.1
Mangrove Snapper *	1	.4	.9	.2
TOTAL	114	239.8	100.1	100.0
Marine Fish	73	19.5	64.0	91.9
Fresh Water Fish	41	220.3	36.0	8.1

* Marine Species.

TABLE VII
Fresh Water Station (Station 11)
Bear Creek

<i>Species</i>	<i>No.</i>	<i>Wt.</i>	<i>% Composition</i>	
			<i>No.</i>	<i>Wt.</i>
Longnose Gar	5	23.9	8.5	75.4
Striped Mullet *	2	1.3	3.4	4.1
Chain Pickerel	1	2.1	1.7	6.6
Spotted Sucker	3	2.5	5.1	7.9
Largemouth Black Bass	5	1.9	8.5	6.0
Warmouth	2	..	3.4	..
Stumpknocker	1	..	1.7	..
Redbreast	4	..	6.8	..
Spring Redeye Chub	6	..	10.2	..
Mosquito-Fish	1	..	1.7	..
Florida Brook Silversides	7	..	11.9	..
Largemouth Goby *	1	..	1.7	..
Naked Goby *	8	..	13.5	..
Hogchoker *	13	..	22.0	..
TOTAL	59	31.7	100.1	100.0
Marine Fish	24	1.3	41.0	4.0
Fresh Water Fish	35	30.4	59.0	96.0

* Marine Species.

TABLE VIII
Fresh Water Station (Station 22)
Cedar Creek

<i>Species</i>	<i>No.</i>	<i>Wt.</i>	<i>% Composition</i>	
			<i>No.</i>	<i>Wt.</i>
Spotted Gar	1	.1	.6	.3
Longnose Gar	1	.1	.6	.3
Spotted Sucker	8	7.4	5.1	22.6
White Catfish	3	.1	1.9	.3
White Mullet*	1	.5	.6	1.5
Largemouth Black Bass	29	20.4	18.4	62.4
Warmouth	9	.1	5.7	.3
Stumpknocker	5	.6	3.2	1.8
Shellcracker	4	.5	2.5	1.5
Redbreast	24	2.4	15.2	7.3
Bluegill	1	.1	.6	.3
Sailfin Shiner	3	..	1.9	..
Tadpole Madtom	5	..	3.2	..
American Eel*	8	.3	5.1	.9
Florida Brook Silversides	16	..	10.1	..
Everglades Pigmy Sunfish	12	..	7.6	..
Hogchoker*	17	.1	10.8	.3
Florida Swamp Darter	4	..	2.5	..
Darter (Unidentified)	1	..	.6	..
Crawl-a-Bottom	6	..	3.8	..
TOTAL	158	32.7	100.0	99.8
Marine Fish	26	.9	16.0	2.7
Fresh Water Fish	132	31.8	84.0	97.2

* Marine Species.

TABLE IX
Fresh Water Stations (Stations 19 and 20)
Econfina Creek

<i>Species</i>	<i>No.</i>	<i>Wt.</i>	<i>% Composition</i>	
			<i>No.</i>	<i>Wt.</i>
Redfin Pickerel	2	.5	.3	1.4
Spotted Sucker	23	12.7	3.9	34.6
Yellow Catfish	2	.5	.3	4.1
Snail Catfish	11	.2	1.8	.5
Largemouth Black Bass	34	11.6	5.7	31.6
Warmouth	13	2.0	2.2	5.4
Stumpknocker	95	3.0	16.0	8.2
Shellcracker	14	2.3	2.4	6.2
Redbreast	13	.1	2.2	.3
Bluegill	8	.3	1.3	.8
Central Weed Shiner	19	.2	3.2	.5
Sailfin Shiner	28	.1	4.7	.3
Gulf Madtom	26	.2	4.4	.5
Tadpole Madtom	27	.1	4.5	.3
American Eel*	5	1.3	.8	3.5
Red-Finned Killifish	7	..	1.1	..
Star-Headed Topminnow	3	..	.5	..
Mosquito-Fish	10	..	1.7	..
Least Killifish	1	..	.2	..
Pirate Perch	14	.2	2.4	.5
Florida Brook Silversides	20	.1	3.3	.3
Everglades Pigmy Sunfish	63	..	10.6	..
Largemouth Goby*	1	..	.2	..

* Marine Species.

TABLE IX—Continued

Species	No.	Wt.	% Composition	
			No.	Wt.
Hogchoker *	9	..	1.5	..
Brown Darter	6	..	1.0	..
Darter (Unidentified)	1	..	.2	..
Spring Redeye Chub	124	.2	20.8	.5
Crawl-a-Bottom	16	.1	2.7	.3
TOTAL	595	36.7	99.9	99.8
Marine Fish	15	1.3	2.5	3.5
Fresh Water Fish	580	35.4	97.5	96.5

TABLE X

LIST OF FISHES COLLECTED FROM NORTH BAY AND ITS TRIBUTARIES

Common Name	Scientific Name
1. Florida Spotted Gar	<i>Lepisosteus platyrhinchus</i>
2. Longnose Gar	<i>Lepisosteus osseus</i>
3. Gizzard Shad	<i>Dorosoma cepedianum</i>
4. Chain Pickerel	<i>Esox niger</i>
5. Redfin Pickerel	<i>Esox americanus</i>
6. Spotted Sucker	<i>Minytrema melanops</i>
7. White Catfish	<i>Ictalurus catus</i>
8. Snail Catfish	<i>Ameiurus platycephalus</i>
9. Yellow Catfish	<i>Ameiurus natalis</i>
10. Largemouth Black Bass	<i>Micropterus salmoides salmoides</i>
11. Warmouth	<i>Chaenobryttus coronarius</i>
12. Stumpknocker	<i>Lepomis punctatus punctatus</i>
13. Shellcracker	<i>Lepomis microlophus</i>
14. Redbreast	<i>Lepomis auritus</i>
15. Bluegill	<i>Lepomis macrochirus purpurescens</i>
16. Everglades Pigmy Sunfish	<i>Elassoma evergladei</i>
17. Mosquito-fish	<i>Gambusia affinis holbrooki</i>
18. Florida Brook Silversides	<i>Labidesthes sicculus vanhyningi</i>
19. Spring Redeye Chub	<i>Hybopsis harperi</i>
20. Central Weed Shiner	<i>Notropis roseus roseus</i>
21. Sailfin Shiner	<i>Notropis hypselopterus</i>
22. Peterson's Shiner †	<i>Notropis petersoni</i>
23. Star-Headed Topminnow	<i>Fundulus notti</i>
24. Gulf Killifish *	<i>Fundulus grandis grandis</i>
25. Spotfin Killifish *	<i>Fundulus confluentus confluentus</i>
26. Long-Nosed Killifish *	<i>Fundulus similis</i>
27. Diamond Killifish	<i>Adinia xenica</i>
28. Red-Finned Killifish	<i>Lucania goodei</i>
29. Least Killifish	<i>Heterandria formosa</i>
30. Freshwater Glass-Minnow *	<i>Menidia beryllina</i>
31. Florida Swamp Darter	<i>Etheostoma barratti</i>
32. Darter	<i>Etheostoma sp.</i>
33. Brown Darter	<i>Etheostoma edwini</i>
34. Crawl-a-Bottom	<i>Hadropterus nigrofasciatus</i>
35. Pirate Perch	<i>Aphredoderus sayanus</i>
36. Tadpole Madtom	<i>Schilbeodes mollis</i>
37. Gulf Madtom	<i>Schilbeodes leptacanthus</i>
38. Striped Mullet *	<i>Mugil cephalus</i>
39. White Mullet *	<i>Mugil curema</i>
40. Menhaden *	<i>Brevoortia smithi</i>
41. Speckled Trout *	<i>Cynoscion nebulosus</i>
42. Pinfish *	<i>Lagodon rhomboides</i>
43. Anchovy *	<i>Anchoa sp.</i>

* Marine Species.

† Outside Poison Area.

TABLE X—Continued

LIST OF FISHES COLLECTED FROM NORTH BAY AND ITS TRIBUTARIES

Common Name	Scientific Name
44. Glut Herring *	<i>Alosa aestivalis</i>
45. Redfish (Channel Bass) *	<i>Sciaenops ocellatus</i>
46. Silver Perch *	<i>Bairdella chrysura</i>
47. Common Jack *	<i>Caranx hippos</i>
48. Mojarra *	<i>Eucinostomus argenteus</i>
49. Mangrove Snapper *	<i>Lutjanus griseus</i>
50. Sea Drum *	<i>Pogonias cromis</i>
51. Needlefish *	<i>Strongylura marina</i>
52. Sea Robin *	<i>Prionotus sp.</i>
53. Pipefish *	<i>Syngnathus scovelli</i>
54. Tonguefish *	<i>Symphurus plagiusa</i>
55. Hogchoker *	<i>Trinectes maculatus fasciatus</i>
56. American Eel *	<i>Anguilla rostrata</i>
57. Largemouth Goby *	<i>Microgobius gulosus</i>
58. Naked Goby *	<i>Gobiosoma boscii</i>
59. Sea Catfish *	<i>Galeichthys felis</i>
Collected with wire minnow trap—not included in report.	
60. Blacktail Shiner	<i>Notropis venustus</i>
61. Lowland Shiner	<i>Notropis cummingsae cummingsae</i>

CONCLUSIONS AND RECOMMENDATIONS

Large quantities of fresh water fishes exist in streams contiguous to North Bay. Decreasing salinities brought about by impoundment of North Bay should result in reduction of its marine species and in expansion of its fresh water fish population.

Subsequent to impoundment, periodic checks of the fish population and water quality should be conducted to detect changes which might necessitate remedial action.

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