

Table 1.—Archaeological sites (380) in the Manistee River watershed, listed by county and townships downstream from headwaters to the mouth. Data from: B. Mead, Michigan Department of State, Archaeological Section.

County and townships	Number of sites
Crawford	
Frederick	1
Beaver Creek	1
Kalkaska	
Excelsior	1
Garfield	23
Springfield	4
Missaukee	
Norwich	3
Pioneer	1
Bloomfield	9
Wexford	
Liberty	8
Greenwood	2
Hanover	3
Cedar Creek	5
Colfax	26
Antioch	16
Springville	7
Haring	4
Selma	11
Boon	30
Slagle	19
Clam Lake	5
Cherry Grove	9
Henderson	26
South Branch	27
Manistee	
Pleasanton	4
Marilla	6
Bear Lake	2
Dickson	12
Brown	21
Manistee	25
Norman	20
Stronach	23
Filer	7
Grand Traverse	
Fife Lake	8
Paradise	1

Table 1.–Continued.

County and Township	Number of sites
Osceola	
Rose Lake	1
Lake	
Dover	8
North Newkirk	1

Table 2.–List of fishes in the Manistee River watershed. Compiled by G.R. Smith, University of Michigan and Tom Rozich, Michigan Department of Natural Resources, Fisheries Division. Common family names are in bold print. Species origin: N=native; C=colonized, O=extirpated, I=Introduced. Manistee status: P=recent observation, U=historic record, current status unknown.

Common name	Scientific name	Species origin	Manistee status
Lampreys			
Chestnut lamprey	<i>Ichthyomyzon castaneus</i>	N	P
Northern brook lamprey	<i>Ichthyomyzon fossor</i>	N	P
American brook lamprey	<i>Lampetra appendix</i>	N	P
Sea lamprey	<i>Petromyzon marinus</i>	C	P
Sturgeons			
Lake sturgeon (threatened)	<i>Acipenser fulvescens</i>	N	P
Gars			
Longnose gar	<i>Lepisosteus osseus</i>	N	P
Bowfins			
Bowfin	<i>Amia calva</i>	N	P
Herrings			
Alewife	<i>Alosa pseudoharengus</i>	C	P
Gizzard shad	<i>Dorosoma cepedianum</i>	N	P
Minnows			
Central stoneroller	<i>Campostoma anomalum</i>	I	P
Lake chub (rare)	<i>Couesius plumbeus</i>	N	P
Spotfin shiner	<i>Cyprinella spiloptera</i>	N	P
Common carp	<i>Cyprinus carpio</i>	I	P
Brassy minnow	<i>Hybognathus hankinsoni</i>	N	P
Common shiner	<i>Luxilus cornutus</i>	N	P
Pearl dace	<i>Margariscus margarita</i>	N	P
Hornyhead chub	<i>Nocomis biguttatus</i>	N	P
River chub	<i>Nocomis micropogon</i>	N	P
Golden shiner	<i>Notemigonus crysoleucas</i>	N	P
Pugnose shiner (rare)	<i>Notropis anogenus</i>	N	U
Emerald shiner	<i>Notropis atherinoides</i>	N	P
Blackchin shiner	<i>Notropis heterodon</i>	N	P
Blacknose shiner	<i>Notropis heterolepis</i>	N	P
Spottail shiner	<i>Notropis hudsonius</i>	N	P
Rosyface shiner	<i>Notropis rubellus</i>	N	P
Sand shiner	<i>Notropis stramineus</i>	N	P
Mimic shiner	<i>Notropis volucellus</i>	N	P
Northern redbelly dace	<i>Phoxinus eos</i>	N	P
Finescale dace	<i>Phoxinus neogaeus</i>	N	P
Bluntnose minnow	<i>Pimephales notatus</i>	N	P
Fathead minnow	<i>Pimephales promelas</i>	N	P
Blacknose dace	<i>Rhinichthys atratulus</i>	N	P
Longnose dace	<i>Rhinichthys cataractae</i>	N	P
Creek chub	<i>Semotilus atromaculatus</i>	N	P

Table 2.–Continued.

Common name	Scientific name	Species origin	Manistee status
Suckers			
Quillback	<i>Carpionodes cyprinus</i>	N	P
Longnose sucker	<i>Catostomus catostomus</i>	N	P
White sucker	<i>Catostomus commersoni</i>	N	P
Northern hog sucker	<i>Hypentelium nigricans</i>	N	P
Silver redhorse	<i>Moxostoma anisurum</i>	N	P
Golden redhorse	<i>Moxostoma erythrurum</i>	N	P
Shorthead redhorse	<i>Moxostoma macrolepidotum</i>	N	P
Greater redhorse	<i>Moxostoma valenciennesi</i>	N	P
Bullhead catfishes			
Black bullhead	<i>Ameiurus melas</i>	N	P
Yellow bullhead	<i>Ameiurus natalis</i>	N	P
Brown bullhead	<i>Ameiurus nebulosus</i>	N	P
Channel catfish	<i>Ictalurus punctatus</i>	N	P
Tadpole madtom (rare)	<i>Noturus gyrinus</i>	N	U
Pikes			
Northern pike	<i>Esox lucius</i>	N	P
Muskellunge	<i>Esox masquinongy</i>	I	P
Tiger muskellunge	<i>Esox masquinongy x Esox lucius</i>	I	P
Mudminnows			
Central mudminnow	<i>Umbra limi</i>	N	P
Smelts			
Rainbow smelt	<i>Osmerus mordax</i>	I	P
Trouts			
Lake herring (threatened)	<i>Coregonus artedii</i>	N	P
Lake whitefish	<i>Coregonus clupeaformis</i>	N	P
Pink salmon	<i>Oncorhynchus gorbuscha</i>	C	P
Coho salmon	<i>Oncorhynchus kisutch</i>	I	P
Rainbow trout (steelhead)	<i>Oncorhynchus mykiss</i>	I	P
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	I	P
Round whitefish	<i>Prosopium cylindraceum</i>	N	P
Brown trout	<i>Salmo trutta</i>	I	P
Brook trout	<i>Salvelinus fontinalis</i>	N/C	P
Lake trout	<i>Salvelinus namaycush</i>	N	P
Splake	<i>Salvelinus fontinalis x S. namaycush</i>	I	P
Arctic grayling (extirpated)	<i>Thymallus tricolor</i>	O	
Trout-perches			
Trout perch	<i>Percopsis omiscomaycus</i>	N	P
Cods			
Burbot	<i>Lota lota</i>	N	P
Killifishes			
Banded killifish	<i>Fundulus diaphanus</i>	N	P

Table 2.–Continued.

Common name	Scientific name	Species origin	Manistee status
Silversides			
Brook silverside	<i>Labidesthes sicculus</i>	N	P
Sticklebacks			
Brook stickleback	<i>Culaea inconstans</i>	N	P
Ninespine stickleback	<i>Pungitius pungitius</i>	N	P
Sculpins			
Mottled sculpin	<i>Cottus bairdi</i>	N	P
Slimy sculpin	<i>Cottus cognatus</i>	N	P
Temperate basses			
White bass	<i>Morone chrysops</i>	N	U
Sunfishes			
Rock bass	<i>Ambloplites rupestris</i>	N	P
Green sunfish	<i>Lepomis cyanellus</i>	N	P
Pumpkinseed sunfish	<i>Lepomis gibbosus</i>	N	P
Bluegill	<i>Lepomis macrochirus</i>	N	P
Longear sunfish	<i>Lepomis megalotis</i>	N	P
Smallmouth bass	<i>Micropterus dolomieu</i>	N	P
Largemouth bass	<i>Micropterus salmoides</i>	N	P
Black crappie	<i>Pomoxis nigromaculatus</i>	N	P
Perches			
Rainbow darter	<i>Etheostoma caeruleum</i>	N	P
Iowa darter	<i>Etheostoma exile</i>	N	P
Johnny darter	<i>Etheostoma nigrum</i>	N	P
Yellow perch	<i>Perca flavescens</i>	N	P
Logperch	<i>Percina caprodes</i>	N	P
Blackside darter	<i>Percina maculata</i>	N	P
Walleye	<i>Stizostedion vitreum</i>	N	P
Drums			
Freshwater drum	<i>Aplodinotus grunniens</i>	N	P

Table 3.—Non-indigenous fish species in the Manistee River. Data from: Michigan Department of Natural Resources, Fisheries Division.

Common name	Scientific name
Sea lamprey	<i>Petromyzon marinus</i>
Alewife	<i>Alosa pseudoharengus</i>
Central stoneroller	<i>Campostoma anomalum</i>
Common carp	<i>Cyprinus carpio</i>
Muskellunge	<i>Esox masquinongy</i>
Tiger muskellunge	<i>Esox masquinongy x Esox lucius</i>
Rainbow smelt	<i>Osmerus mordax</i>
Pink salmon	<i>Oncorhynchus gorbuscha</i>
Coho salmon	<i>Oncorhynchus kisutch</i>
Rainbow trout	<i>Oncorhynchus mykiss</i>
Chinook salmon	<i>Oncorhynchus tshawytscha</i>
Brown trout	<i>Salmo trutta</i>
Splake	<i>Salvelinus fontinalis x Salvelinus namaycush</i>

Table 4.–Fish stocking in the Manistee River, 1984-93. Sites are listed from headwaters to the mouth. Data from: Michigan Department of Natural Resources, Fisheries Division. Fish life stage: Fr=fry; SF=spring fingerlings; FF=fall fingerlings; Y=yearlings; A=adults.

County and common name	Stocking location	Years	Number (fish life stage)	Comments
Crawford				
Brown trout	Manistee River	84-93	58,543 (Y)	good fishery
Grayling	Manistee River	87,88	27,634 (Y)	experimental plant
Rainbow trout	Manistee River	84-86, 90	5,724 (Y)	supplemental plant
Northern pike	Lake Margrethe	84-90, 93	38,831 (SF)	on-going
Tiger muskellunge	Lake Margrethe	85-91	40,037 (FF)	on-going
Muskellunge	Lake Margrethe	90	151 (FF)	rearing pond experiment
Walleye	Lake Margrethe	84-88, 90	294,072 (SF)	on-going
Walleye	Lake Margrethe	92, 93	3.61 million (Fr)	fry plants
Walleye	Lake Margrethe	93	397 (A)	on-going
Hybrid sunfish	Howes Lake	86, 89	9,600 (Y)	create a fishery
Largemouth bass	Howes Lake	88	41 (A)	create a fishery
Kalkaska				
Brown trout	Manistee River	84-93	4,908 (A)	on-going
Brown trout	Manistee River	84-93	216,081 (Y)	on-going
Brown trout	Manistee River	84-93	72,107 (FF)	on-going
Brown trout	Bear Lake	84-93	144,353 (Y)	excellent fishery
Brown trout	Big Twin Lake	84-93	50,090 (Y)	good fishery
Brown trout	Starvation Lake	84-93	11,220 (Y)	good fishery
Grayling	Manistee River	87	13,139 (Y)	experimental plant
Brook trout	Manistee River	91-93	500 (A)	on-going
Brook trout	Manistee River	85-93	38,850 (Y)	on-going
Rainbow trout	Manistee River	84-86, 88-90, 92	18,466 (A)	on-going
Rainbow trout	Manistee River	84-86, 88-90, 92	1,500 (Y)	on-going
Rainbow trout	Starvation Lake	86-89, 91-93	7,440 (Y)	on-going
Rainbow trout	Rainbow Lake	84-86	1,390 (Y)	dropped
Rainbow trout	Big Blue Lake	87-91	9,659 (Y)	on-going
Rainbow trout	Bass Lake	88-93	7,559 (Y)	on-going
Lake trout	Big Blue Lake	90, 92-93	6,800 (Y)	on-going
Lake trout	Big Twin Lake	84	400 (A)	one-time plant
Splake	Big Blue Lake	85, 87, 89-93	17,488 (F)	on-going
Walleye	Manistee Lake	85, 87, 90, 93	100,708 (SF)	on-going
Walleye	Cub Lake	90, 93	9,052 (SF)	on-going
Walleye	East Lake	90	9,644 (SF)	on-going
Walleye	Pickeral Lake	90, 92	8,504 (SF)	on going
Missaukee				
Brown trout	Manistee River	88, 90-93	36,112 (FF)	good fishery
Wexford				
Brown trout	Manistee River	84-93	76,037 (Y)	good fishery
Brown trout	Manistee River	86-93	60,216 (FF)	co-op program
Brown trout	Soper Creek	89	2,000 (FF)	one time plant
Rainbow trout	Lake Billings	84-86	4,950 (Y)	dropped
Rainbow trout	Garlets Pond	84-85	2,450 (Y)	dropped
Rainbow trout	Burkett Creek	85	120 (Y)	dropped
Walleye	Hodenpyl Dam	89, 92	97,547 (SF)	good fishery
Channel catfish	Hodenpyl Dam	88, 91	47,154 (FF)	good fishery

Table 4.–Continued.

County and common name	Stocking location	Years	Number (fish life stage)	Comments
Manistee				
Brown trout	Manistee River	84-93	470,610 (Y)	good fishing
Brown trout	Pine Lake	84-93	43,122 (Y)	on-going
Steelhead, winter & summer	Manistee River	84-93	520,232 (Y)	excellent fishery
Chinook salmon	Manistee River	84-93	1,066,331 (SF)	good fishery
Coho salmon	Manistee River	93	110,030 (Y)	on-going
Walleye	Tippy Dam	84-85, 92	65,951 (SF)	good fishery
Walleye	Tippy Dam	84-85	297,500 (Fr)	good fishery
Walleye	Bear Lake	84-86, 89-91, 93	99,989 (SF)	good fishery
Channel catfish	Tippy Dam	88, 91	36,530 (FF)	on-going
Grand Traverse				
Walleye	Fife Lake	84-86, 88, 92	91,309 (FF)	good fishery
Osceola				
Walleye	Rose Lake	85, 88, 91	61,454 (SF)	good fishery

Table 5.—Natural features of the Manistee River watershed, listed from headwaters to the mouth. Data from: Michigan Department of Natural Resources, Wildlife Division, Natural Features Inventory, July 1990. Type: A=vertebrate animal; C=plant community; G=geological feature; I=invertebrate animal; O=other feature (rookery, champion tree); P=plant. Status: E=endangered; T=threatened; SC=special concern (rare, may become E or T in the future); P=proposed.

County and common name	Scientific name or feature	Type	Federal status	State status
Otsego				
Prairie or pale agoseris	<i>Agoseris glauca</i>	P		T
Arethusa or dragon's mouth	<i>Arethusa bulbosa</i>	P		SC
Red-shouldered hawk	<i>Buteo lineatus</i>	A		T
Wapiti or elk	<i>Cervus elaphus</i>	A		
Hill's thistle	<i>Cirsium hillii</i>	P		SC
Spotted turtle	<i>Clemmys guttata</i>	A		SC
Wood turtle	<i>Clemmys insculpta</i>	A		SC
Ram's head lady-slipper	<i>Cypripedium arietinum</i>	P		SC
Rough fescue	<i>Festuca scabrella</i>	P		T
Common loon	<i>Gavia immer</i>	A		T
Bald eagle	<i>Haliaeetus leucocephalus</i>	A	E/T	T
Geographical feature	Karst	G		
Marten	<i>Martes americana</i>	A		T
Spike-lipped crater	<i>Mesodon sayanus</i>	I		SC
Geographical feature	Moraine	G		
Pugnose shiner	<i>Notropis anogenus</i>	A		SC
Blazing Star borer	<i>Papaipema beeriana</i>	I		SC
Hill's pondweed	<i>Potamogeton hillii</i>	P		T
Grizzled skipper	<i>Pyrgus wyandot</i>	I		SC
Crawford County				
Prairie or pale Agoseris	<i>Agoseris glauca</i>	P		T
Secretive locust	<i>Appalachia arcana</i>	I		SC
Dusted skipper	<i>Atrytonopsis hianna</i>	I		SC
Calypso or fairy-slipper	<i>Calypso bulbosa</i>	P		T
Hill's thistle	<i>Cirsium hillii</i>	P		SC
Wood turtle	<i>Clemmys insculpta</i>	A		SC
False-violet	<i>Dalibarda repens</i>	P		T
Kirtland's warbler	<i>Dendroica kirtlandii</i>	A	E	E
	Dry-mesic northern forest	C		
Dry woodland, upper Midwest type	Dry northern forest	C		
Rough fescue	<i>Festuca scabrella</i>	P		T
Common loon	<i>Gavia immer</i>	A		T
Great blue heron rookery	Great blue heron rookery	O		
Bald eagle	<i>Haliaeetus leucocephalus</i>	A	E/T	T
Henry's Elfyn	<i>Incisalia henrici</i>	I		SC
Woodland vole	<i>Microtus pinetorum</i>	A		SC
Alleghany or sloe plum	<i>Prunus alleghaniensis var davisii</i>	P		SC
Grizzled skipper	<i>Pyrgus wyandot</i>	I		SC
Massasauga	<i>Sistrurus catenatus</i>	A		SC
Houghton's goldenrod	<i>Solidago houghtonii</i>	P	T	T

Table 5.–Continued.

County and common name	Scientific name or feature	Type	Federal status	State status
Kalkaska				
Arethusa or dragon's mouth	<i>Arethusa bulbosa</i>	P		SC
Hill's thistle	<i>Cirsium hillii</i>	P		SC
Spotted turtle	<i>Clemmys guttata</i>	A		SC
Wood turtle	<i>Clemmys insculpta</i>	A		SC
Kirtland's warbler	<i>Dendroica kirtlandii</i>	A	E	E
Common loon	<i>Gavia immer</i>	A		T
Great blue heron rookery	Great blue heron rookery	O		
Bald eagle	<i>Haliaeetus leucocephalus</i>	A	E/T	T
Osprey	<i>Pandion haliaetus</i>	A		T
Eastern Flat-whorl	<i>Planogyra asteriscus</i>	I		SC
Hill's pondweed	<i>Potamogeton hillii</i>	P		T
Massasauga	<i>Sistrurus catenatus</i>	A		SC
Missaukee				
Secretive locust	<i>Appalachia arcana</i>	I		SC
Wood turtle	<i>Clemmys insculpta</i>	A		SC
Common loon	<i>Gavia immer</i>	A		T
Great blue heron rookery	Great blue heron rookery	O		
Bald eagle	<i>Haliaeetus leucocephalus</i>	A	E/T	T
Loggerhead shrike	<i>Lanius ludovicianus migrans</i>	A		E
Marten	<i>Martes americana</i>	A		T
Eastern Flat-whorl	<i>Planogyra asteriscus</i>	I		SC
Hill's pondweed	<i>Potamogeton hillii</i>	P		T
Wexford				
Arethusa or dragon's mouth	<i>Arethusa bulbosa</i>	P		SC
	Bog	C		
Wood turtle	<i>Clemmys insculpta</i>	A		SC
Common loon	<i>Gavia immer</i>	A		T
Great blue heron rookery	Great blue heron rookery	O		
	Hardwood-conifer swamp	C		
Geographical feature	Kame	G		
	Landscape complex	C		
Marten	<i>Martes americana</i>	A		T
Virginia bluebells	<i>Mertensia virginica</i>	P		T
	Mesic northern forest	C		
Scrub bog, Upper Midwest type	Muskeg	C		
Wet meadow, Upper Midwest type	Northern wet meadow	C		
Ginseng	<i>Panax quinquefolius</i>	P		T
	Rich conifer swamp	C		
Manistee				
Lake sturgeon	<i>Acipenser fulvescens</i>	A		T
Geographical feature	Bluff	G		
	Bog	C		
Red-Shouldered hawk	<i>Buteo lineatus</i>	A		T
American beech (<i>Fagus grandifolia</i>)	Champion tree	O		
Northern harrier	<i>Circus cyaneus</i>	A		SC
Pitcher's thistle	<i>Cirsium pitcheri</i>	P	T	T
Wood turtle	<i>Clemmys insculpta</i>	A		SC
	Dry-mesic northern forest	C		

Table 5.–Continued.

County and common name	Scientific name or feature	Type	Federal status	State status
Manistee continued				
Great blue heron rookery	Great blue heron rookery	O		
	Emergent marsh	C		
	Great Lakes marsh	C		
Bald eagle	<i>Haliaeetus leucocephalus</i>	A	E/T	T
Dwarf-bulrush	<i>Hemicarpha micrantha</i>	P		SC
Infertile pond/marsh, Gt. Lk. type	Intermittent wetland	C		
Shrub swamp, Central Midwest type	Inundated shrub swamp	C		
Least pinweed	<i>Lechea minor</i>	P		SC
Marten	<i>Martes americana</i>	A		T
	Mesic northern forest	C		
Wet meadow, upper Midwest type	Northern west meadow	C		
Pugnose shiner	<i>Notropis anogenus</i>	A		SC
Barrens, Central Midwest type	Oak barrens	C		
Beach/shoredunes, Great Lakes type	Open dunes	C		
Clustered broom-rape	<i>Orobanche fasciculata</i>	P		T
Ginseng	<i>Panax quinquefolius</i>	P		T
Brown walker	<i>Pomatiopsis cincinnatiensis</i>	I		SC
	Poor conifer swamp	C		
Alleghany or Sloe plum	<i>Prunus alleghaniensis var davisii</i>	P		SC
King rail	<i>Rallus elegans</i>	A		E
	Rich conifer swamp	C		
Massasauga	<i>Sistrurus catenatus</i>	A		SC
	Southern floodplain forest	C		
	Southern swamp	C		
	Submergent marsh	C		
Lake Huron locust	<i>Trimerotropis huroniana</i>	I		PT
Grand Traverse				
Arethusa or dragon's mouth	<i>Arethusa bulbosa</i>	P		SC
	Bog	C		
Red-Shouldered hawk	<i>Buteo lineatus</i>	A		T
American chestnut (<i>Castanea dentata</i>)	Champion tree	O		
Basswood (<i>Tilia americana</i>)	Champion tree	O		
Black willow (<i>Salix nigra</i>)	Champion tree	O		
Eastern red-cedar (<i>Juniperus virginiana</i>)	Champion tree	O		
Ironwood, Hop-Hornbeam (<i>Ostrya virginiana</i>)	Champion tree	O		
Rock Elm, Cork Elm (<i>Ulmus thomasii</i>)	Champion tree	O		
Hill's thistle	<i>Cirsium hillii</i>	P		SC
Pitcher's thistle	<i>Cirsium pitcheri</i>	P	T	T
Wood turtle	<i>Clemmys insculpta</i>	A		SC
	Dry-mesic northern forest	C		
Dry woodland, upper Midwest type	Dry northern forest	C		
	Emergent marsh	C		
Common loon	<i>Gavia immer</i>	A		T
	Great Lake marsh	C		
Bald eagle	<i>Haliaeetus leucocephalus</i>	A	E/T	T
	Hardwood-conifer swamp	C		
Loggerhead shrike	<i>Lanius ludovicianus migrans</i>	A		E

Table 5.–Continued.

County and common name	Scientific name or feature	Type	Federal status	State status
Grand Traverse continued				
Marten	<i>Martes americana</i>	A		T
	Mesic northern forest	C		
Alkaline shrub/herb, upper Midwest type	Northern fen	C		
Osprey	<i>Pandion haliaetus</i>	A		T
King rail	<i>Rallus elegans</i>	A		E
	Rich conifer swamp	C		
Lake Huron tansy	<i>Tanacetum huronense</i>	P		T
	Wooded dune & swale complex	C		
Osceola				
Wood turtle	<i>Clemmys insculpta</i>	A		SC
Common loon	<i>Gavia immer</i>	A		T
Great blue heron rookery	Great blue heron rookery	O		
Geographical feature	Kettle	G		
Marten	<i>Martes americana</i>	A		T
Osprey	<i>Pandion haliaetus</i>	A		T
Lake				
Dense long-beaked sedge	<i>Carex sychnocephala</i>	P		T
Larch, Tamarack (<i>Larix laricina</i>)	Champion tree	O		
Hill's thistle	<i>Cirsium hillii</i>	P		SC
Spotted turtle	<i>Clemmys guttata</i>	A		SC
Wood turtle	<i>Clemmys insculpta</i>	A		SC
	Dry-mesic northern forest	C		
Dry sand prairie, Midwest type	Dry sand prairie	C		
Watercress snail	<i>Fontigens nickliniana</i>	I		SC
Common loon	<i>Gavia immer</i>	A		T
Great blue heron rookery	Great blue heron rookery	O		
Bald eagle	<i>Haliaeetus leucocephalus</i>	A	E/T	T
Dwarf-bulrush	<i>Hemicarpha micrantha</i>	P		SC
Karner blue	<i>Lycaeides samuelis</i>	I		PT
Marten	<i>Martes americana</i>	A		T
Moist sand prairie, Midwest type	Mesic sand prairie	C		
Barrens, upper Midwest type	Pine barrens	C		
Bog bluegrass	<i>Poa paludigena</i>	P		T
	Poor conifer swamp	C		
Alleghany or Sloe plum	<i>Prunus alleghaniensis var davisii</i>	P		SC
	Rich conifer swamp	C		
Massasauga	<i>Sistrurus catenatus</i>	A		SC
	Southern floodplain forest	C		
	Southern swamp	C		
	Bog	C		

Table 6.—Amphibians and reptiles in the Manistee River watershed, that require aquatic environment. Data from: Greg Schneider, University of Michigan.

Common name	Scientific name
Salamanders	
Spotted salamander	<i>Ambystoma maculatum</i>
Blue-spotted hybrid	<i>Ambystoma laterale</i>
Tiger salamander	<i>Ambystoma tigrinum</i>
Four-toed salamander	<i>Hemidactylium scutatum</i>
Mudpuppy	<i>Necturus maculosus</i>
Red-spotted newt	<i>Notophthalmus viridescens</i>
Red-backed newt	<i>Plethodon cinereus</i>
Lizards	
Five-lined skink	<i>Eumeces fasciatus</i>
Frogs	
American toad	<i>Bufo americanus</i>
Fowler's toad	<i>Bufo woodhousii</i>
Spring peeper	<i>Hyla crucifer</i>
Gray tree frog	<i>Hyla chrysoscelis</i>
Chorus frog	<i>Pseudacris triseriata</i>
Bullfrog	<i>Rana catesbeiana</i>
Green frog	<i>Rana clamitans</i>
Pickeral frog	<i>Rana palustris</i>
Leopard frog	<i>Rana pipiens</i>
Wood frog	<i>Rana sylvatica</i>
Turtles	
Softshell	<i>Apalone spinifera</i>
Snapping turtle	<i>Chelydra serpentina</i>
Painted turtle	<i>Chrysemys picta</i>
Spotted turtle	<i>Clemmys guttata</i>
Wood turtle	<i>Clemmys insculpta</i>
Blanding's turtle	<i>Emydoidea blandingii</i>
Map turtle	<i>Graptemys geographica</i>
Eastern box turtle	<i>Terrapene carolina</i>
Snakes	
Northern black racer	<i>Coluber constrictor</i>
Ringneck snake	<i>Diadophis punctatus</i>
Hognose snake	<i>Heterodon platyrhinos</i>
Milk snake	<i>Lampropeltis triangulum</i>
Water snake	<i>Nerodia sipedon</i>
Smooth green snake	<i>Opheodrys vernalis</i>
Queen snake	<i>Regina septemvittata</i>
Massasauga	<i>Sistrurus catenatus</i>
Brown snake	<i>Storeria dekayi</i>
Red-bellied snake	<i>Storeria occipitomaculata</i>
Ribbon snake	<i>Thamnophis sauritus</i>
Garter snake	<i>Thamnophis sirtalis</i>

Table 7. Common and scientific names of species referred to in text.

Common name	Scientific name
Fish	
Sea lamprey	<i>Petromyzon marinus</i>
Northern brook lamprey	<i>Ichthyomyzon fossor</i>
Chestnut lamprey	<i>Ichthyomyzon castaneus</i>
Lake sturgeon	<i>Acipenser fulvescens</i>
Alewife	<i>Alosa pseudoharengus</i>
Common carp	<i>Cyprinus carpio</i>
Pugnose shiner	<i>Notropis anogenus</i>
Blacknose dace	<i>Rhinichthys atratulus</i>
Longnose dace	<i>Rhinichthys cataractae</i>
Creek chub	<i>Semotilus atromaculatus</i>
White sucker	<i>Catostomus catostomus</i>
Silver redhorse	<i>Moxostoma anisurum</i>
Shorthead redhorse	<i>Moxostoma macrolepidotum</i>
Channel catfish	<i>Ictalurus punctatus</i>
Flathead catfish	<i>Pylodictis olivaris</i>
Northern pike	<i>Esox lucius</i>
Muskellunge	<i>Esox masquinongy</i>
Lake herring	<i>Coregonus artedi</i>
Lake whitefish	<i>Coregonus clupeaformis</i>
Coho salmon	<i>Oncorhynchus kisutch</i>
Rainbow trout (steelhead)	<i>Oncorhynchus mykiss</i>
Chinook salmon	<i>Oncorhynchus tshawytscha</i>
Round whitefish	<i>Prosopium cylindraceum</i>
Brown trout	<i>Salmo trutta</i>
Brook trout	<i>Salvelinus fontinalis</i>
Tiger trout	<i>Salvelinus fontinalis x Salmo trutta</i>
Lake trout	<i>Salvelinus namaycush</i>
Arctic grayling	<i>Thymallus arcticus</i>
Trout-perch	<i>Percopsis omiscomaycus</i>
Burbot	<i>Lota lota</i>
Mottled sculpin	<i>Cottus bairdi</i>
Slimy sculpin	<i>Cottus cognatus</i>
Rock bass	<i>Ambloplites rupestris</i>
Green sunfish	<i>Lepomis cyanellus</i>
Warmouth	<i>Lepomis gulosus</i>
Pumpkinseed	<i>Lepomis gibbosus</i>
Bluegill	<i>Lepomis macrochirus</i>
Smallmouth bass	<i>Micropterus dolomieu</i>
Largemouth bass	<i>Micropterus salmoides</i>
Black crappie	<i>Pomoxis nigromaculatus</i>
Yellow perch	<i>Perca flavescens</i>
Walleye	<i>Stizostedion vitreum</i>

Table 7.–Continued.

Common name	Scientific name
Aquatic invertebrates	
European spiny water flea	<i>Bythotrephes cederstroemi</i>
Rusty crayfish	<i>Orconectes rusticus</i>
Giant mayfly	<i>Hexagenia limbatta</i>
Stoneflies	<i>Plecoptera spp.</i>
Caddisflies	<i>Trichoptera spp.</i>
Mussels	
Zebra mussels	<i>Dreissena polymorpha</i>
Amphibians and reptiles	
Spotted turtle	<i>Clemmys guttata</i>
Wood turtle	<i>Clemmys insculpta</i>
Massasauga rattlesnake	<i>Sistrurus catenatus</i>
Mammals	
Woodland vole	<i>Microtus pinetorum</i>
White-tail deer	<i>Odocoileus virginianus</i>
Beaver	<i>Castor canadensis</i>
Elk	<i>Cervus canadensis</i>
Muskrat	<i>Ondatra zibethica</i>
Raccoon	<i>Procyon lotor</i>
River otter	<i>Lutra canadensis</i>
Mink	<i>Mustela vison</i>
Pine martin	<i>Martes americana</i>
Avians	
Great blue heron	<i>Ardea herodias</i>
Red shouldered hawk	<i>Buteo lineatus</i>
Common loon	<i>Gavia immer</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>
King rail	<i>Rallus elegans</i>
Kirtland's warbler	<i>Dendrocia kirtlandii</i>
Loggerhead shrike	<i>Lanius ludovicianus migrans</i>
Northern harrier hawk	<i>Circus cyaneus</i>
Osprey	<i>Pandion haliaetus</i>
Pileated woodpecker	<i>Dryocopus pileatus</i>
Mute swan	<i>Cygnus olor</i>
Insects	
Gypsy moth	<i>Porthoeivia dispar</i>
Forest tent caterpillar	<i>Malacosoma disstria</i>
Spruce budworm	<i>Choristoneura fumiferana</i>
Jack pine budworm	<i>Choristoneura pinus pinus</i>
Plants	
Purple loosestrife	<i>Lythrum salicaria</i>
Eurasian milfoil	<i>Myriophyllum sp.</i>

Table 8.—Manistee River gradient expressed as a change in elevation (ft/mi) from headwaters to mouth. Data from: Michigan Department of Natural Resources, Fisheries Division.. Class codes: R=river; H=impoundment created by operating hydroelectric facility. PAS=public access site.

River mile	Class code	Distance (mile)	Gradient (ft/mile)	Comments
202.67				Origin Antrim County
201.99	R	0.68	14.58	
200.05	R	1.94	5.08	
198.51	R	1.53	6.42	
197.22	R	4.29	7.63	
195.54	R	1.69	5.84	
194.72	R	0.82	12.02	
192.87	R	1.85	5.31	
190.98	R	1.88	5.22	
188.84	R	2.14	4.59	
184.51	R	4.33	2.31	County Road 612
178.51	R	6.00	1.67	M-72 Highway
175.75	R	2.76	3.62	
173.34	R	2.41	4.14	
170.92	R	2.42	4.13	
167.02	R	3.85	2.60	
162.52	R	4.55	2.20	
161.52	R	1.00	9.81	
158.93	R	2.59	3.80	
156.21	R	2.72	3.61	
154.53	R	1.67	5.88	
152.78	R	1.76	5.60	Sharon
147.77	R	5.00	1.97	
142.56	R	5.22	1.89	Smithville
139.84	R	2.71	3.63	
132.65	R	5.78	1.70	
128.43	R	1.41	6.96	
129.91	R	2.74	3.59	
126.74	R	3.17	3.11	PAS
125.04	R	1.71	5.77	
119.98	R	5.06	1.95	
117.55	R	2.43	4.05	
112.20	R	5.35	1.84	
108.37	R	3.83	2.57	Manton
104.38	R	3.98	2.47	
101.95	R	2.43	4.05	Baxter Bridge PAS
97.60	R	4.36	2.26	
94.83	R	2.77	3.55	
88.75	R	6.08	1.62	
85.95	R	2.80	3.52	
83.38	R	2.57	3.83	Harvey Bridge PAS
77.66	R	5.72	1.72	M-37 Highway

Table 8.—Continued.

River mile	Class code	Distance (mile)	Gradient (ft/mile)	Comments
76.88	R	0.78		
65.49	H	11.39	2.37	Hodenpyl Impoundment
63.45	H	2.04	4.90	Hodenpyl Impoundment
59.96	H	3.49	2.94	Hodenpyl Impoundment
58.08	H	1.88	10.80	Hodenpyl Impoundment
57.65	R	0.43	8.77	
56.40	R	1.25	7.88	
55.30	R	1.10	8.95	
53.26	R	2.04	4.98	
51.28	R	1.98	4.98	
47.66	R	3.62	2.72	
29.26	H	18.40	2.82	Tippy Dam Impoundment
25.03	R	4.23	4.65	From Tippy Dam tailwater to contour 186
16.81	R	8.22	1.20	PAS
10.40	R	6.41	1.54	Rainbow Bend PAS
6.61	R	3.80	1.30	
0.00	R	6.61	0.74	Hwy M-55 bridge

Table 9.–Pine River gradient expressed as a change in elevation (ft/mi) from headwaters to confluence with mainstem. Data from: Michigan Department of Natural Resources, Fisheries Division. Class codes: R=river; H= impoundment created by operating hydroelectric facility; I=impoundment created by a dam. PAS=public access site.

River mile	Class code	Distance (mile)	Gradient (ft/mile)	Comments
52.22	R	1.35	7.30	Confluence of East & North Branches
51.12	R	1.10	8.97	PAS
50.00	R	1.12	8.81	
48.66	R	1.34	7.33	PAS and Sprague Creek
47.31	R	1.35	7.31	Norman Road
45.53	R	1.98	4.97	Beaver Creek
43.96	R	1.37	7.19	Edgetts Bridge
42.13	R	1.84	5.36	PAS
40.83	R	1.30	7.57	PAS
40.35	R	0.47	20.74	
39.50	R	0.85	11.57	Coe Creek, Meadowbrook Bridge PAS
38.17	R	1.33	7.42	
36.64	R	1.53	6.42	Skookum Road and PAS
35.58	R	1.06	9.27	Footbridge Crossing
34.60	R	0.98	10.08	Sellers Creek
33.78	R	0.82	12.02	
32.39	R	1.39	7.06	Side Pond in Section 19
30.96	R	1.43	6.88	State Road and Walker Bridge
28.83	R	2.13	10.78	Silver Creek & Campground
27.03	R	1.9	9.15	Lincoln Bridge PAS & Elm Creek
22.96	R	4.08	4.02	Poplar Creek & PAS
20.82	R	2.13	6.15	Hoxey Creek
20.46	R	0.36	27.32	Section 34
18.90	R	1.56	6.31	Number. 50 road crossing & PAS
17.91	R	0.99	9.93	
16.91	R	1.00	9.86	Number. 48 1/2 road crossing
15.64	R	1.27	7.73	
14.90	R	0.74	13.33	
14.16	R	0.74	13.24	
13.02	R	1.14	8.66	M37 and MDNR PAS
12.44	R	0.58	16.85	
11.40	R	1.04	9.46	
11.03	R	0.37	26.82	
10.45	R	0.58	16.94	
9.84	R	0.61	16.19	
8.80	R	1.05	9.42	Section 23 Line
7.37	R	1.43	6.89	
6.22	R	1.15	3.52	Stronach Dam influence zone to impoundment
4.13	I	0.52	17.17	Stronach Impoundment
3.83	I	0.30	10.38	Stronach Impoundment
3.67	R	0.16	17.74	Stronach Dam Tailwater

Table 9.–Continued.

River mile	Class code	Distance (mile)	Gradient (ft/mile)	Comments
3.09	H	0.58	13.93	Tippy Impoundment - Section 17 Line
2.76	H	0.33	15.59	Tippy Impoundment
2.61	H	0.15	25.42	Tippy Impoundment
2.26	H	0.35	6.41	Tippy Impoundment - Section 8 Line
1.26	H	1.00	5.99	Tippy Impoundment
0.60	H	0.67	14.93	Tippy Impoundment
0.0	H	0.60	7.03	Tippy Impoundment - Manistee River confluence

Table 10.—Erosion sites by reach for the Manistee River (mainstem), Bear Creek and Pine River. Data from: Northwest Michigan Streambank Erosion Inventory, US Department of Agriculture, Soil Conservation Service, 1986. Br.=Bridge.

Reach	Length (mile)	Minor	Moderate	Severe	Total sites	Sites per mile
MANISTEE RIVER						
M-72 to Sharon	33	5	1	0	6	0.2
Sharon to Smithville	12	11	1	0	12	1.0
Smithville to Missaukee Br.	22	11	15	4	30	1.4
Missaukee Br. to Baxter Br.	38	8	23	15	46	1.2
Baxter Br. to Harvey Br.	27	6	20	45	71	2.6
Harvey Br. to Hodenpyl Dam Backwaters	26	2	7	1	10	0.4
Hodenpyl Dam to Tippy Dam Backwaters	7	0	2	62	64	9.1
Tippy Dam to Manistee Lk.	26	4	13	15	32	1.2
Manistee Lk. to Lk Michigan	2	3	9	0	12	0.8
Totals	193	50	91	142	283	1.5
BEAR CREEK						
9 Mile Rd. to Milks Rd.	2	7	15	0	22	11
Milks Rd to Coates	6	8	29	13	50	8.3
Coates to Griffith Rd.	2	5	3	2	10	5
Totals	10	20	47	15	82	8.2
PINE RIVER						
LeRoy, Osceola Co. to Skookum Br. in Dover Twnshp, Lake Co.	16	17	19	4	40	2.5
Ne-Bo-Shone Assoc. to Lincoln Br.	9	27	21	6	54	6.0
Lincoln Br. to Lake-Wexford Co. Line	5	5	5	2	12	2.4
Lake-Wexford Co line to Wexford-Manistee Co. Line	13	13	29	43	85	6.5
Wexford-Manistee line to Tippy Dam backwaters	6	15	27	23	65	10.8
Totals	49	77	101	78	256	5.2

Table 11.—Channel width analysis for the reach from Tippy Dam to below High Bridge Road. E transects were 1,300 ft downstream of Tippy Dam. F transects were 8,000 ft downstream of Tippy Dam. G transects were 13,000 ft downstream of Tippy Dam. H transects were 20,000 ft downstream of Tippy Dam. I transects were 1,000 ft downstream of High Bridge Road. Width is measured width. Lower limit is the lower bound of theoretical width at discharge. Mean width is the theoretical mean width at discharge. Upper limit is the upper bound of theoretical width at discharge. Difference is the difference between measured width and theoretical width. Status states if measured data is within theoretical bounds. Data from: Lawler, Matusky & Skelly 1991.

Location	Width (ft)	Lower limit(ft)	Mean width(ft)	Upper limit(ft)	Difference (ft)	Status
E1	220.5	168.4	247.8	364.8	-25.0	OK
E2	197.2	168.4	247.8	364.8	-49.4	OK
F1	215.7	155.3	227.5	333.4	-8.3	OK
F2	174.7	154.0	225.5	330.3	-48.9	OK
F3	175.9	156.7	229.7	336.7	-51.1	OK
F4	196.5	158.0	231.8	339.9	-33.2	OK
F5	207.4	161.6	237.4	348.6	-27.0	OK
F6	202.0	163.7	240.6	353.7	-34.8	OK
G3	214.2	161.9	237.8	349.3	-35.6	OK
G4	157.8	164.2	241.3	354.7	-83.6	Too narrow
G5	170.0	155.7	228.2	334.5	-55.9	OK
G6	172.7	157.4	230.8	338.4	-57.4	OK
H2	169.0	166.0	244.2	359.2	-72.4	OK
H3	179.1	152.0	222.4	325.4	-42.3	OK
H4	143.8	163.0	239.6	352.0	-92.6	Too narrow
H5	160.4	168.0	247.2	363.8	-83.4	Too narrow
H6	186.7	164.3	241.5	355.0	-54.0	OK
I1	246.7	164.5	241.9	355.6	16.9	OK
I2	194.0	160.7	236.0	346.4	35.6	OK
I3	290.7	164.4	241.7	366.3	43.2	OK
I4	313.4	176.7	260.8	385.0	82.6	OK

Table 12.—Channel width analysis for reach below Hodenpyl Dam to Slagle Creek. P transects were 18,000 ft downstream of Hodenpyl Dam. Q transects were 23,000 ft downstream of Hodenpyl Dam. R transects were located at the mouth of Slagle Creek (29,000 ft downstream of dam). Width is measured width. Lower limit is the lower bound of theoretical width at discharge. Mean width is theoretical mean width at discharge. Upper limit is the upper bound of theoretical width at discharge. Difference is the difference between measured and theoretical width. Status states if measured data is within theoretical bounds. Data from: Lawler, Matusky & Skelly 1991.

Location	Width (ft)	Lower limit (ft)	Mean width (ft)	Upper limit (ft)	Difference	Status
P1	122.4	128.1	185.6	269.0	-58.6	Too narrow - 1.1 ft
P2	107.9	127.5	184.7	267.5	-77.3	Too narrow - 20.1 ft
P3	130.6	135.0	196.2	285.1	-59.7	OK
P4	166.6	131.7	191.2	277.5	-21.6	OK
P5	136.6	125.6	181.7	263.1	-43.6	OK
P6	99.3	128.1	185.6	269.0	-80.7	Too narrow - 23.2 ft
Q1	146.5	145.8	212.9	310.8	-60.9	OK
Q2	149.1	149.2	218.1	318.8	-65.3	OK
Q3	124.6	141.9	206.8	301.5	-80.9	Too narrow - 16.0 ft
Q4	128.3	141.0	205.5	299.4	-59.3	OK
Q5	157.9	139.7	203.5	296.4	-43.7	OK
Q6	192.8	142.5	207.7	302.8	-105.1	Too narrow - 39.9 ft
Q7	199.2	151.0	220.8	323.0	-18.4	OK
Q8	116.6	139.7	203.5	296.4	-81.7	Too narrow - 12.9 ft
R1	108.7	140.4	204.5	297.9	-76.0	Too narrow - 11.9 ft
R2	123.9	141.1	205.6	299.6	-72.9	Too narrow - 8.4 ft
R3	120.0	143.5	209.3	305.3	-89.6	Too narrow - 23.8 ft
R4	120.0	144.9	211.5	308.7	-91.8	Too narrow - 25.2 ft
R5	101.4	144.3	210.5	307.1	-104.0	Too narrow - 37.8 ft
R6	123.3	143.1	208.7	304.4	-82.7	Too narrow - 17.1 ft
R7	132.9	143.0	208.6	304.1	-70.6	Too narrow - 5.0 ft

Table 13.—Channel width analysis for minor Manistee River tributaries. Transect is data collection site. Discharge column is discharge for which the data is presented. Width column is the measured width. Lower limit column is the lower bound of the theoretical width at discharge. Mean width column is the theoretical mean width at discharge. Upper limit is the upper bound of the theoretical width at discharge. Difference column is the difference between measured width and theoretical width. Status column refers to whether measured data is within theoretical bounds. Calculated width data for the Manistee River - based on IFIM data. All measurements are in feet. Data were collected by US Geological Survey.

Transect	Calculated	Theoretical	Width	Bounds		CFS	Status	Differen ce by (feet)
	Width	Mean	Differenc e	Upper	Lowe r			
Goose Creek	18.0	21.8	3.8	28.1	16.9	15.70	OK	
Portage Creek	25.0	27.5	-2.5	35.9	21.0	25.10	OK	
Big Cannon Creek	24.0	30.0	-6.0	39.4	22.8	29.90	OK	
N. Br. Manistee-Sharon	12.0	26.5	-14.5	34.5	20.3	23.30	too narrow	8.3
N. Br. Manistee-Diversion	22.5	18.9	3.6	24.3	14.8	11.90	OK	
Slagel Creek - Below hatchery	13.0	21.6	-8.6	27.9	16.8	15.60	too narrow	3.8
Slagel Creek - 120' above dam	18.5	14.8	3.7	18.7	11.7	7.28	OK	
Slagel Creek - below race	22.8	12.0	10.8	15.0	9.6	4.76	too wide	7.8
Slagel Creek - south of bridge	10.5	10.9	-0.4	13.5	8.8	3.91	OK	
Slagel Creek - above bridge	10.3	11.0	-0.8	13.7	8.9	4.01	OK	

Table 14.—Channel diversity analysis for reach from Tippy Dam to High Bridge Road. E transects were 1,300 ft downstream of Tippy Dam. F transects were 8,000 ft downstream of Tippy Dam. G transects were 13,000 ft downstream of Tippy Dam. H transects were 20,000 ft downstream of Tippy Dam. I transects were 1,000 ft downstream of High Bridge. Width is actual measured width. Discharge is cfs for which diversity is calculated. Number of samples refers to number of data points used in diversity calculation. Channel diversity is the cross-sectional diversity index value using Shannon-Wiener diversity index. Percent maximum diversity is channel diversity divided by maximum possible diversity. Number of different cells is number of different combinations of velocity and depth in cross-section. Percent different cells is the number of different combinations divided by number of samples. Data from: Lawler, Matusky & Skelly 1991.

Location	Width (ft)	Discharge (cfs)	Number of samples	Channel diversity	Percent maximum diversity	Number different cells	Percent different cells
E1	220.5	2068	36	2.70	75.4	17	47.2
E2	197.2	2068	44	3.14	82.9	26	59.1
F1	215.7	1742	53	3.08	77.5	26	49.1
F2	174.2	1712	36	3.07	85.7	23	63.9
F3	175.9	1776	36	2.93	81.8	21	58.3
F4	196.5	1808	40	2.98	80.7	25	62.5
F5	207.4	1897	21	2.75	90.3	17	81.0
F6	202.0	1950	48	3.25	84.0	29	60.4
G3	214.2	1904	43	3.20	85.0	28	65.1
G4	157.8	1960	32	3.24	93.6	28	87.5
G5	120.0	1753	35	3.23	90.9	27	77.1
G6	122.7	1293	44	3.16	83.4	28	63.6
H2	169.0	2008	34	3.02	85.5	23	67.6
H3	129.1	1664	45	3.26	85.6	24	53.3
H4	143.8	1932	29	3.03	90.0	22	75.0
H5	160.4	2058	33	3.13	89.4	26	78.8
H6	186.7	1964	38	3.48	95.8	34	89.5
I1	246.7	1970	66	3.43	82.9	41	62.1
I2	194.0	1874	47	2.98	77.5	24	51.1
I3	290.7	1966	61	3.14	76.4	30	49.2
I4	313.4	2292	67	336.00	79.8	36	53.7

Table 15.—Channel diversity analysis for reach from Hodenpyl Dam to Slagle Creek. P transects were 18,000 ft downstream of Hodenpyl Dam. Q transects were 23,000 ft downstream of Hodenpyl Dam. R transects were 29,000 ft downstream of Hodenpyl Dam just above Slagle Creek. Width is actual measured width. Discharge is cfs for which diversity is calculated. The Number of samples refers to number of data points used in diversity calculation. Channel diversity is the cross-sectional diversity index value using the Shannon-Wiener diversity index. Number of different cells is number of different combinations of velocity and depth in the cross-section. Percent different cells is number of different combinations divided by number of samples. Data from: Lawler, Matusky & Skelly 1991.

Location	Width (ft)	Discharge (cfs)	Number of samples	Channel diversity	Percent maximum diversity	Number different cells	Percent different cells
P1	122.4	1158	35	2.79	78.4	21	60.0
P2	107.9	1146	22	2.75	89.0	17	77.3
P3	130.6	1294	24	2.89	90.8	21	87.5
P4	166.6	1229	34	2.92	82.7	22	64.7
P5	136.6	1110	26	2.82	86.7	19	73.1
P6	99.3	1158	23	2.81	89.7	18	78.3
P7	131.0	1139	26	2.93	90.1	22	84.6
P8	140.0	1176	32	3.05	87.9	25	78.1
Q1	146.5	1525	21	2.84	93.3	18	85.7
Q2	149.1	1600	22	2.42	78.1	14	63.6
Q3	124.6	1439	25	2.53	78.6	16	64.0
Q4	128.3	1420	26	2.69	82.6	17	65.4
Q5	157.9	1393	30	2.52	73.9	16	53.3
Q6	192.8	1451	37	3.08	85.4	25	67.6
Q7	199.2	1641	46	3.46	90.4	35	76.1
Q8	116.6	1393	20	2.64	88.0	16	80.0
R1	108.7	1406	27	3.11	94.2	23	85.2
R2	123.9	1422	27	2.86	86.7	21	77.8
R3	120.0	1474	24	2.94	92.5	20	83.3
R4	120.0	1505	34	3.22	88.2	24	70.6
R5	101.4	1490	22	2.68	86.7	17	77.3
R6	123.3	1465	27	2.98	90.5	21	77.8
R7	132.9	1463	27	2.66	80.6	18	66.7

Table 16.—Channel diversity analysis for minor Manistee River tributaries. Location is data collection site. Discharge is cfs for which data are presented. Number of samples refers to number of data points used in diversity calculation. Channel diversity is the cross-sectional diversity index value using Shannon-Wiener diversity index. Percent maximum diversity is channel diversity divided by maximum possible diversity. Number of different cells is number of different combinations of velocity and depth in the cross-section. Percent different cells is number of different combinations divided by number of samples. Data from: US Geological Survey.

Location	Discharge (cfs)	Number of samples	Channel diversity	Percent maximum diversity	Number different cells	Percent different cells
Goose Creek	15.7	23	1.00	31.9	4	17.4
Portage Creek	25.1	23	1.64	52.4	6	26.1
Big Cannon Creek	29.9	22	2.05	66.5	9	40.9
N. Br. Manistee River	23.3	23	1.73	55.2	7	30.4
N. Br. Manistee River	11.9	21	1.24	40.8	4	19.0
Slagle Creek @ hatchery	15.5	25	0.74	23.0	4	16.0
Slagle Creek @ Slagle Club	7.3	25	1.29	40.0	4	16.0
Slagle Creek @ Slagle Club	4.8	28	1.37	41.1	5	17.9
Slagle Creek above Co. Line Rd.	3.9	21	0.66	21.8	2	9.5
Slagle Creek below Co. Line Rd.	4.0	20	0.69	23.1	2	10.0

Table 17.—Land ownership within the Manistee River watershed by river segment. Date from: US Department of Agriculture, Forest Service (1983) and Michigan Department of Natural Resources, Lands Division.

Segment	Private	State	Federal	Consumers Energy	Total
1	840	2,490	--	--	2,520
2	4,770	1,610	--	310	7,500
3	3,120	12,060	--	520	15,700
4	--	--	1,720	--	1,720
5	1,220	2,330	5,370	--	8,920
6	800	2,160	--	--	2,960
7	2,540	20	1,080	--	3,640
8	3,600	1,400	4,040	--	9,040
Totals	16,890	22,070	12,210	830	52,380

Table 18.—Statutes administered by Michigan Department of Environmental Quality, Land and Water Management Division, that affect the aquatic resource. Adapted from Bean and Braunscheidel (1996).

State of Michigan Acts	Previous statute
Public Health Code (1978 PA 386, as amended)	Amendments to Aquatic Nuisance Control Act (PA 86, 1977)
Part 13 N.R.P. Act(1994 PA 451)	Floodplain Regulatory Authority(PA 167, 1968)
Part 91 N.R.P. Act (1994 PA 451)	Soil Erosion and Sedimentation Control Act (PA 347, 1972)
Part 301 N.R.P. Act (1994 PA 451)	Inland Lakes and Streams Act(PA 346, 1972)
Part 303 N.R.P. Act (1994 PA 451)	Wetland Protection Act (PA 203, 1979)
Part 307 N.R.P. Act (1994 PA 451)	Inland Lake Level Act (PA 146, 1961)
Part 309 N.R.P. Act (1994 PA 451)	Inland Improvement Act (PA 345, 1966)
Part 315 N.R.P. Act (1994 PA 451)	Dam Safety Act (PA 300, 1989)
Part 323 N.R.P. Act (1994 PA 451)	Shoreland Protection and Management Act (PA 245, 1970)
Part 325 N.R.P. Act (1994 PA 451)	Great Lakes Submerged Lands Act (PA 247, 1955)
Part 341 N.R.P. Act (1994 PA 451)	Irrigation District Act (PA 205, 1967)

US Federal Acts

Federal Water Pollution Control Act, Section 314 (PL 92-55)
 Coastal Zone Management Act (PL 92-583, 1972)
 Clean Water Act, Section 404 (PL 95-217)
 River and Harbor Act, Section 10 (1899)
 Coastal Energy Impact Program (PL 92-538)

Table 19.—Designated drains in the Manistee River watershed, by county and township. Data from: county drain offices. Total drains=40.

Missaukee County	Manistee County
<i>Bloomfield Township</i>	<i>Manistee Township</i>
Golden Creek Drain	Bar Lake Drain
Ham Creek Drain	Gromer Drain
	McGuineas Drain
Wexford County	<i>Maple Grove Township</i>
<i>Liberty Township</i>	Maple Grove Drain
Cedar Creek #1	Litzan Drain
Cedar Creek #2	Bond Drain
Harmon Drain	Lindruse Luomala Drain
Liberty #4	Big Kaiser Drain
Liberty Hwy.	<i>Springdale Township</i>
Liberty Valley Hwy	Bear Creek Drain
Missaukee-Wexford Drain	<i>Bear Lake Township</i>
Seaman Drain	Big Kaiser Drain
<i>Cedar Creek Township</i>	Chief Lake Drain
Manton Creek Drain	Gustafson Drain
Manton Lagoon Drain	Schoolhouse Drain
<i>Greenwood Township</i>	Beaver Creek Drain
Briggs Drain	<i>Brown Township</i>
Colfax Drain	Chief Lake Drain
Greenwood Drain	<i>Filer Township</i>
	Green Lake Drain
Osceola County	<i>Pleasanton Township</i>
<i>Burdell Township</i>	Lumley Drain
Burdell Drain #1	<i>Norman Township</i>
<i>LeRoy Township</i>	Mud Lake Drain
Beaver Creek Drain	
LeRoy Drain #2	
<i>Rose Lake Township</i>	
Rose Lake Drain	
Rose Lake Drain #1	
Rose Lake Drain #2	
Rose Lake Drain #3	

Table 20.—Access and campground facilities along the Manistee River. Data from: US Department of Agriculture, Forest Service 1983. USFS=US Forest Service.

Sites	Access		Campgrounds				Number of campsites
	Road right of way	Developed site	County	Private	State	USFS	
Mancelona Bridge	X				X		
Cameron Bridge	X				X		
612 Bridge	X				X		
Manistee River Forest Camp 1& 2		X			X		26
Manistee River Camp - 72		X			X		24
T26N, R5W, Sec. 30	X				X		
CCC Camp		X			X		25
T25N, R6W, Sec. 3	X				X		
North Sharon Road	X				X		
West Sharon Road		X			X		
T25N, R7W, Sec. 22	X				X		
M-66 Campground				X			15
Smithville		X			X		19
M-66 Bridge	X				X		
Rainbow Jim		X			X		
Missaukee Bridge		X	X				
Chase Creek		X			X		9
Highway 131 Bridge							
Roadside Park		X			X		
Old 131 Camp		X			X		23
Baxter Camp		X			X		18
Baxter Bridge		X			X		
Indian Trail Camp		X			X		12
Harvey Bridge		X			X		
Sherman Bridge	X				X		
High Bridge		X				X	15
Blacksmith Bayou		X				X	12
Bear Creek		X				X	
Rainbow Bend		X				X	20
Coho Bend				X			30
Udell Rollway						X	23
M-55 Bridge	X				X		
Access 67-1		X			X		
Access 67-5		X			X		
Lakola Road	X		X		X		
Edgetts Bridge		X					
Meadow Brook Bridge		X			X		
Skookum Bridge (2)		X			X		
Walker Bridge	X				X		
Hi School Bridge	X		X				
Silver Creek Campground		X			X		

Table 20.—Continued.

Sites	Access		Campgrounds				Number of campsites
	Road right of way	Developed site	County	Private	State	USFS	
Lincoln Bridge Campground		X			X		
Elm Flats		X				X	
Dobson Bridge		X				X	
Peterson Access		X				X	
Peterson Bridge		X			X		
Skookum Bridge	X				X		

Table 21.–Dam inventory, Manistee River system. Data from: Michigan Department of Environmental Quality, Land and Water Management Division. Trib.=tributary.

Dam	River	Town	Range	Section	Head	Acre ft
Crawford						
Lake Margrethe	Portage Creek	26N	4W	8	3	N/A
Kalkaska						
Lutz Dam	Trib. Maple Ck.	25N	7W	12		
Gray Dam	Waterhole Ck.	25N	7W	16	2	
Goulait Dam	Little Silver Ck	25N	7W	27	20	15
Simmons Dam	Trib. Manistee R.	25N	8W	22	8	
Gould Dam	Springfed trib. to Gould Creek	25N	8W	30	2	
Vantol Dam	Bourne Creek	25N	8W	32	3	
Williams Dam	Trib. Manistee R.	25N	8W	31	3	
Condon Dam	Trib. Manistee R.	25N	8W	31		
Ash Dam	Fife Lake outlet	25N	8W	18	2	
Skinner Dam	Inlet Ck.	25N	8W	17		
Goose Creek Imp. Dam	Goose Ck.	27N	5W	1		
Cotton Dam	Collar Ck.	27N	6W	28	2	
Missaukee						
Cannon Creek Dam #1	Big Cannon Ck.	24N	5W	7		
Cannon Creek Dam #2	Big Cannon Ck.	24N	6W	12	4	60
Horseshoe Lake Dam	Big Cannon Ck.	24N	6W	2	11	135
Missaukee Walleye Rearing Pond Dam	Trib. Morrisy Ck.	24N	8W	31	5	
Hamm Creek Dam	Trib. Hamm Ck.	24N	8W	10	3	1
Jenkins Dam	Trib Morrisy Ck.	24N	8W	31	11	10
Wexford						
Malstrom Dam	Trib. N. Br. Pine	21N	10W	35	5	5
Norman Smith Dam	Trib. Spaulding Ck.	21N	10W	23	16	105
Korr Dam	Yates Ck.	21N	12W	23	6	
Carlson Dam #2	Yates Ck.	21N	12W	22	8	
Olga Lake Dam	Coe Ck.	22N	11W	36	5	145
Bayma Dam	Slagle Ck.	22N	11W	17	5	4
Slagle Trout Club Dam	Slagle Ck.	22N	12W	6	6	115
Corlett Dam	Slagle Ck.	22N	12W	6	12	
Manton Millpond Dam	Manton Ck.	23N	9W	4	10	230
Manton Upper Power Dam	Manton Ck.	23N	9W	3	11	260
Brooke Dam	Trib. Soper Ck.	23N	10W	5	8	
Spink Dam	Burkett Ck.	23N	11W	6	30	
McNitt Dam	Trib. Hodenpyl Pd	23N	11W	14	3	2
Carnahan Dam	Ferguson L. Outlet	23N	11W	3		
Barnes Dam	Trib. Adams Ck.	23N	11W	11	17	84
Jackson Dam	Burkett Ck.	23N	11W	7	6	
Von Hofe Dam	Seaton Ck.	23N	12W	32	4	4

Table 21.–Continued.

Dam	River	Town	Range	Section	Head	Acre ft
Wexford continued						
Taylor Dam	East Chase Ck.	24N	9W	26	3	
Woodworth Dam	Trib. Buttermilk Ck.	24N	9W	32	5	6
Parks No. One Dam	Silver Ck.	24N	10W	36	10	
Parks No. Two Dam	Silver Ck.	24N	10W	36	10	
Kerr Upper Dam	Trib. Manistee R.	24N	11W	31	25	25
Kerr Lower Dam	Trib. Manistee River	24N	11W	31	11	5
Guthrie Dam	Wheeler Ck.	24N	11W	31	24	12
Wheeler Ck. Dam	Wheeler Ck.	24N	11W	8	17	892
Nehez Dam	Trib. Fletcher Ck.	24N	12W	5	10	10
Manistee						
Easterling Dam	Pine Ck.	21N	13W	19	4	
Prunski Dam	Trib. Pine R.	21N	13W	27		16
Stronach Dam	Pine River	21N	13W	16	18	180
Sunnybrook Dam	Pine River	21N	13W	32		
Manistee Sport & Fishing Club Dam	Pine Ck.	21N	14W	8	2	
Manistee marsh Dam	Manistee River	21N	16W	6		
Tippy Dam	Manistee River	22N	13W	31	56	39,500
Schneiders Dam	Chief Creek	22N	15W	16	5	60
Hodenpyl Dam	Manistee River	23N	12W	30	68	60,700
Benton Dam	Lemon Creek	23N	13W	6	4	
Nimitalo's Dam	Cedar Ck.	23N	14W	24	4	
Beneke Dam	Unnamed trib.	23N	14W	35		
Copemish Dam	First Ck.	24N	13W	18	8	160
Grand Traverse						
Headquarters Lake Dam	Fife Lake outlet	25N	9W	26	5	190
Walton Dam	Walton Outlet Ck.	25N	9W	33	3	12
Osceola						
Hatt Dam	Little Beaver Ck.	19N	10W	19	4	10
Barztel Dam	Trib. Pine River	19N	10W	6		
Lake						
Crystal Springs Trout Ranch Dam	Unnamed trib to Pine R.	19N	11W	3	7	
Streator Dam	Silver Ck.	20N	11W	16		

Table 22.-Value estimates for annual turbine mortalities at Hodenpyl and Tippy dams. Entrainment and mortality data from: Lawler, Matusky & Skelly Engineers, 1991. *threatened species. **average weight of each fish is 2.85 pounds.

Species	Average length (cm)	Percent composition	Entrained	Mortality	Replacement value/fish	Restitution value/fish	Total replacement value	Total restitution value
TIPPY								
Golden redborse	33.4	0.3	396	78	\$0.40	\$5.00	\$31.20	\$390
River redborse*	36.1	0.3	396	78	\$0.40	\$5.00	\$31.20	\$390
Shorthead redborse	31.6	1.0	1319	259	\$0.40	\$5.00	\$103.60	\$1,295
White sucker	38.3	32.0	42,203	8,272	\$0.50	\$5.00	\$4,136.00	\$41,360
Black crappie	5.2	3.1	4,088	801	\$0.43	\$10.00	\$344.43	\$8,010
Bluegill	14.1	3.8	5,012	982	\$0.86	\$10.00	\$844.52	\$9,820
Green sunfish	12.7	0.7	923	181	\$0.69	\$10.00	\$124.89	\$1,810
Pumpkinseed	12.0	1.0	1,319	259	\$0.66	\$10.00	\$170.94	\$2,590
Rock bass	14.0	3.4	4,484	879	\$0.85	\$5.00	\$747.15	\$4,395
Smallmouth bass	24.7	17.2	22,684	4,446	\$2.89	\$10.00	\$12,848.94	\$44,460
Sunfish species	10.5	0.3	396	78	\$0.62	\$10.00	\$48.36	\$780
Gizzard shad	33.6	3.1	4,088	801	\$0.75	\$5.00	\$200.25	\$4,005
Spottail shiner	10.5	0.3	396	78	\$0.06	\$5.00	\$4.68	\$390
Burbot	17.3	0.7	923	181	\$1.00	\$5.00	\$181.00	\$905
Logperch	4.5	0.3	396	78	\$0.06	\$5.00	\$4.68	\$390
Walleye	36.1	3.4	4,484	879	\$3.71	\$10.00	\$3,261.09	\$8,790
Yellow perch	11.1	2.1	2,770	543	\$0.32	\$10.00	\$173.76	\$5,430
Trout-perch	7.5	14.4	18,991	3,722	\$0.06	\$5.00	\$223.32	\$18,610
Brown trout	34.5	10.0	13,188	2,585	\$1.89	\$10.00	\$4,885.65	\$25,850
Rainbow trout	12.0	0.3	396	78	\$0.38	\$10.00	\$30.42	\$780
Unidentified	10.5	2.1	2,770	543	\$0.06	\$5.00	\$32.58	\$2,715
Totals			31,622	25,801			\$28,427.88	\$183,165

Table 22.-Continued.

Species	Average length (cm)	Percent composition	Entrained	Mortality	Replacement value/fish	Restitution value/fish	Total replacement value	Total restitution value
HODENPYL								
Black crappie	4.5	7.4	11,177	2,191	\$0.39	\$10.00	\$854.49	
Bluegill	4.2	0.8	1,208	236	\$0.34	\$10.00	\$80.24	
Chestnut lamprey	18.2	0.2	302	59	\$0.06	\$0.00	\$3.54	
Logperch	4.3	3.6	5,438	1,066	\$0.06	\$5.00	\$63.96	
Northern pike	59.5	0.2	302	59	\$12.60	\$30.00**	\$743.40	
Rock bass	12.0	0.9	1,359	266	\$0.66	\$5.00	\$175.56	
Smallmouth bass	3.7	4.2	6,344	1,243	\$0.40	\$10.00	\$497.20	
Spottail shiner	6.8	2.8	4,229	829	\$0.06	\$5.00	\$49.74	
Trout-perch	5.4	75.0	113,283	22,203	\$0.06	\$5.00	\$1,332.18	
Walleye	21.3	0.8	1,208	236	\$2.01	\$10.00	\$474.36	
Yellow perch	7.8	3.3	4,984	977	\$0.21	\$10.00	\$205.17	
Centrarchidae	4.6	0.2	302	59	\$0.36	\$10.00	\$21.24	
Unidentified	3.0	0.6	906	178	\$0.06	\$5.00	\$10.68	
Totals			151,042	29,602			\$4,511.76	

Table 23.—National Pollution Discharge Elimination System permits issued in the Manistee River watershed. Data from: Michigan Department of Environmental Quality, Surface Water Quality Division.

Permittee	Watercourse
Flowing Well Trout Farm	North Br. Manistee River
MDNR - Harrietta State Fish Hatchery	Slagle Creek
McNitt Trout Farm	Slagle Creek
M R Products, Inc.	Copemish Pond (First Creek)
Consumers Energy Co - Hodenpyl hydroelectric facility	Manistee River
Consumers Energy Co - Tippy hydroelectric facility	Manistee River
Packaging Corporation of America	Manistee Lake
Morton Salt	Manistee Lake
AKZO Salt	Manistee Lake
Morton International	Manistee Lake
Martin Marietta	Manistee Lake
City of Manistee - Waste Water Treatment Plant	Manistee Lake

Table 24.—Act 307 sites in the Manistee River watershed, by county, as of 1991. Data from: Michigan Department of Environmental Quality, Environmental Response Division.

County	Oil & gas related	Storage tanks	Industry	Other	Unknown	Total
Crawford	--	2	--	--	--	2
Kalkaska	7	1	--	1	--	9
Missaukee	--	--	--	--	1	1
Wexford	9	2	1	4	2	18
Manistee	30	5	10	4	11	60
Gr. Trav.	10	1	--	--	1	12
Osceola	--	1	--	--	1	2
Lake	--	--	--	--	1	1
Totals	56	12	11	9	17	105

