



**STATE OF MICHIGAN
DEPARTMENT OF NATURAL RESOURCES**

Number 19

July 1997

**Muskegon River Watershed Assessment
Appendix**

Richard P. O'Neal

**MICHIGAN DEPARTMENT OF NATURAL RESOURCES
FISHERIES DIVISION**

**Fisheries Special Report 19
July, 1997**

**MUSKEGON RIVER WATERSHED ASSESSMENT
APPENDIX**

Richard P. O'Neal

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*Printed under authority of Michigan Department of Natural Resources
Total number of copies printed 150 — Total cost \$856.51 — Cost per copy \$5.71*

Appendix 1
Distribution Maps of Fish Species

This appendix contains maps of known past and present fish distributions within the Muskegon River watershed. The distributions of fish species were compiled from records located at The University of Michigan, Museums Fisheries Library, Michigan Department of Natural Resources, Institute for Fisheries Research, and Michigan Department of Natural Resources offices in Grand Rapids and Cadillac. Scientific names and phylogenic order follow Robins et al. 1991. For species that are listed under Michigan's Endangered Species Act (Part 365, Endangered Species Protection, of the Natural Resource and Environmental Protection Act, Act 451 of the Public Acts of 1994), their status follows their scientific name. Categories are declining, rare, threatened, endangered, extinct and locally extinct.

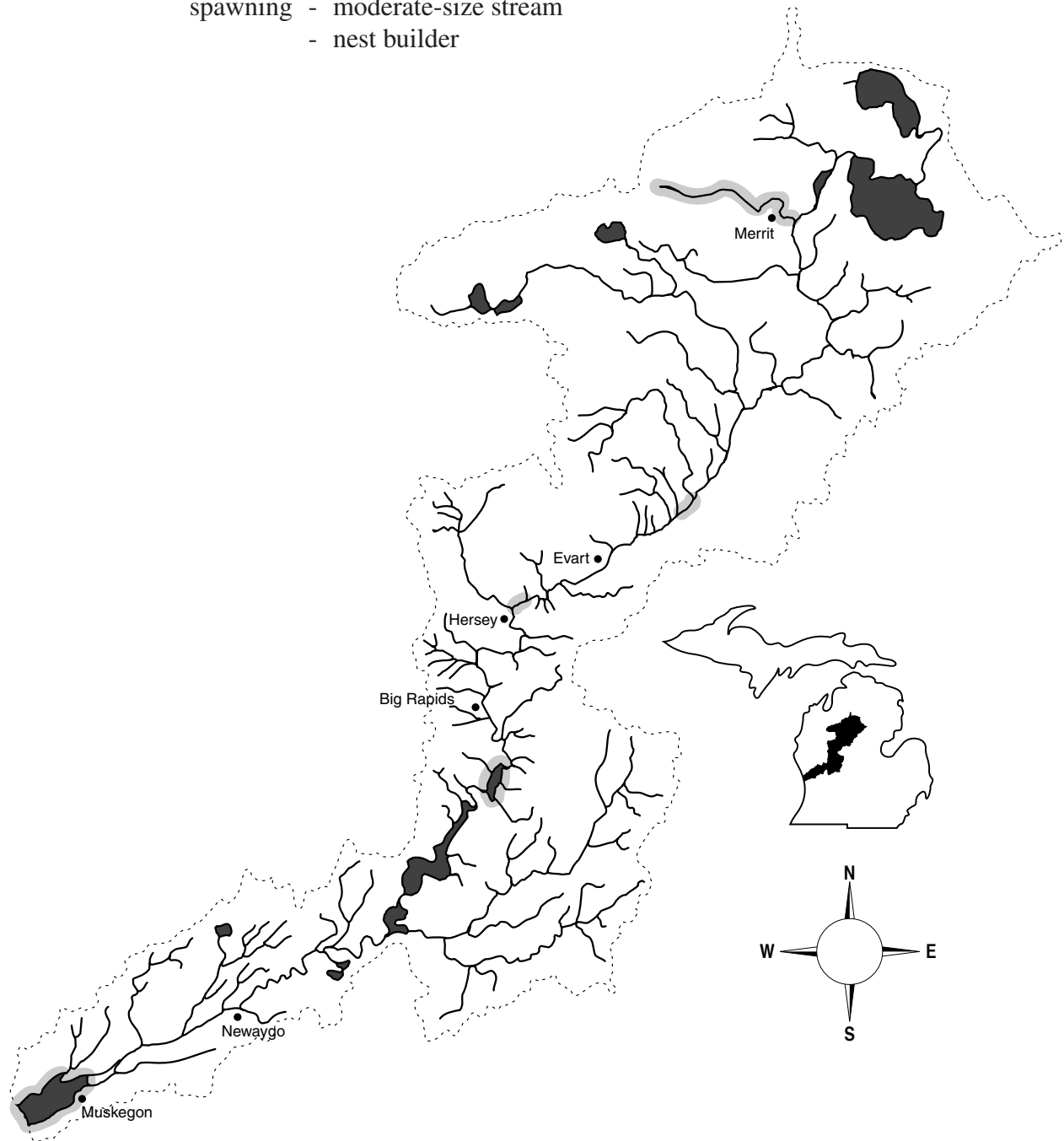
The habitat descriptions were compiled from The Fishes of Ohio (Trautman 1982), Freshwater Fishes of Canada (Scott and Crossman 1973), Fishes of Wisconsin (Becker 1983), Fishes of Missouri (Pflieger 1975), and Fishes of the Great Lakes Region (Hubbs and Lagler 1947).

Chestnut lamprey (*Ichthyomyzon castaneus*)

Habitat:

- feeding - stable substrate of sand and silt with light growth of *chara* or quiet backwaters of muck and silt with dense rooted vegetation
- moderate current
- clear moderate-size water

- spawning - moderate-size stream
- nest builder

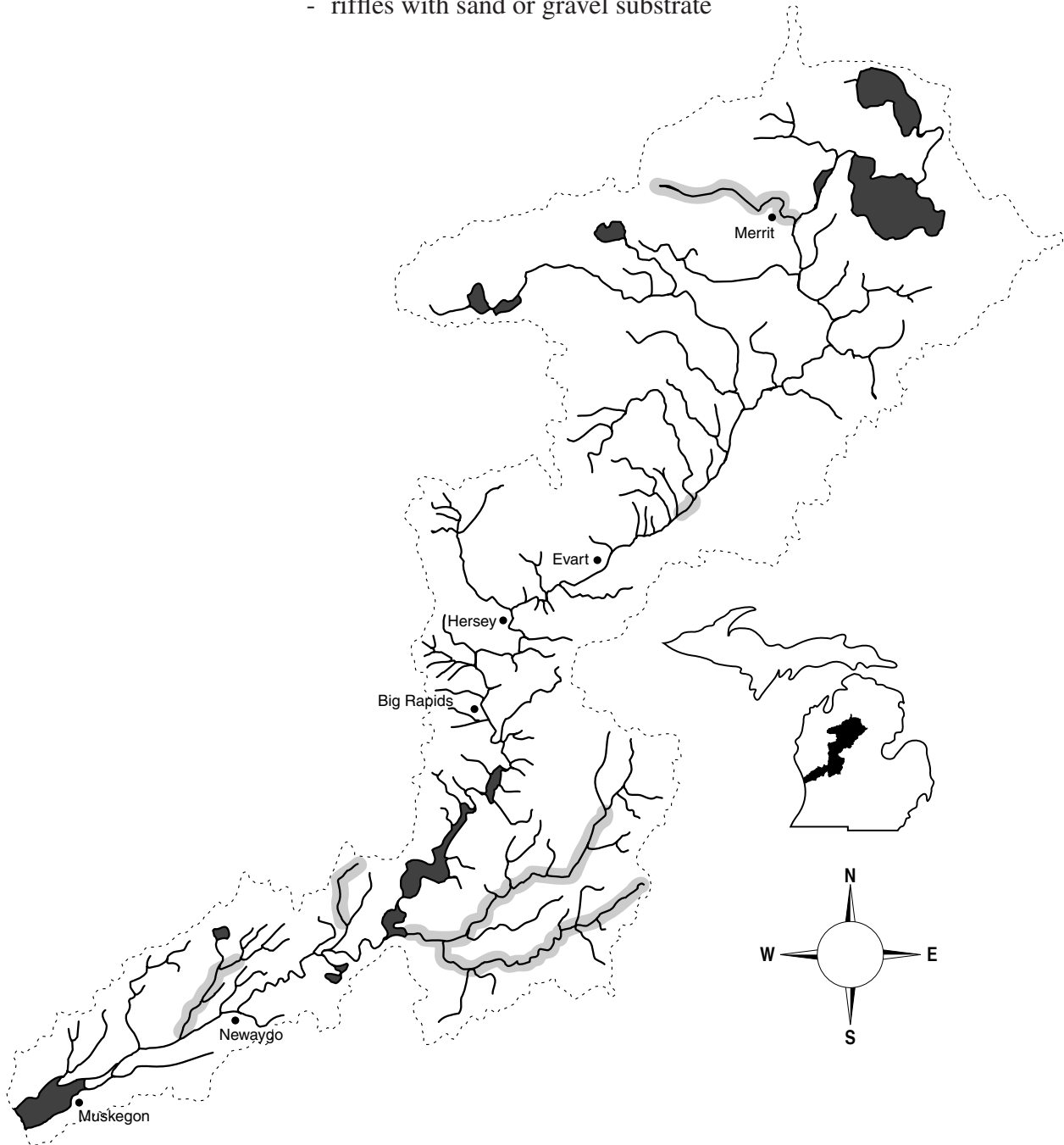


Northern brook lamprey (*Ichthyomyzon fossor*)

Habitat:

- feeding - young: low gradient, substrate with bars and beds of mixed sand and organic debris
- moderately warm water

- spawning - clear, high gradient streams (<15 feet wide)
- riffles with sand or gravel substrate



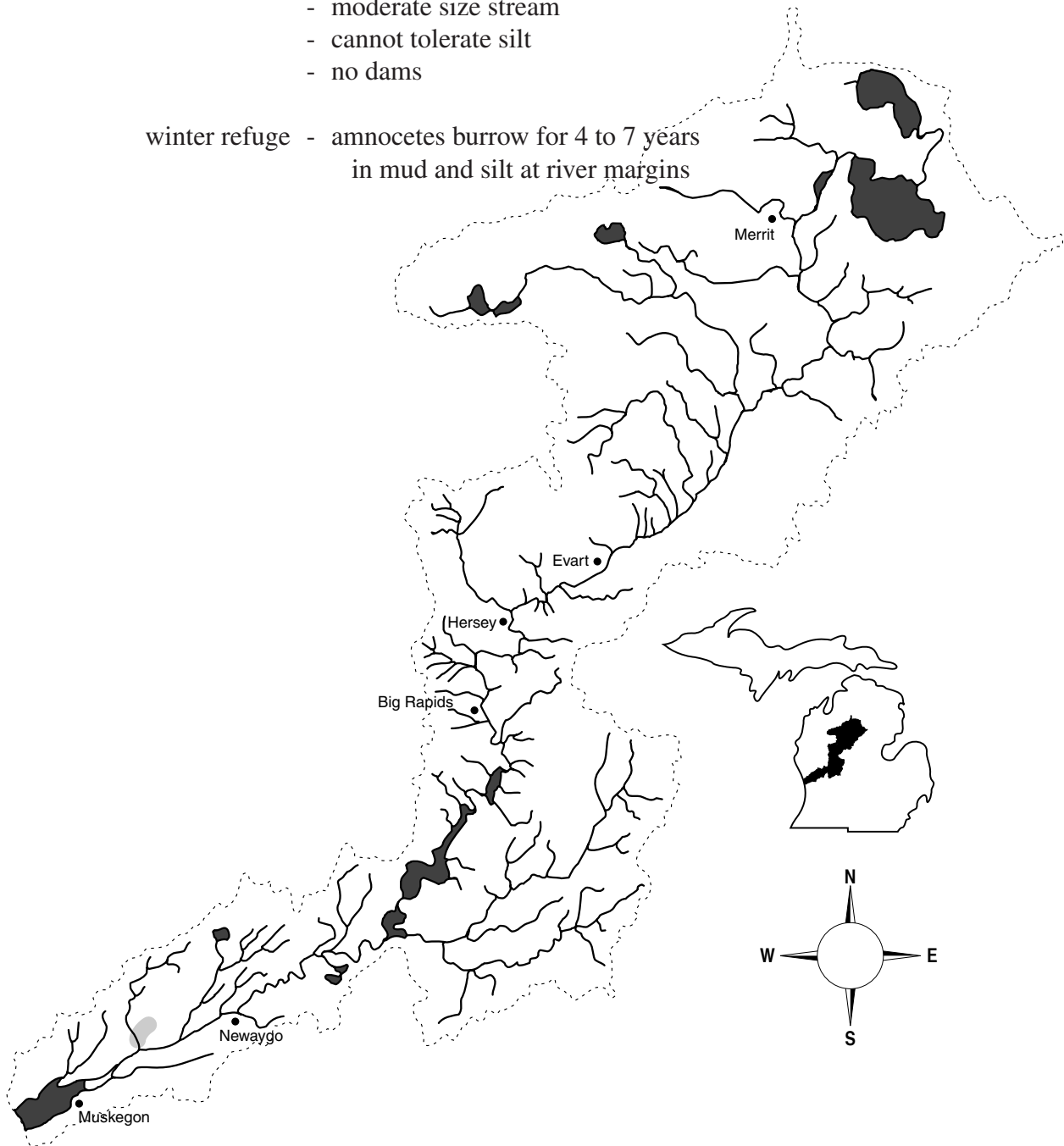
Silver lamprey (*Ichthyomyzon unicuspis*) - rare

Habitat:

- feeding - young: sand, muck, or organic debris substrate
- adults: clear river water with prey species

- spawning - gravel and sand substrate
- moderate gradient
- moderate size stream
- cannot tolerate silt
- no dams

- winter refuge - ammocetes burrow for 4 to 7 years in mud and silt at river margins



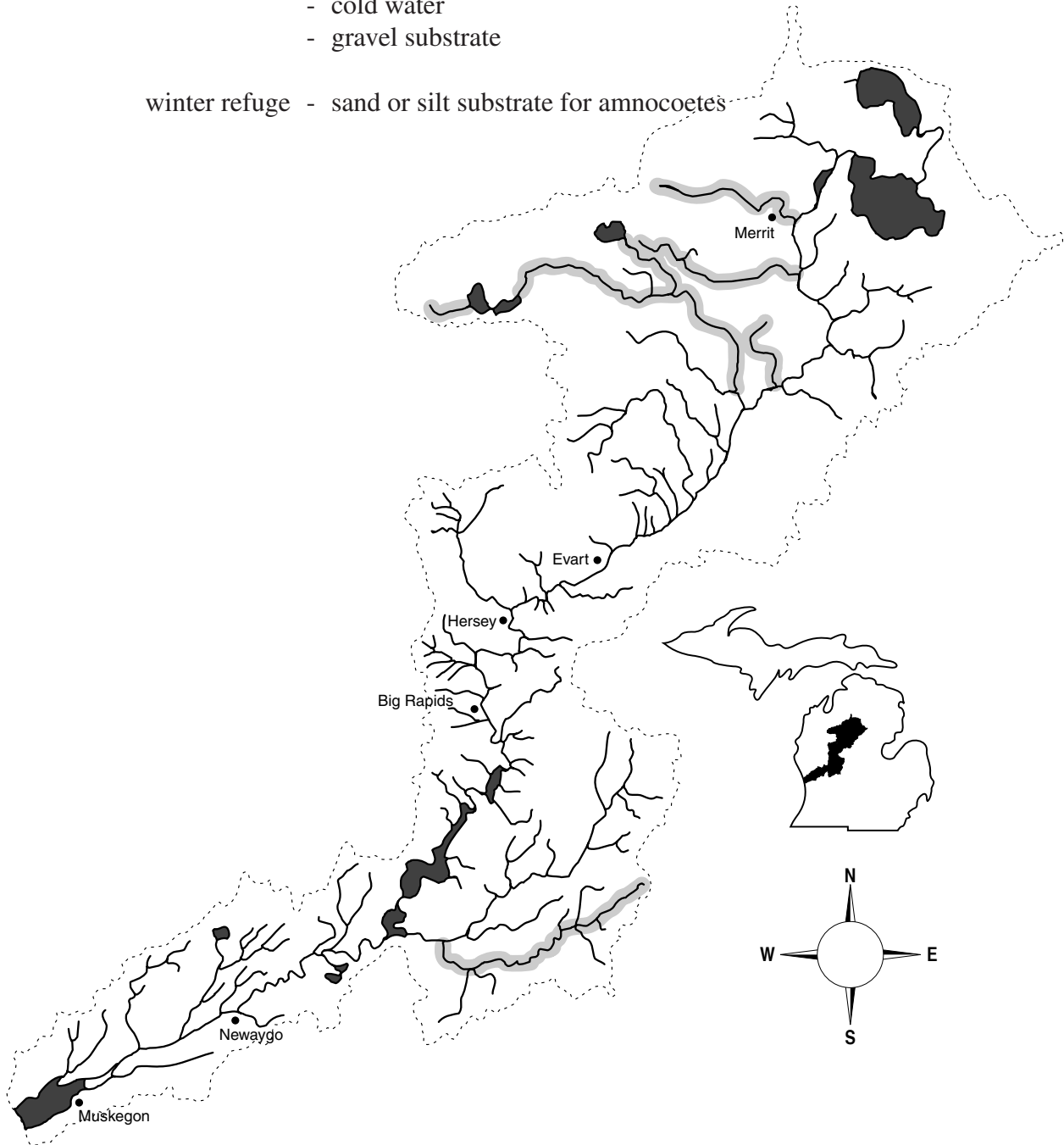
American brook lamprey (*Lampetra appendix*)

Habitat:

- feeding - young: low gradient, substrate with bars and beds of mixed sand and organic debris
- clear cool stream water, sensitive to turbidity

- spawning - clear, high gradient streams (>15 feet wide)
- cold water
- gravel substrate

- winter refuge - sand or silt substrate for ammocoetes



Sea lamprey (*Petromyzon marinus*)

Habitat:

- feeding - young: substrate with beds of sand mixed with organic debris
- cannot tolerate silt
- adults: clear cool water of Lake Michigan

- spawning - no dams
- riffles with sand and gravel substrates

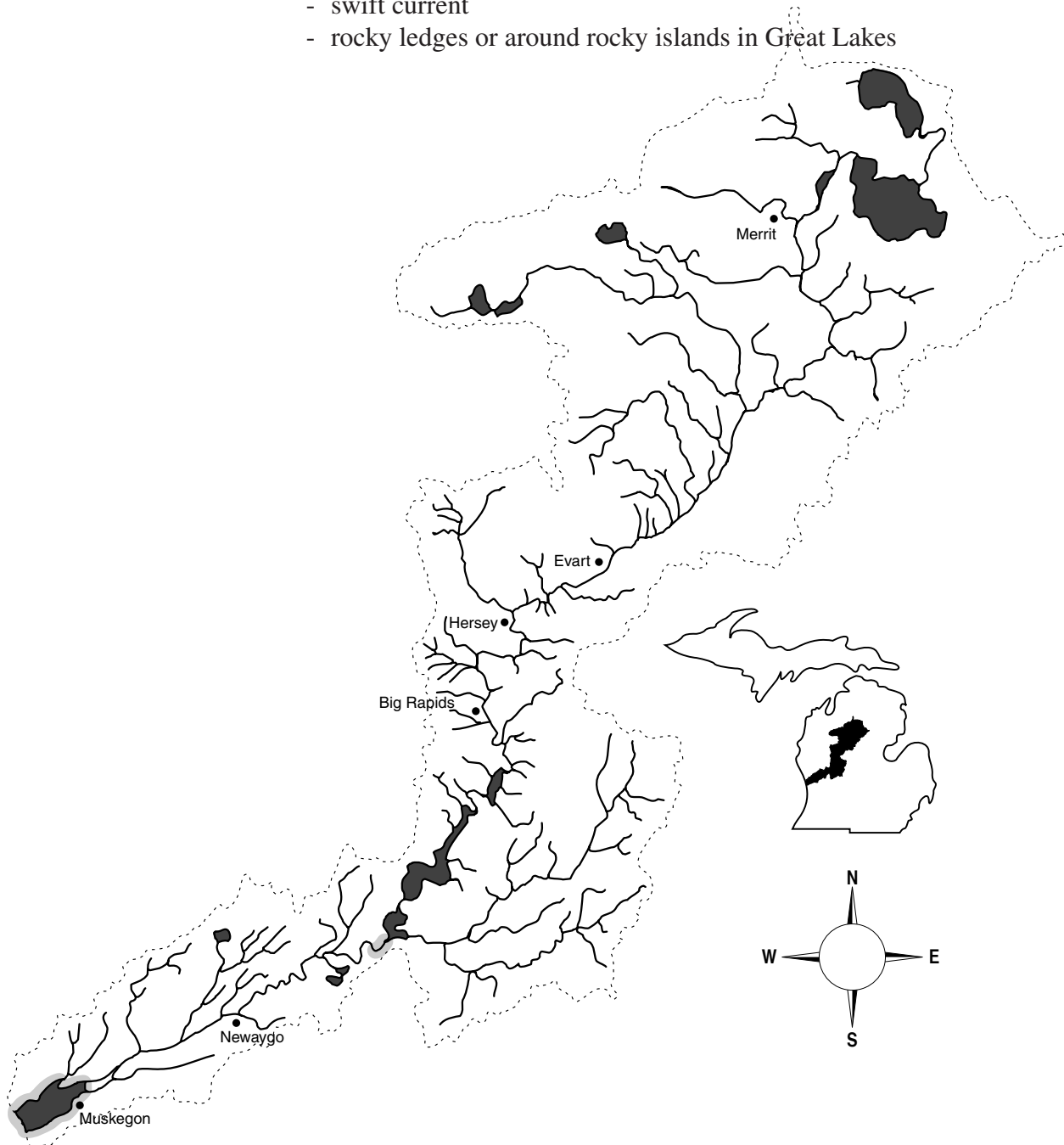


Lake sturgeon (*Acipenser fulvescens*)

Habitat:

- feeding
 - shoal areas of large rivers, lakes, and impoundments
 - gravel, sand, rock substrates

- spawning
 - in or before rapids, at the base of dams in rivers
 - in 2-15 feet of water
 - swift current
 - rocky ledges or around rocky islands in Great Lakes

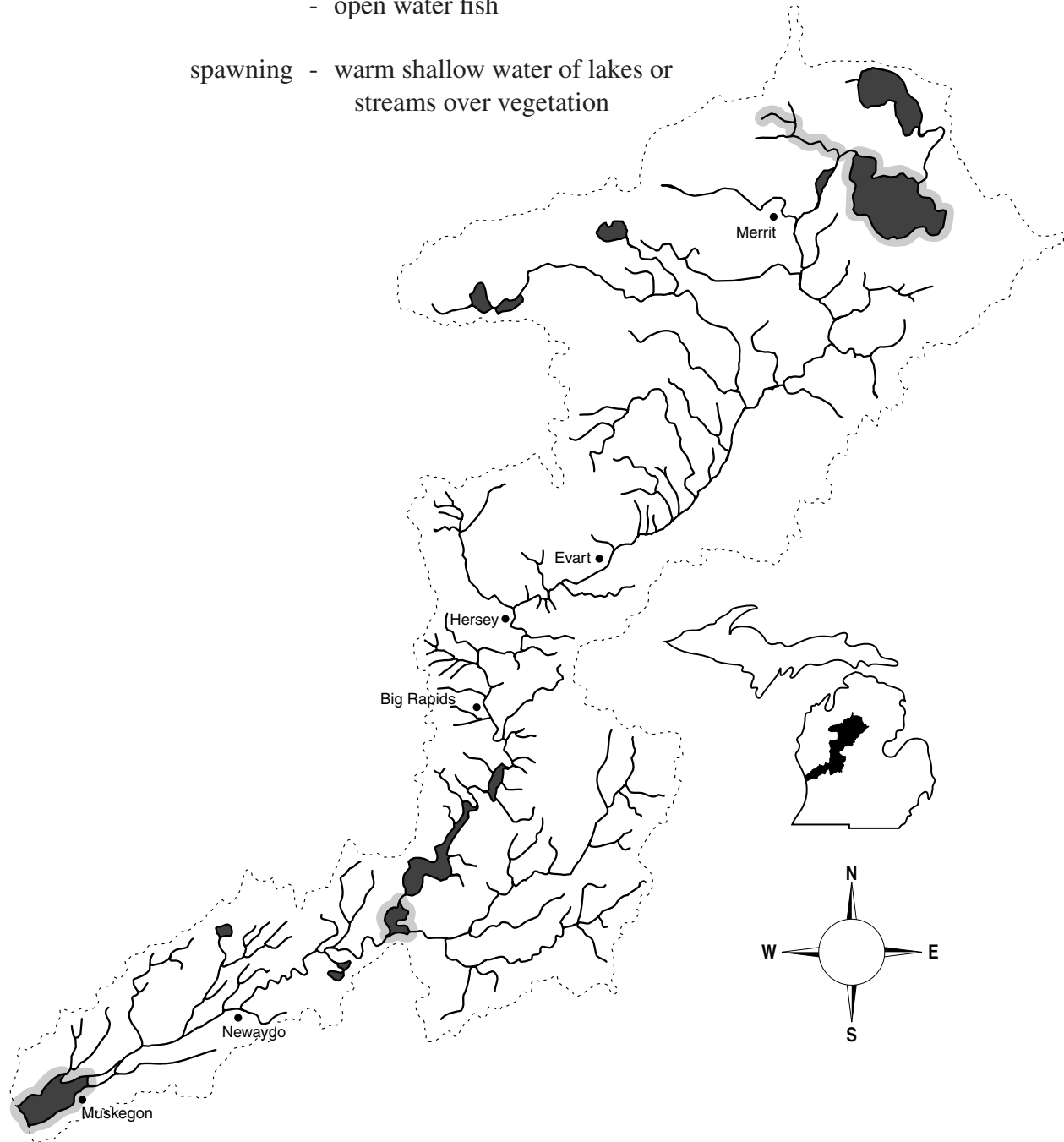


Longnose gar (*Lepisosteus osseus*)

Habitat:

- feeding
 - adults: in deeper water
 - young: in shallows
 - clear water, low-gradient streams, lakes, and impoundments
 - will feed in moderate current
 - aquatic vegetation preferred, but not necessary
 - open water fish

- spawning
 - warm shallow water of lakes or streams over vegetation



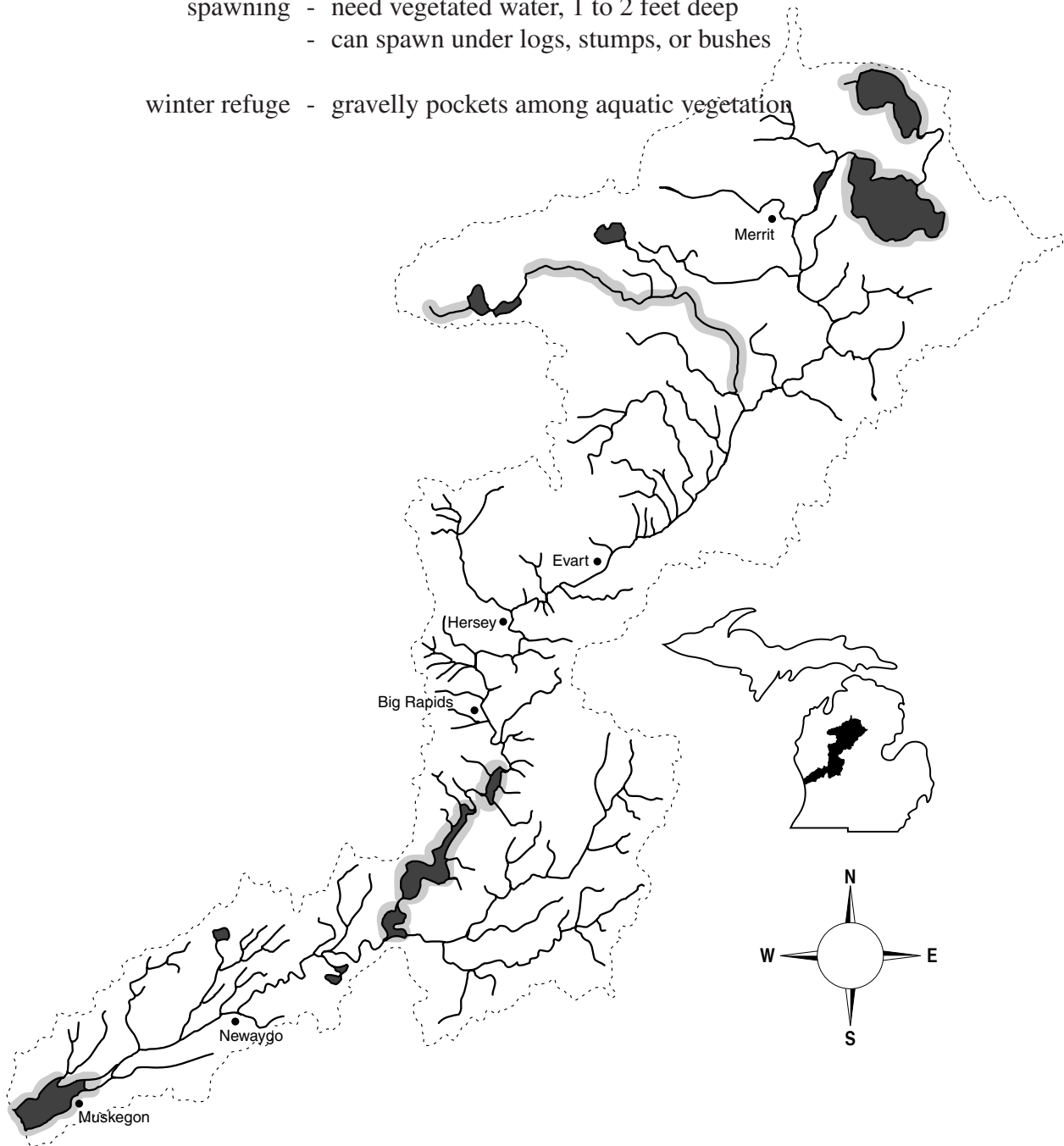
Bowfin (*Amia calva*)

Habitat:

- feeding
 - clear water
 - abundant rooted aquatic vegetation
 - low gradient streams, lakes, and impoundments
 - tolerate only small amount of silt

- spawning
 - need vegetated water, 1 to 2 feet deep
 - can spawn under logs, stumps, or bushes

- winter refuge
 - gravelly pockets among aquatic vegetation



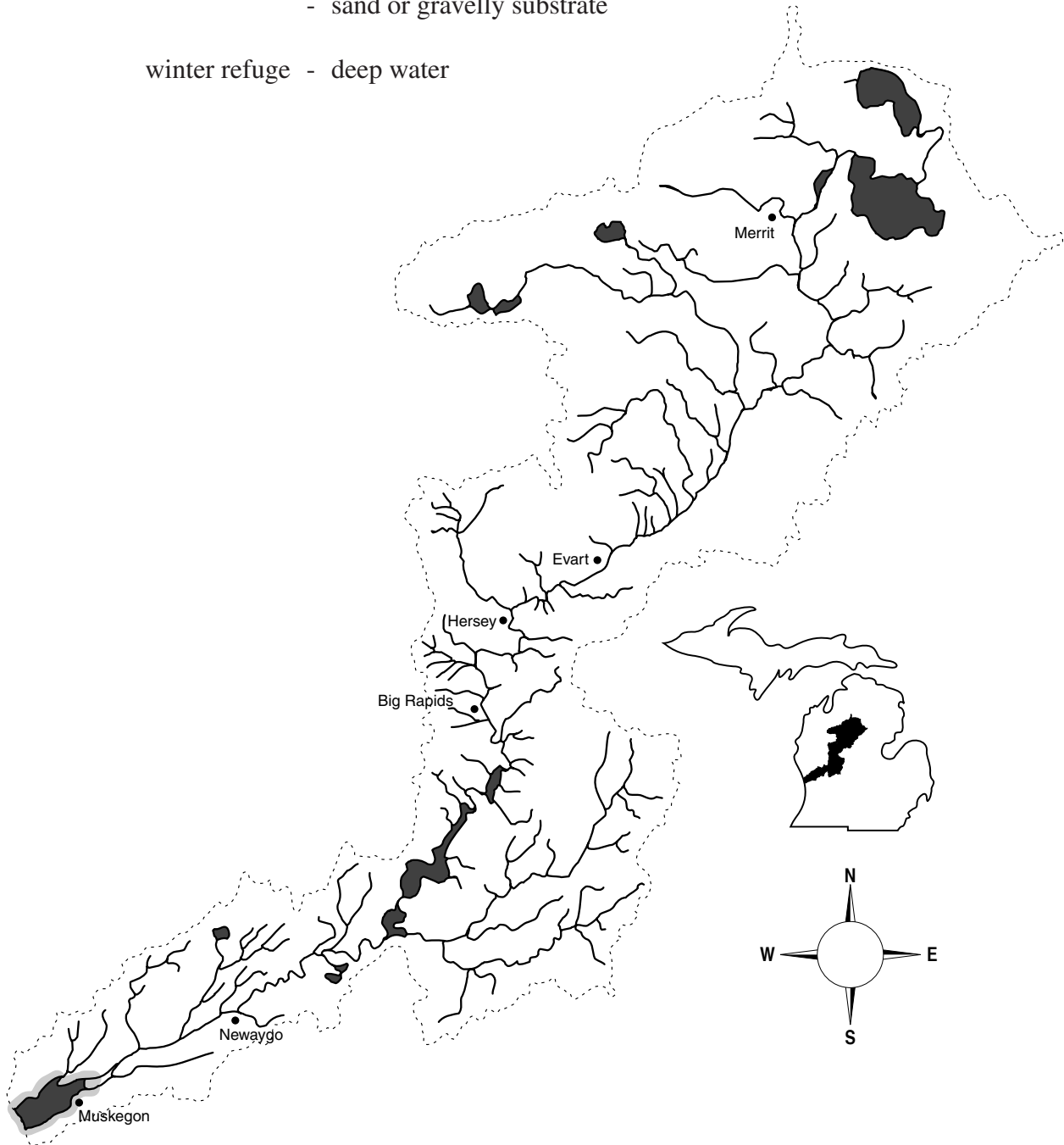
Alewife (*Alosa pseudoharengus*)

Habitat:

- feeding - adults: deep water of Lake Michigan
- young: shallow water of Lake Michigan
- prefers warmer waters

- spawning - streams or shallow beaches of lake
- sand or gravelly substrate

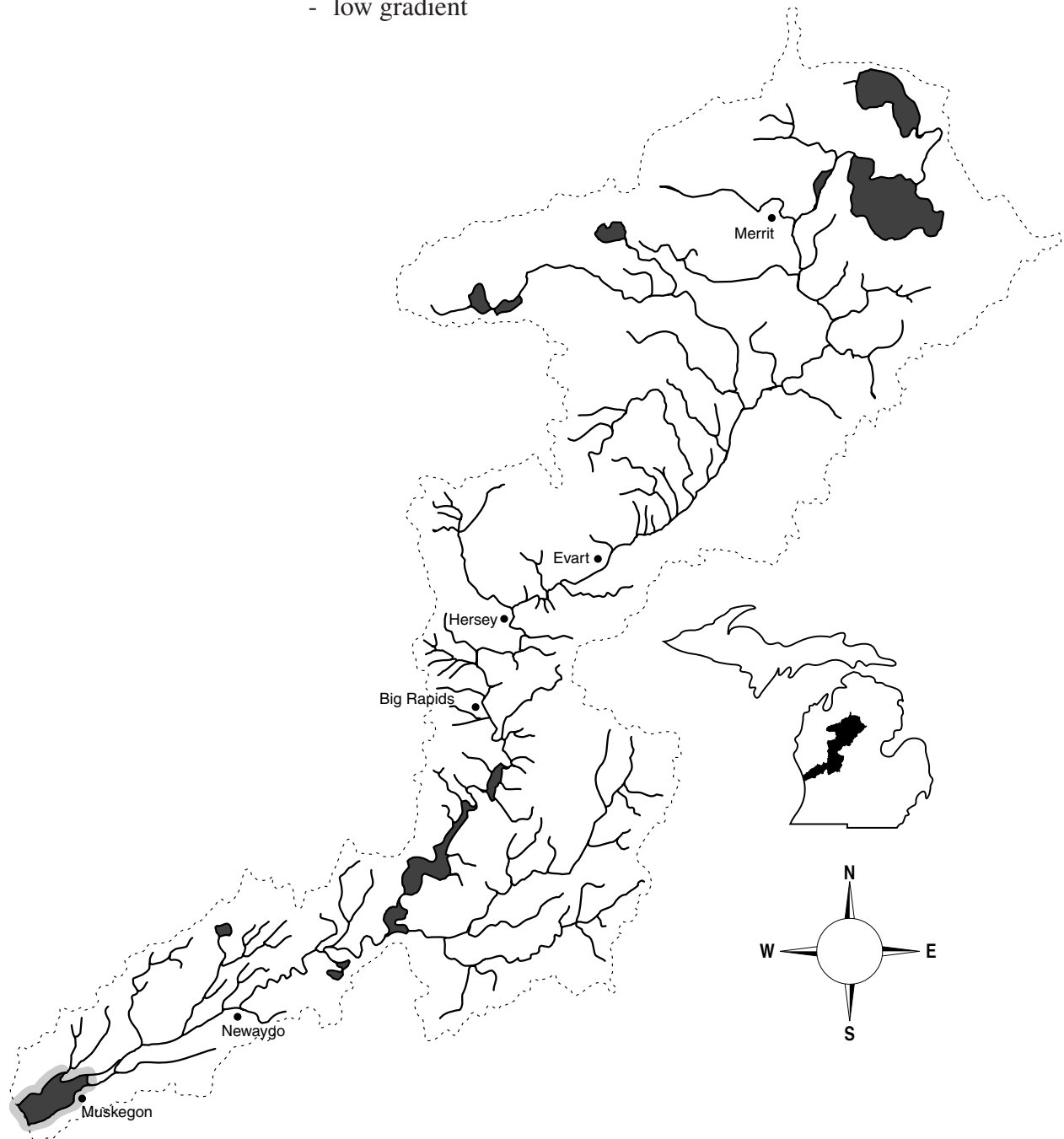
- winter refuge - deep water



Gizzard shad (*Dorosoma cepedianum*)

Habitat:

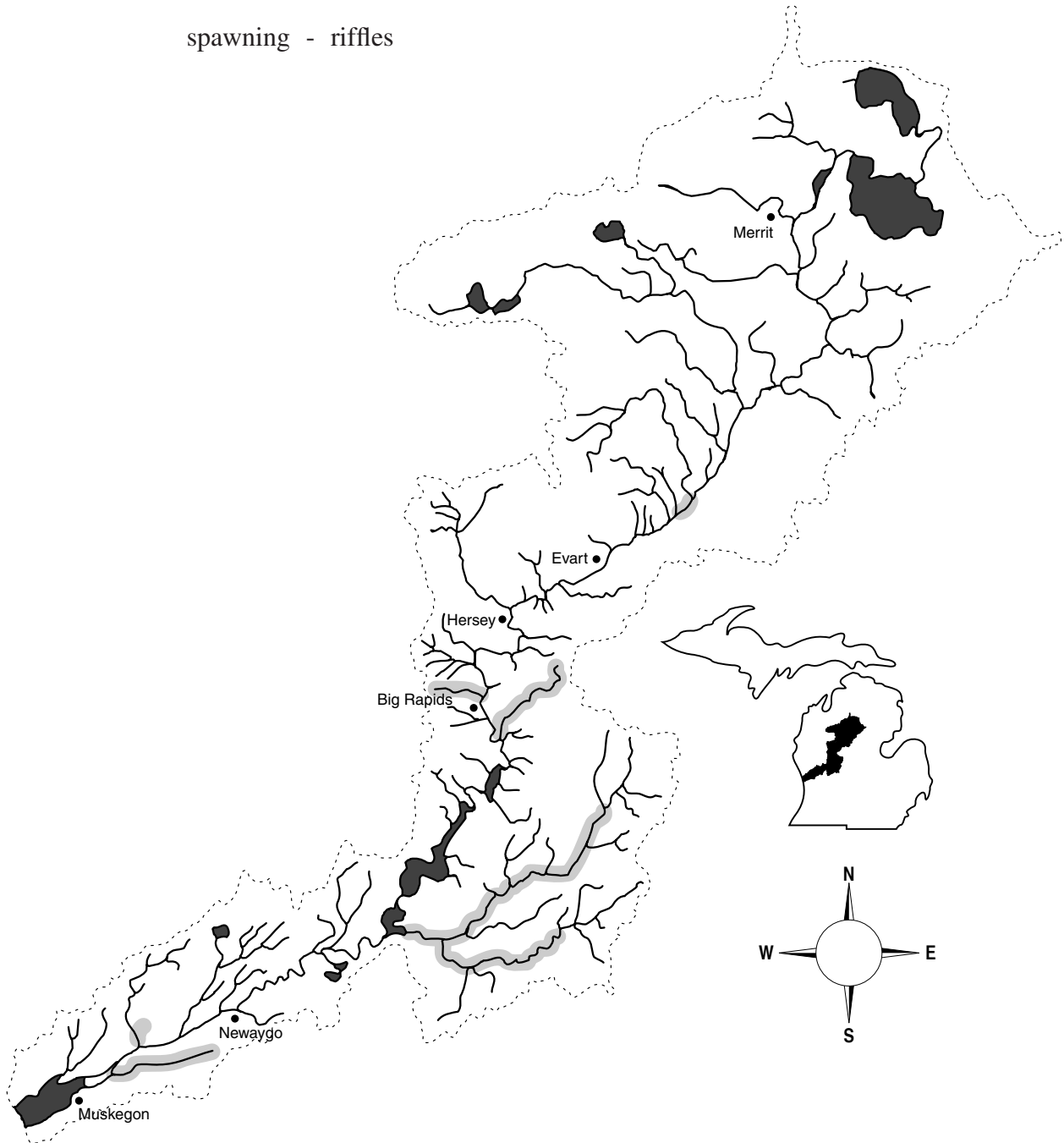
- feeding - large streams with low gradient, impoundments, and Lake Michigan
 - tolerant of clear and turbid water
- spawning - shallow areas of ponds, lakes, and large rivers
 - low gradient



Central stoneroller (*Campostoma anomalum*)

Habitat:

- feeding - moderate to high gradients
 - rocky riffles
 - somewhat tolerant of turbidity
 - riffles and adjacent pools of warm, clear, shallow streams
 - gravel or cobble substrate
- spawning - riffles



Goldfish (*Carassius auratus*)

Habitat:

- feeding - vegetation
- low gradient, shallow, warm water streams, rivers, lakes, and impoundments
- tolerates some turbidity and siltation

- spawning - warm, weedy shallows

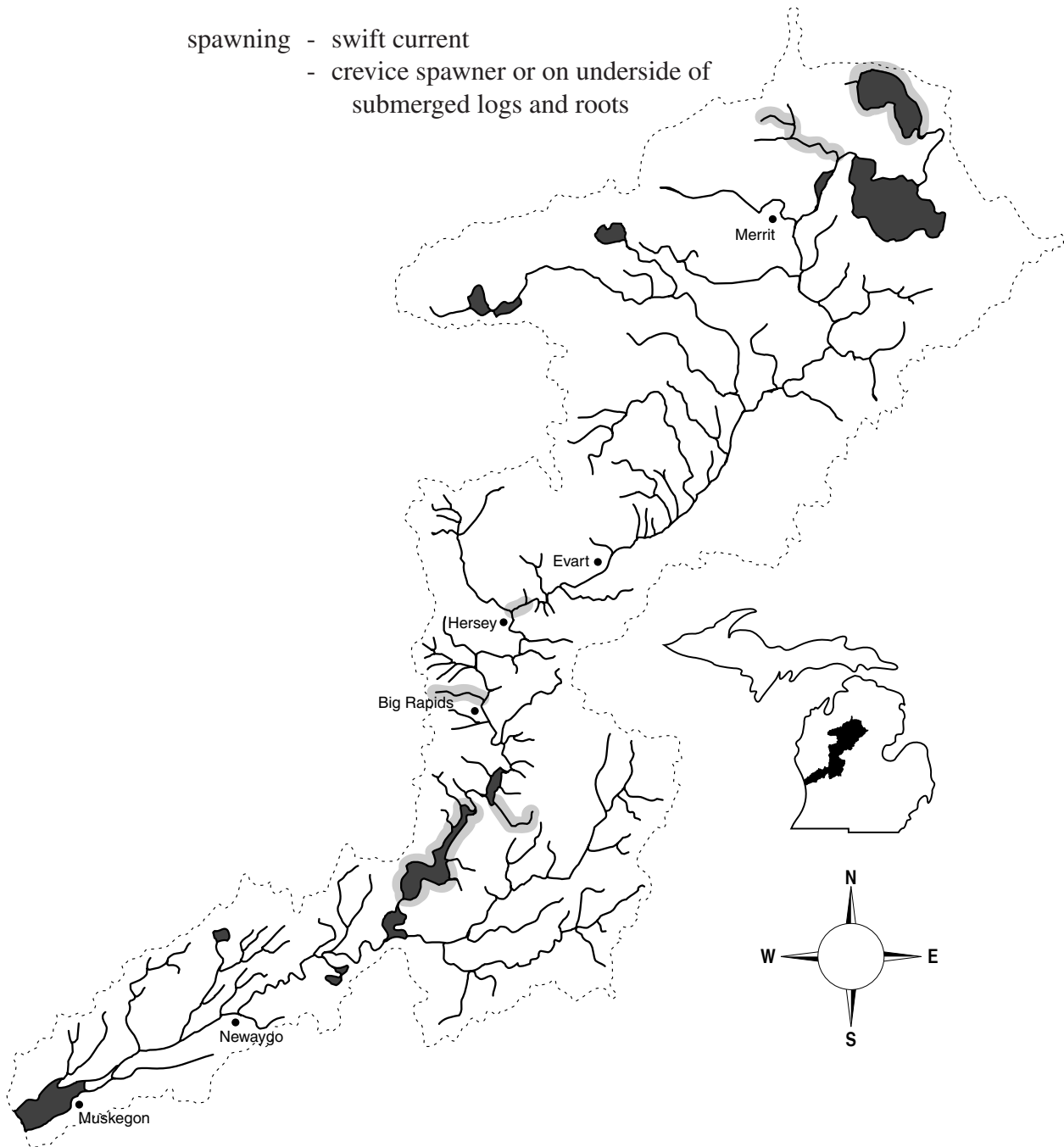


Spotfin shiner (*Cyprinella spiloptera*)

Habitat:

- feeding
 - clear water tolerant of turbidity and siltation
 - some current
 - shallow depths
 - medium sized streams, lakes, and impoundments
 - clear sand or gravel substrate

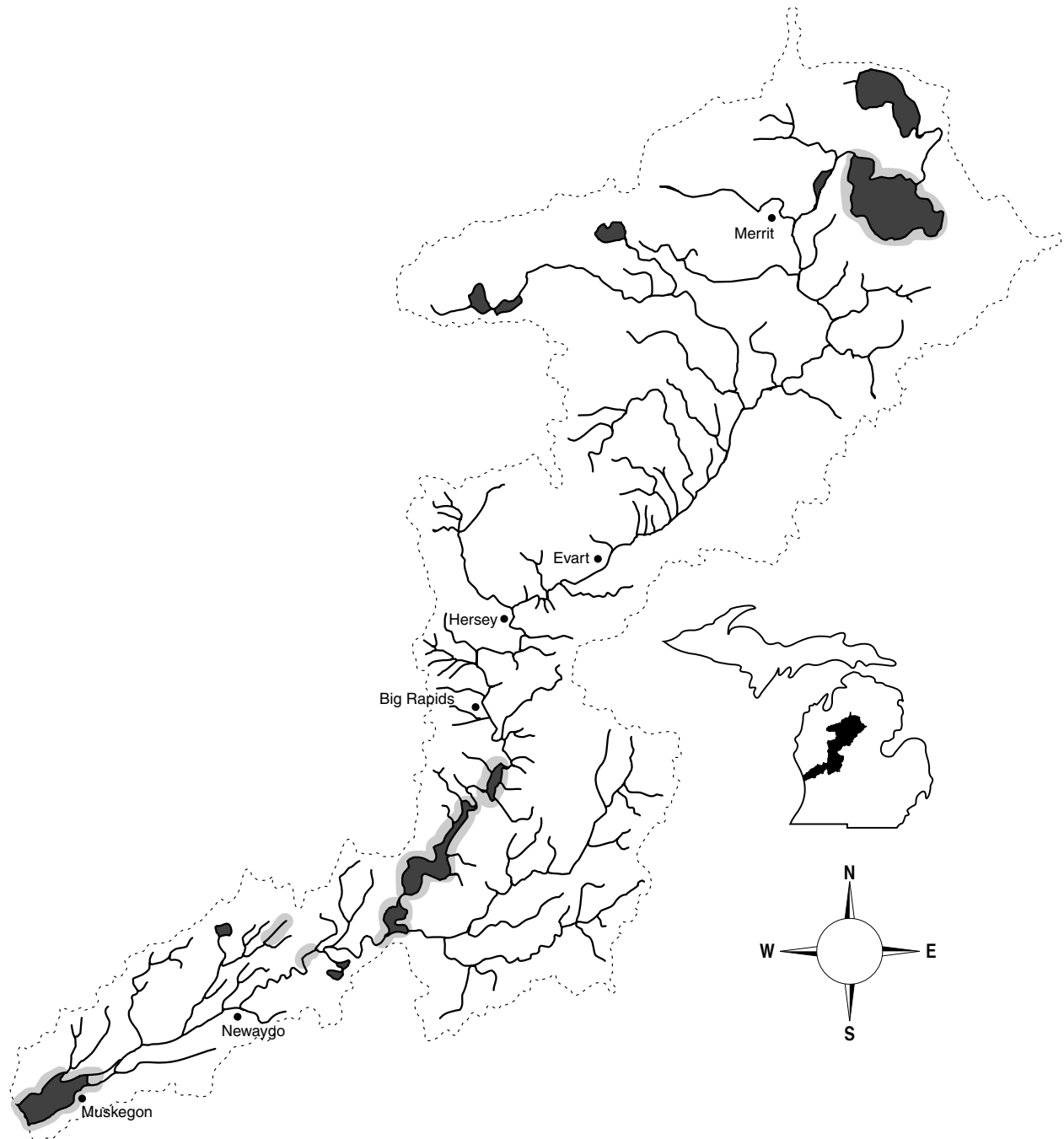
- spawning
 - swift current
 - crevice spawner or on underside of submerged logs and roots



Common carp (*Cyprinus carpio*)

Habitat:

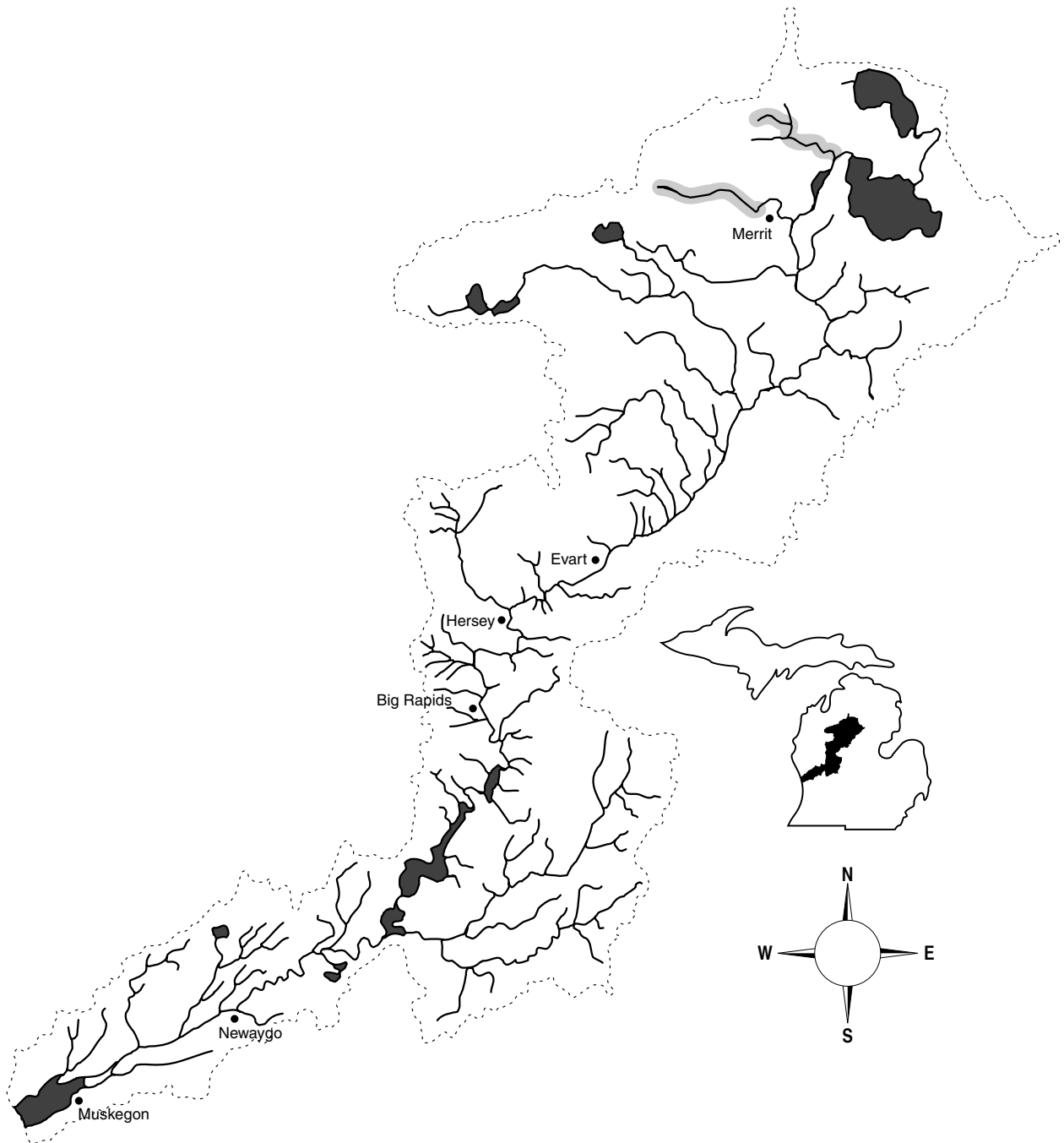
- feeding - low gradient fertile streams, rivers, lakes, and impoundments
 - abundance of aquatic vegetation or organic matter
 - tolerant of all substrates and clear to turbid water
- spawning - weedy or grassy shallows



Brassy minnow (*Hybognathus hankinsoni*)

Habitat:

- feeding - cool acidic streams
- slow to moderate current
- sand or gravel substrate

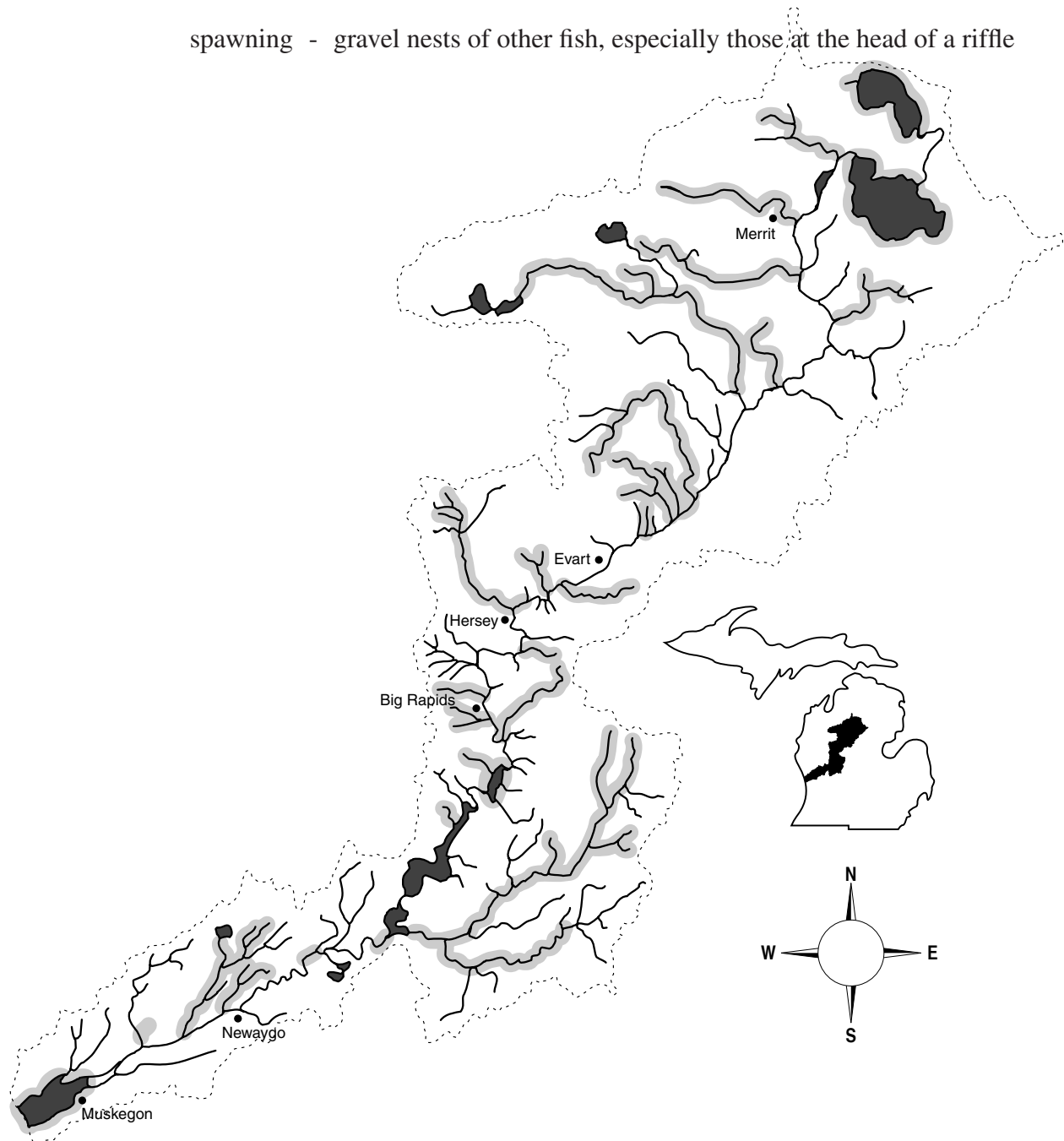


Common shiner (*Luxilus cornutus*)

Habitat:

- feeding - small, clear, high-gradient streams and rivers, or shores of clear water lakes and impoundments
 - gravel substrate
 - can tolerate some submerged aquatic vegetation
 - not very tolerant of turbidity or silted waters

- spawning - gravel nests of other fish, especially those at the head of a riffle

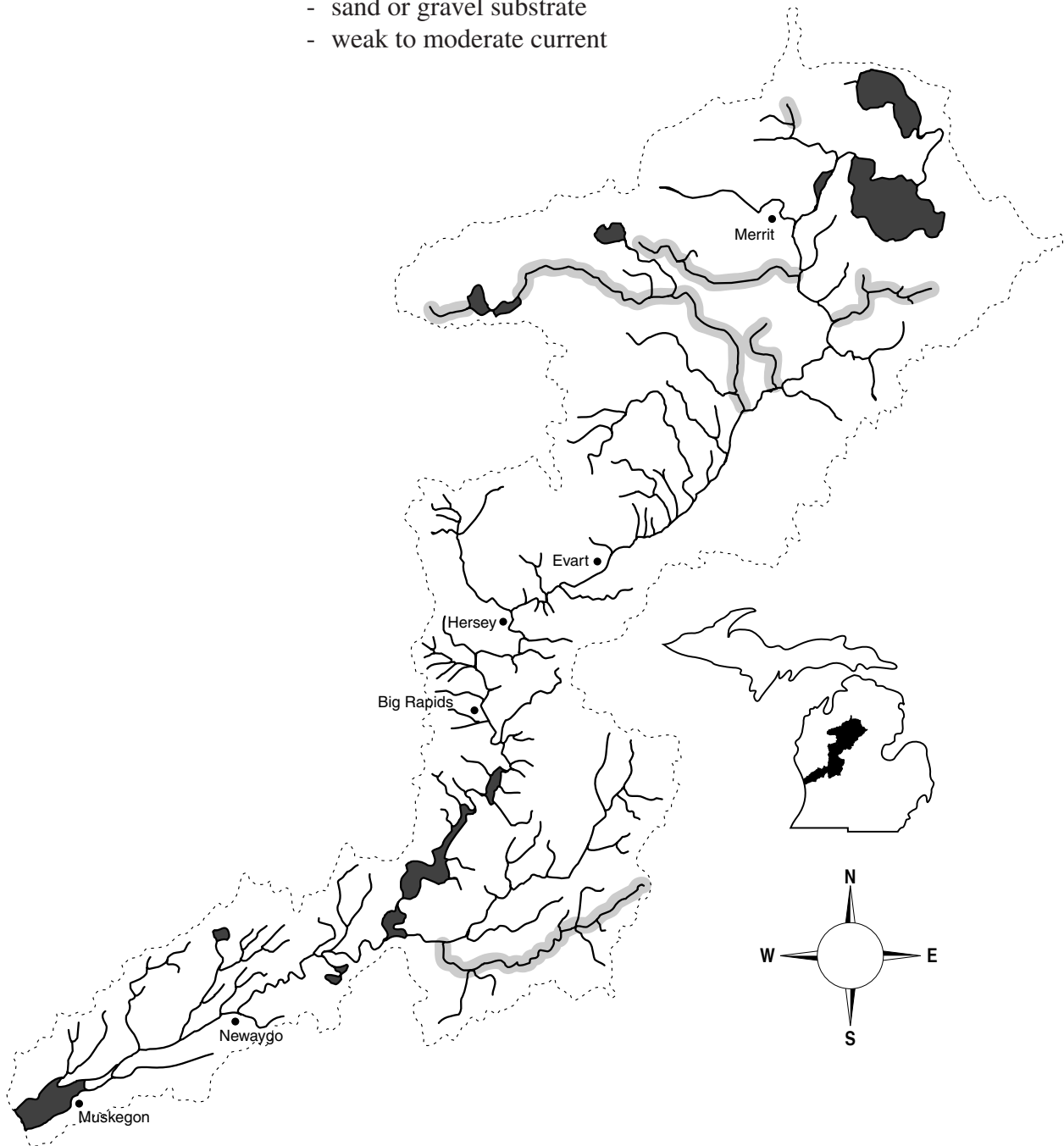


Pearl dace (*Margariscus margarita*)

Habitat:

- feeding - cool, neutral to acidic streams and lakes
- clear to slightly turbid water

- spawning - males are territorial
- clear water, 18-24 inches deep
- sand or gravel substrate
- weak to moderate current

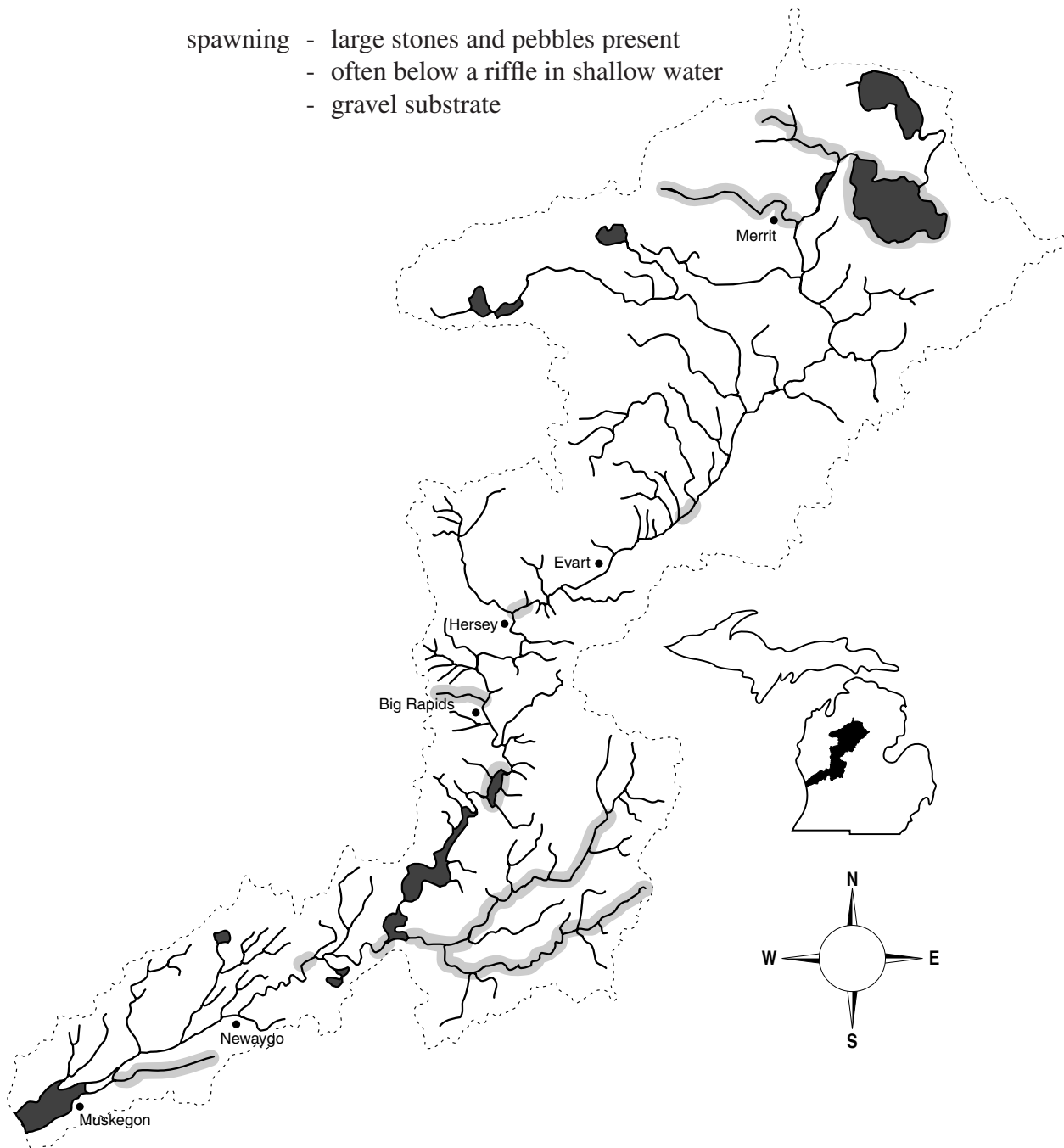


Hornyhead chub (*Nocomis biguttatus*)

Habitat:

- feeding
 - adults: near riffles
 - young: near vegetation
 - clear water, does not tolerate turbidity
 - gravel substrate
 - low gradient streams that are tributaries to large streams

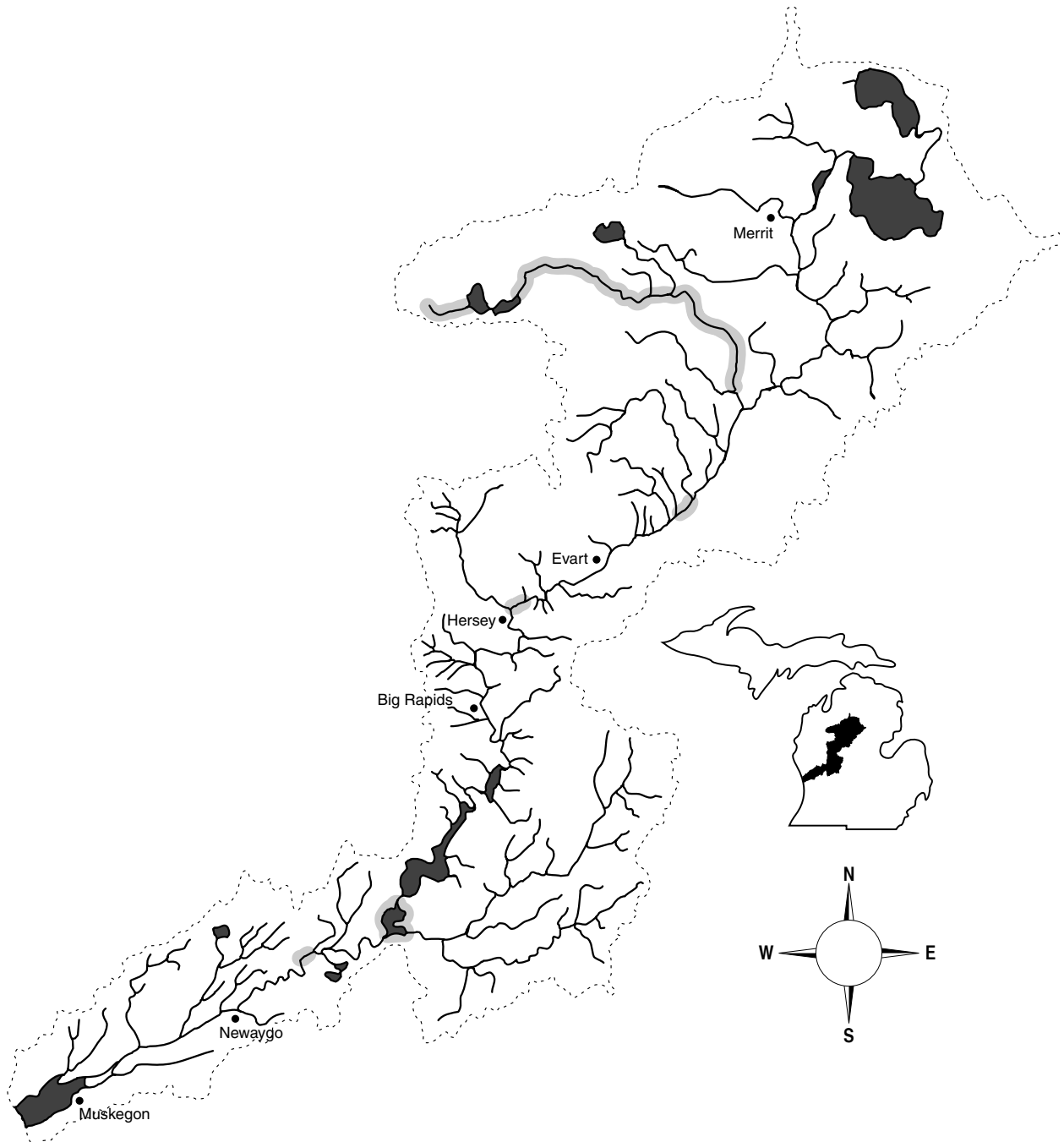
- spawning
 - large stones and pebbles present
 - often below a riffle in shallow water
 - gravel substrate



River chub (*Nocomis micropogon*)

Habitat:

- feeding - moderate to large streams
- moderate to high gradient
- gravel, boulder, or bedrock substrate
- little to no aquatic vegetation
- cannot tolerate turbidity or siltation

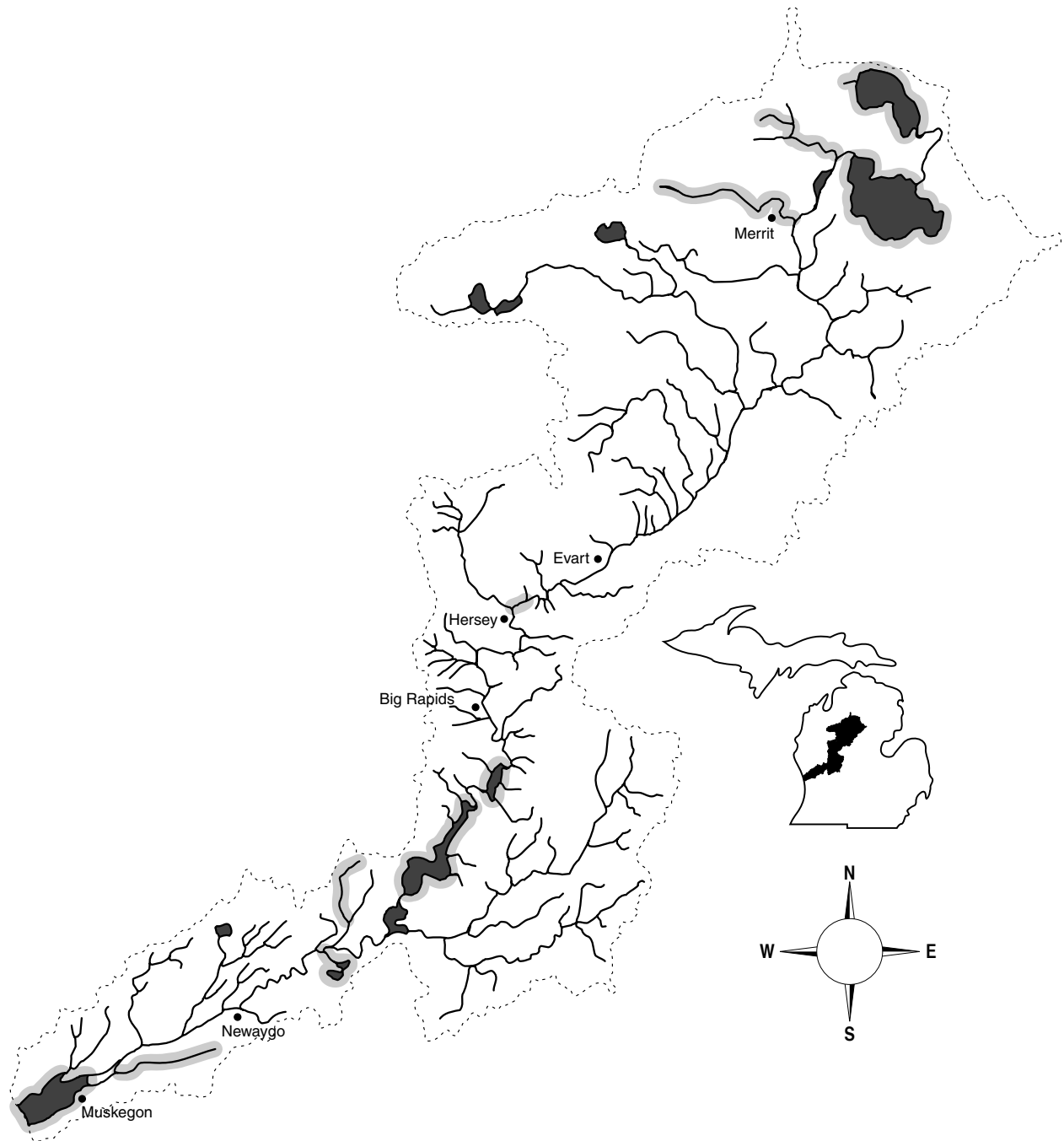


Golden shiner (*Notemigonus crysoleucas*)

Habitat:

- feeding - lakes and impoundments and quiet pools of low gradient streams
- clear shallow water
- heavy vegetation

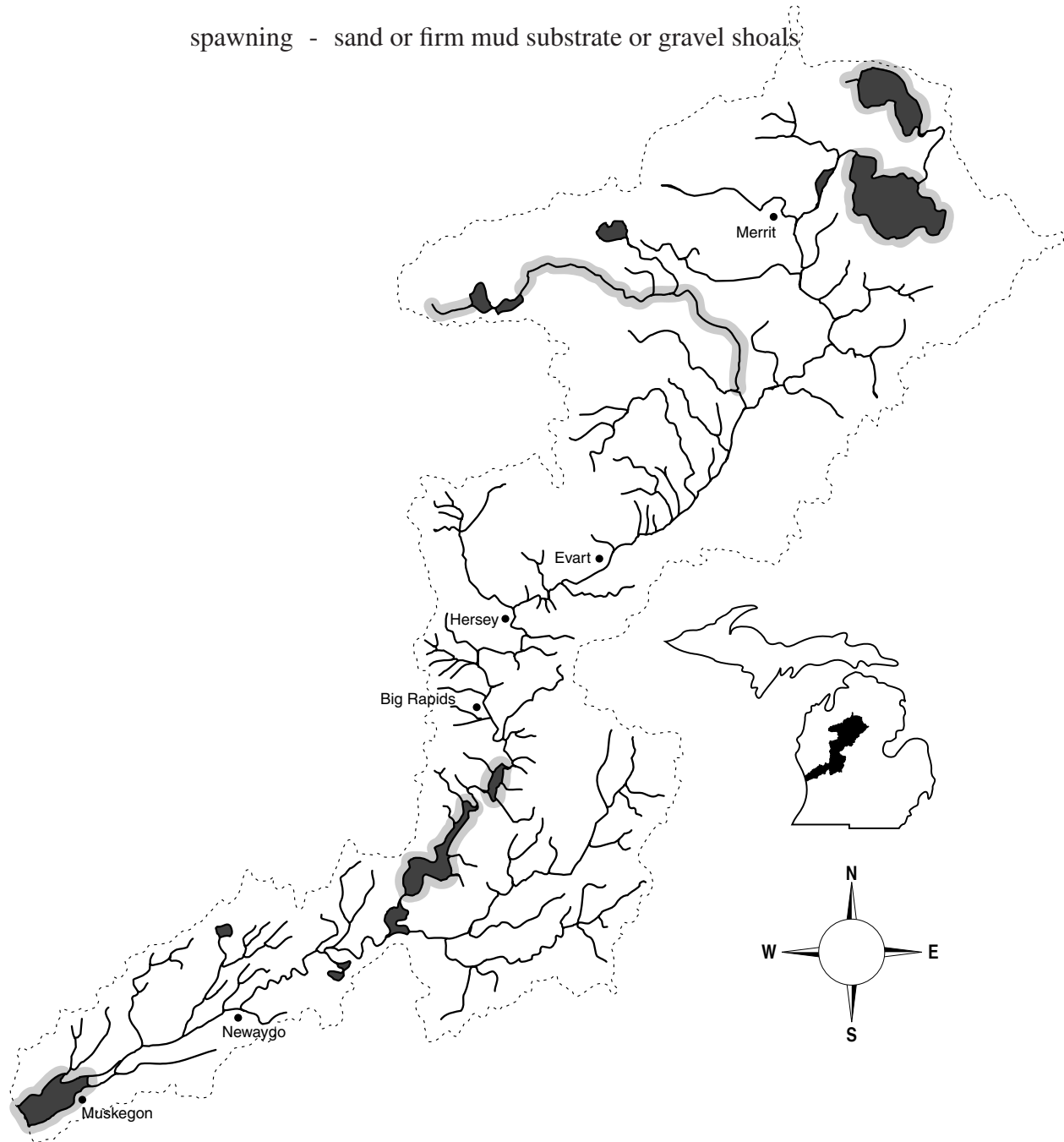
- spawning - vegetation



Emerald shiner (*Notropis atherinoides*)

Habitat:

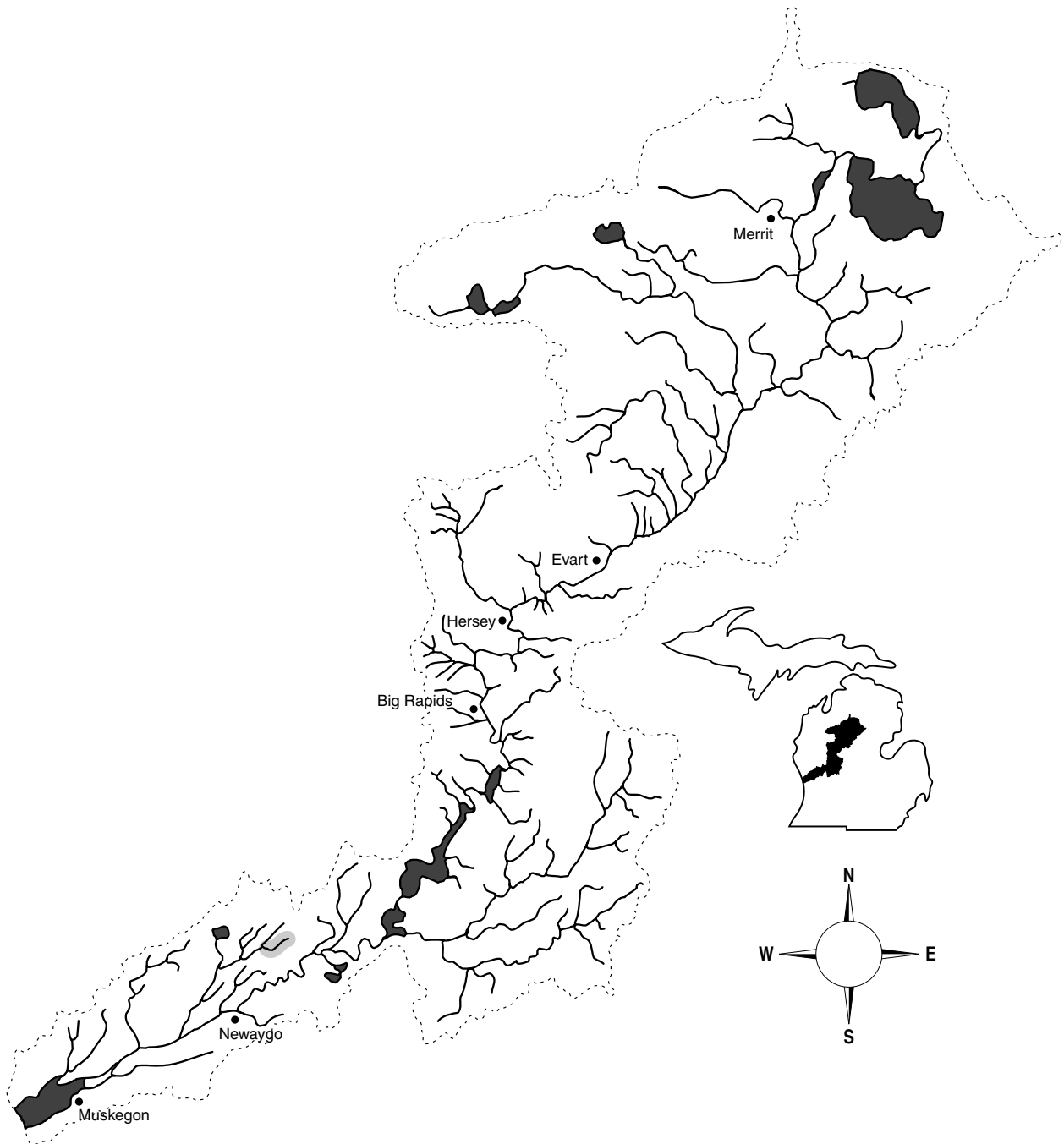
- feeding - open-large stream channels
 - low to moderate gradient
 - range of turbidites and bottom types
 - midwater or surface preferred, substrate of little importance
 - avoids rooted vegetation
- spawning - sand or firm mud substrate or gravel shoals



Bigmouth shiner (*Notropis dorsalis*)

Habitat:

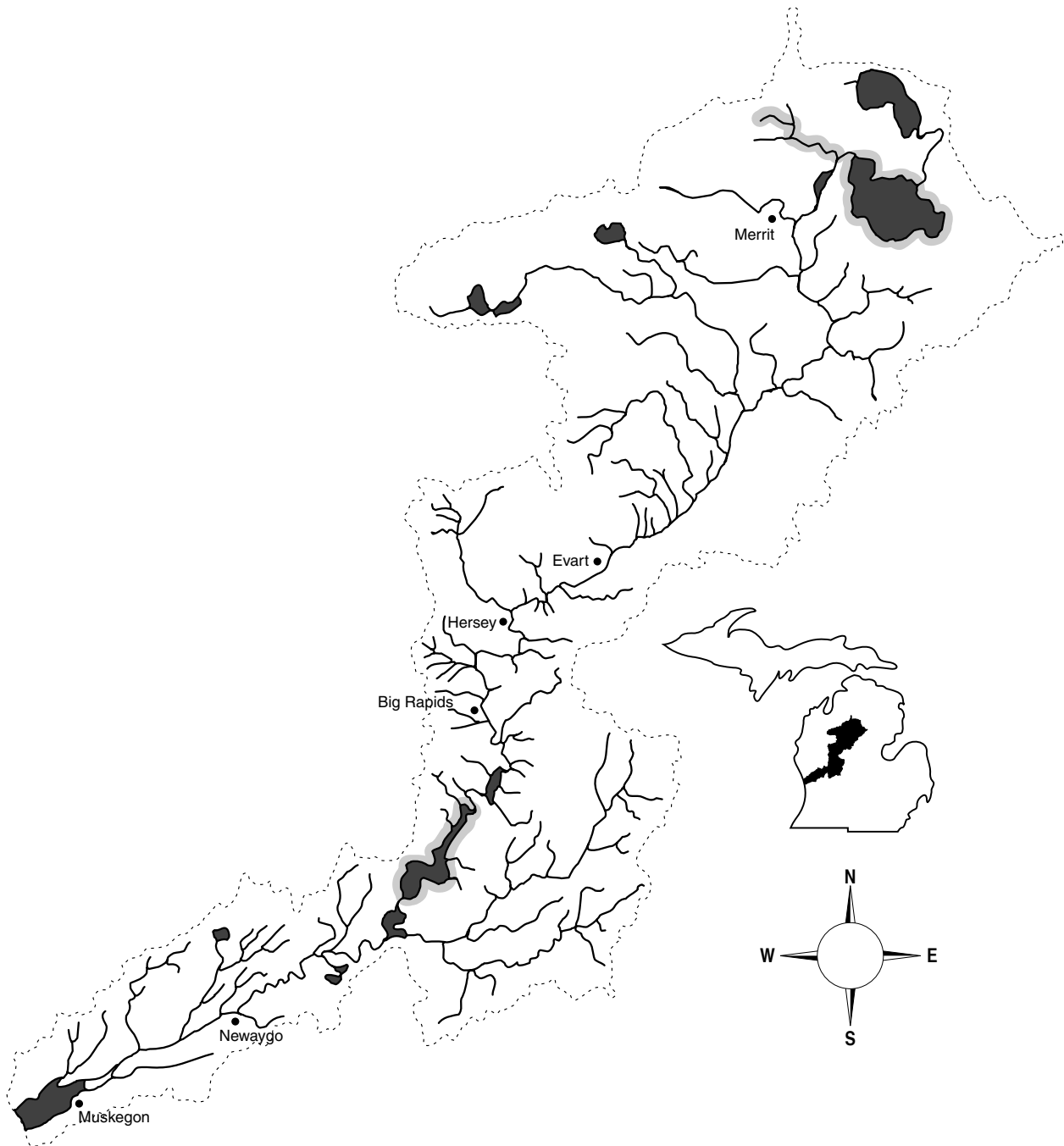
- feeding - small clear streams
- good flows
- sand or gravel substrate
- open water, free from vegetation



Blackchin shiner (*Notropis heterodon*)

Habitat:

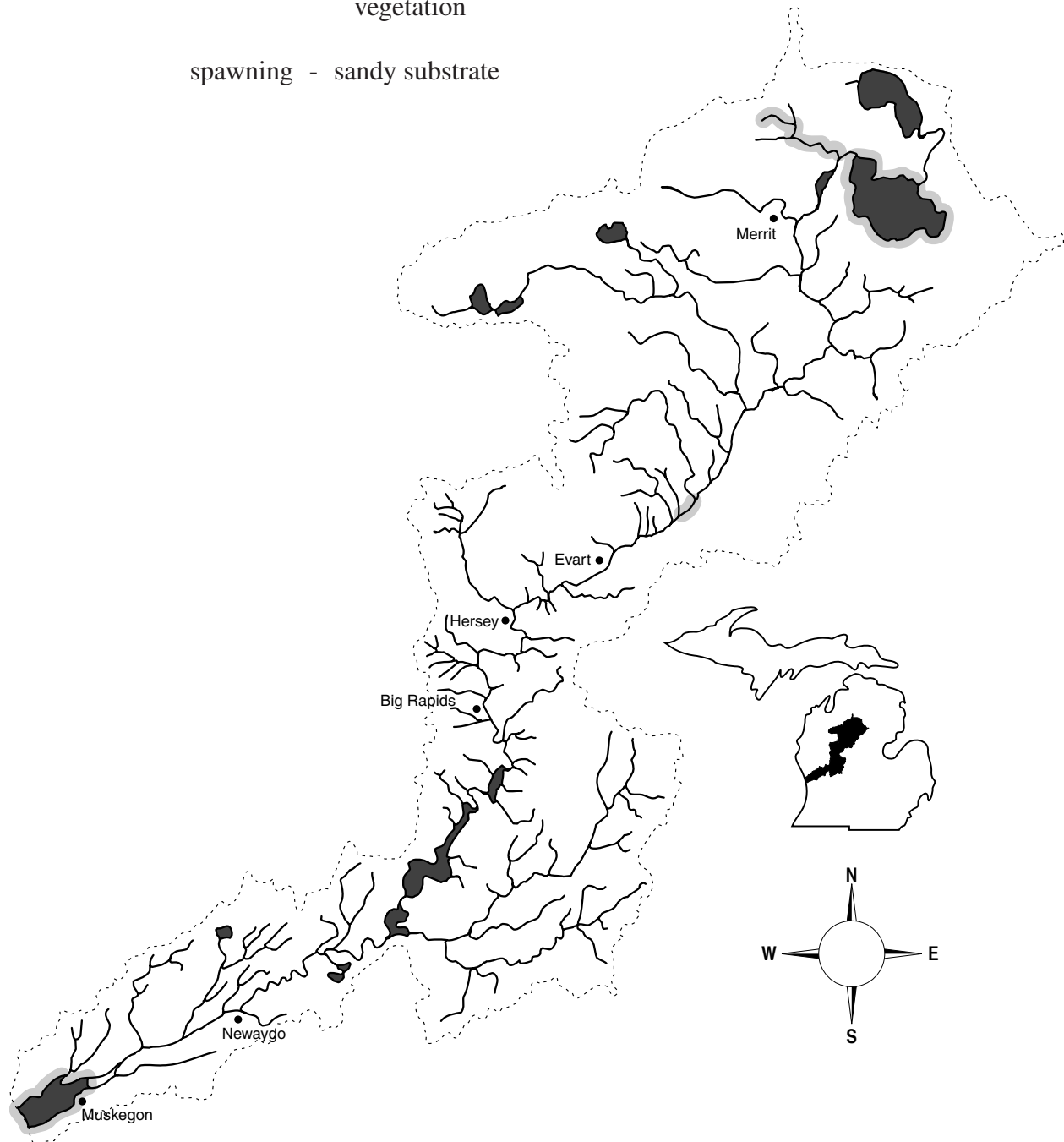
- feeding - lakes, impoundments, and quiet pools in streams and rivers
- clear water
- clean sand, gravel, or organic debris substrate
- dense beds of submerged aquatic vegetation
- cannot tolerate turbidity, silt, or loss of aquatic vegetation



Blacknose shiner (*Notropis heterolepis*)

Habitat:

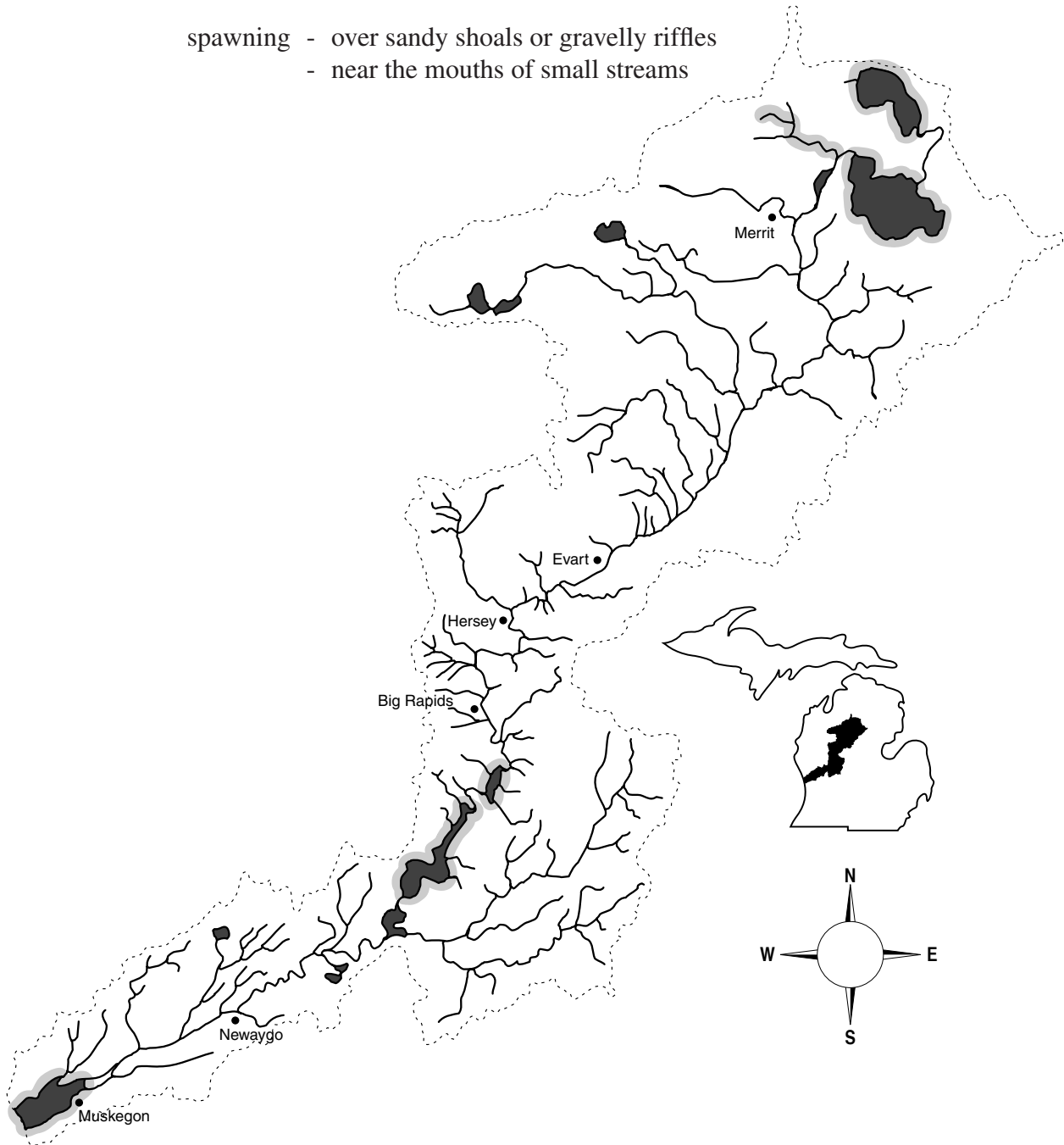
- feeding - clear lakes, impoundments, and pools of small, clear, low gradient streams
 - aquatic vegetation
 - clean sand, gravel, marl, muck, peat, or organic debris substrate
 - cannot tolerate much turbidity, much siltation, or loss of aquatic vegetation
- spawning - sandy substrate



Spottail shiner (*Notropis hudsonius*)

Habitat:

- feeding - large rivers, lakes, and impoundments
 - firm sand and gravel substrate
 - low current
 - sparse to moderate vegetation
 - avoids turbidity
-
- spawning - over sandy shoals or gravelly riffles
 - near the mouths of small streams

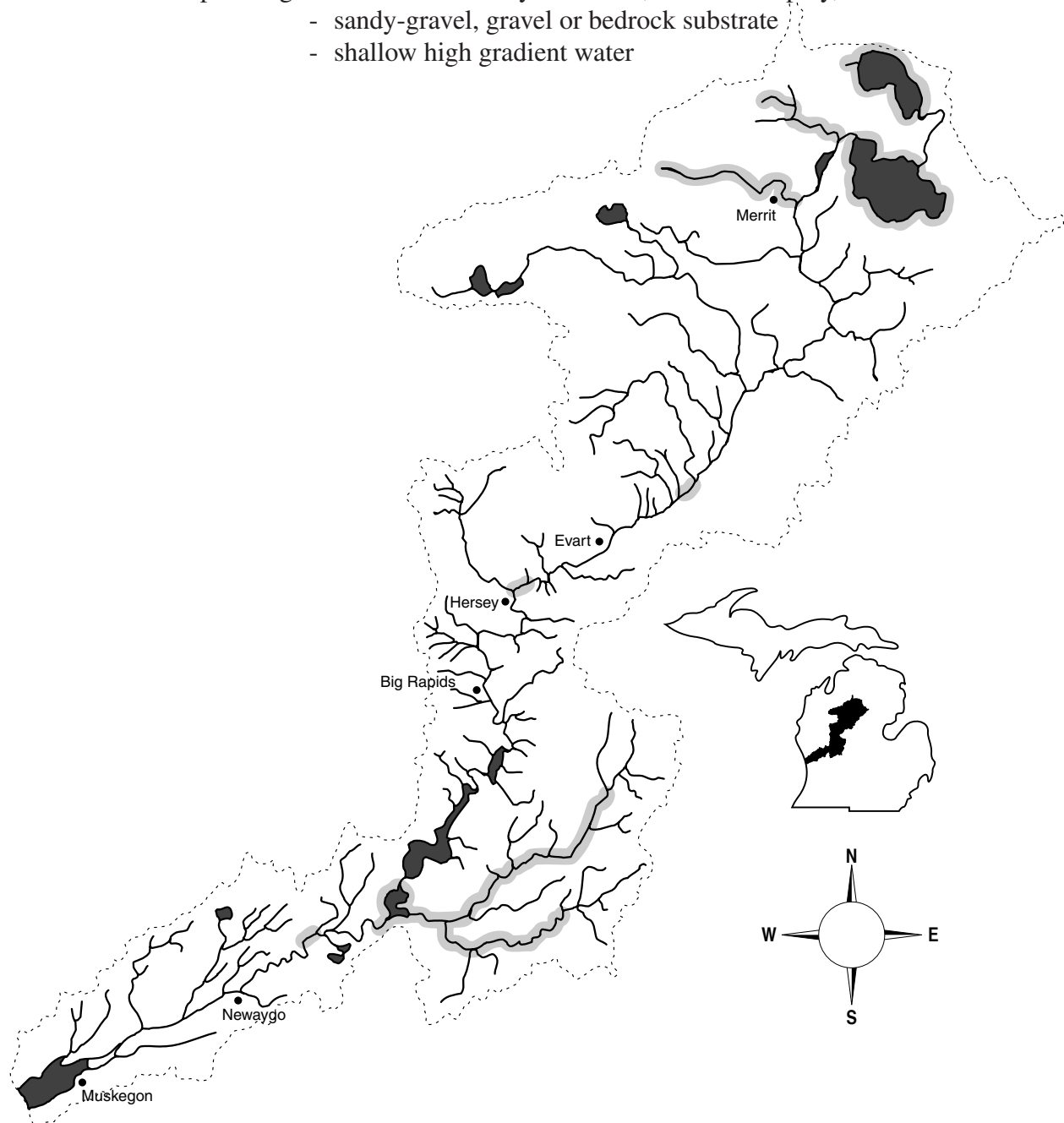


Rosyface shiner (*Notropis rubellus*)

Habitat:

- feeding
 - moderate sized streams
 - moderate to high gradient
 - gravel or sand substrate; intolerant of silt substrate
 - clear water; intolerant of turbidity

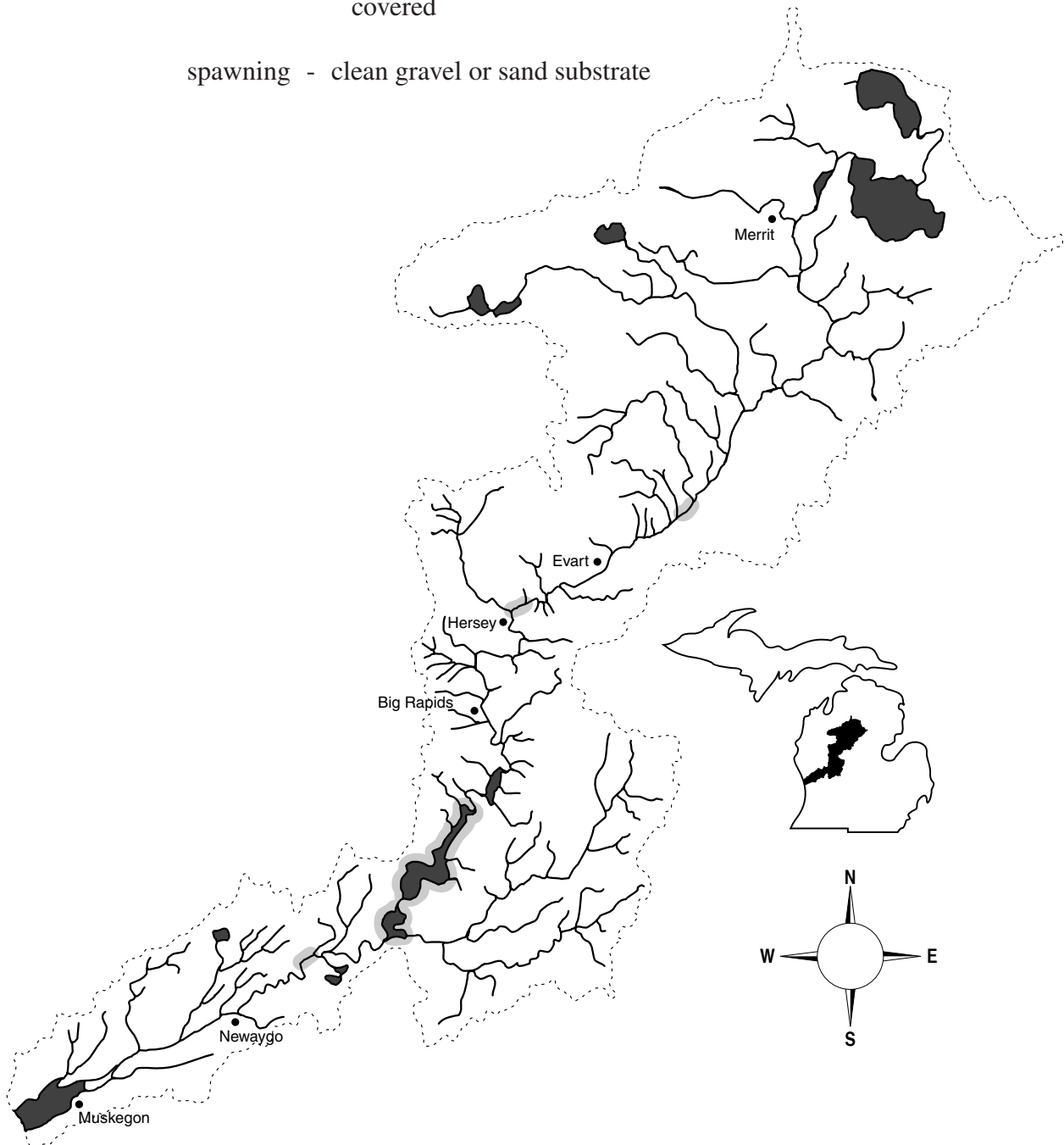
- spawning
 - on nests of horneyhead chub, chesnut lamprey, and redhorses
 - sandy-gravel, gravel or bedrock substrate
 - shallow high gradient water



Sand shiner (*Notropis stramineus*)

Habitat:

- feeding - sand and gravel substrate
 - shallow pools in medium size streams, lakes, and impoundments
 - clear water and low gradient
 - rooted aquatic vegetation preferred
 - tolerant of some inorganic pollutants provided substrate is not covered
- spawning - clean gravel or sand substrate

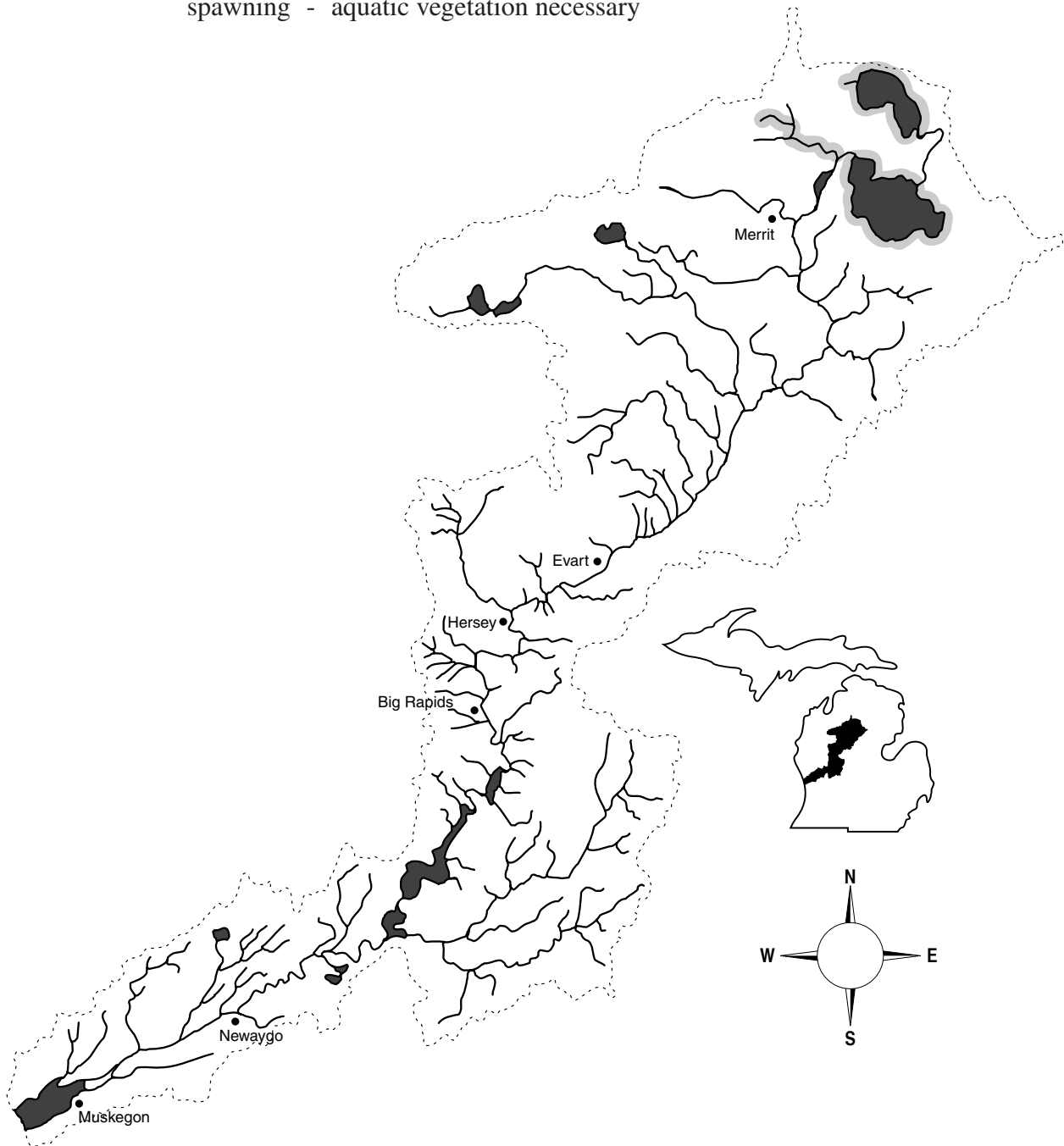


Mimic shiner (*Notropis volucellus*)

Habitat:

- feeding - pools and backwater of streams, moderately weedy lakes and impoundments
- quiet or still water
- clear shallow water

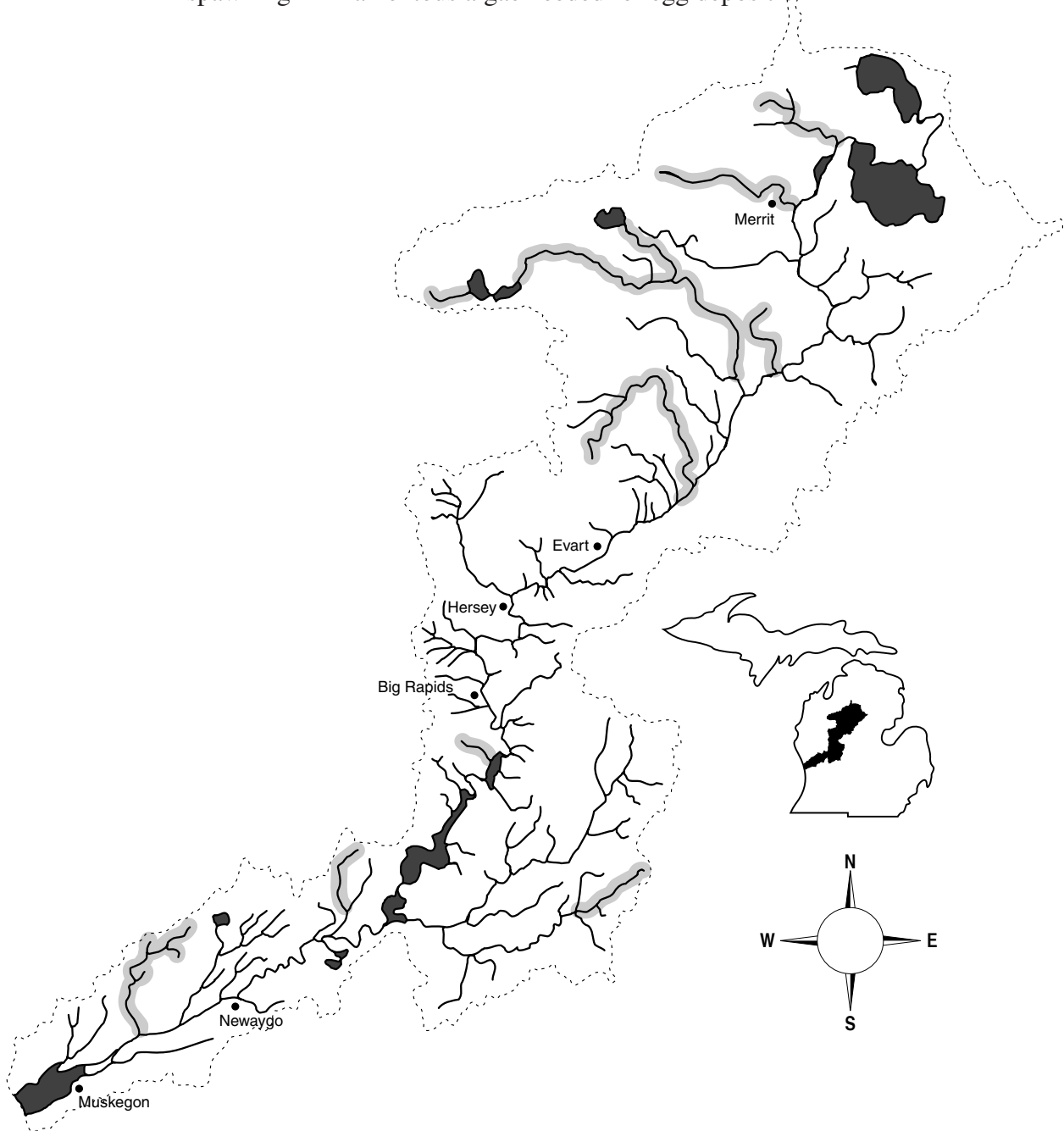
- spawning - aquatic vegetation necessary



Northern redbelly dace (*Phoxinus eos*)

Habitat:

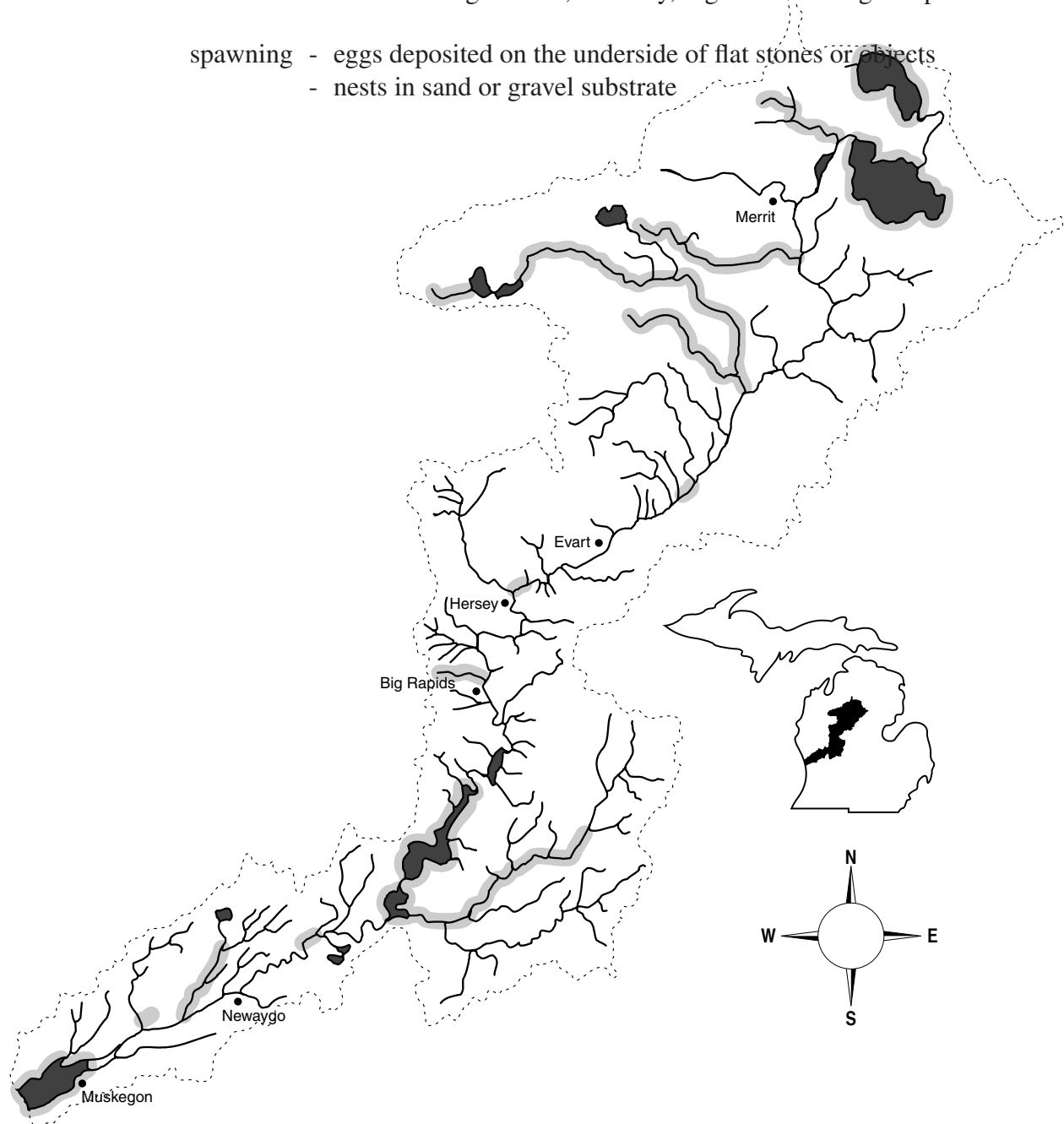
- feeding - slow current
 - in boggy lakes and streams
 - detritus or silt substrate
 - clear to slightly turbid water
- spawning - filamentous algae needed for egg deposition



Bluntnose minnow (*Pimephales notatus*)

Habitat:

- feeding - quiet pools and backwaters of medium to large streams, lakes, and impoundments
 - clear warm water
 - some aquatic vegetation
 - firm substrates
 - tolerates all gradients, turbidity, organic and inorganic pollutants
-
- spawning - eggs deposited on the underside of flat stones or objects
 - nests in sand or gravel substrate

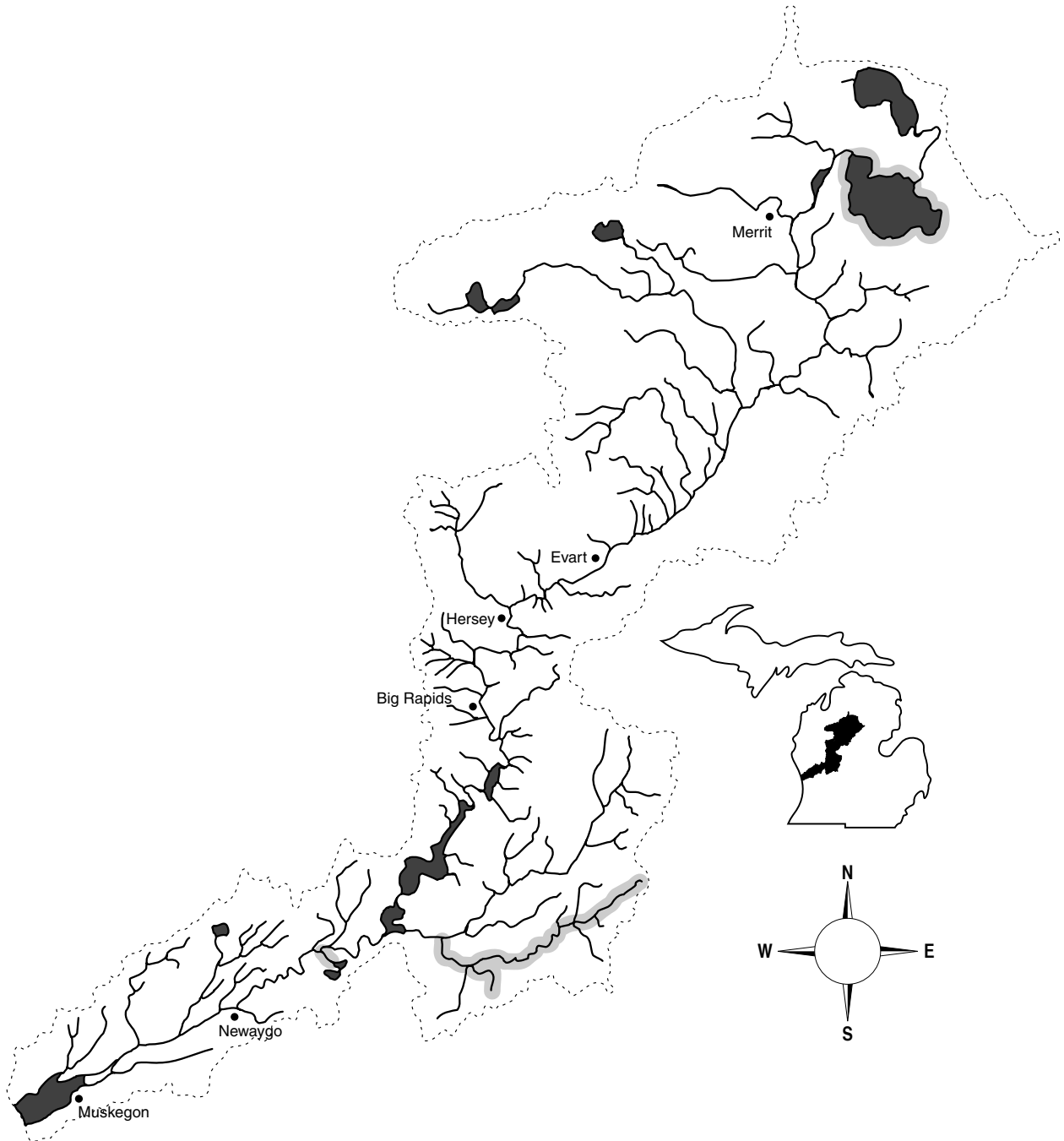


Fathead minnow (*Pimephales promelas*)

Habitat:

- feeding - pools of small streams, lakes, and impoundments
- tolerant of turbidity, high temperatures, and low oxygen

- spawning - on underside of objects in water 2 to 3 feet deep
- prefer sand, marl, or gravel substrate



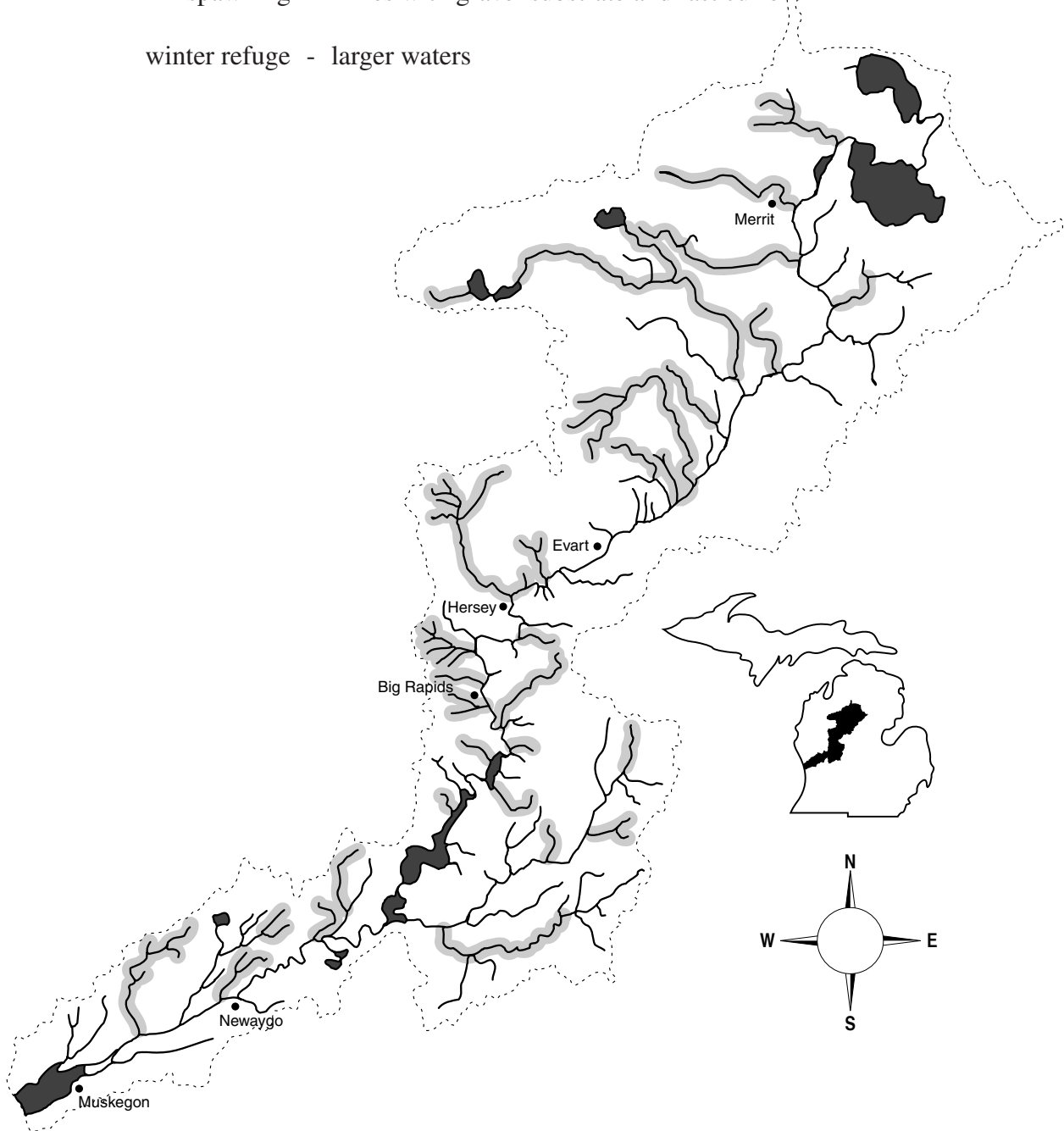
Blacknose dace (*Rhinichthys atratulus*)

Habitat:

- feeding - moderate to high gradient streams
- sand and gravel substrate
- clear cool water in pools with deep holes and undercut banks
- does not tolerate turbidity and silt well

- spawning - riffles with gravel substrate and fast current

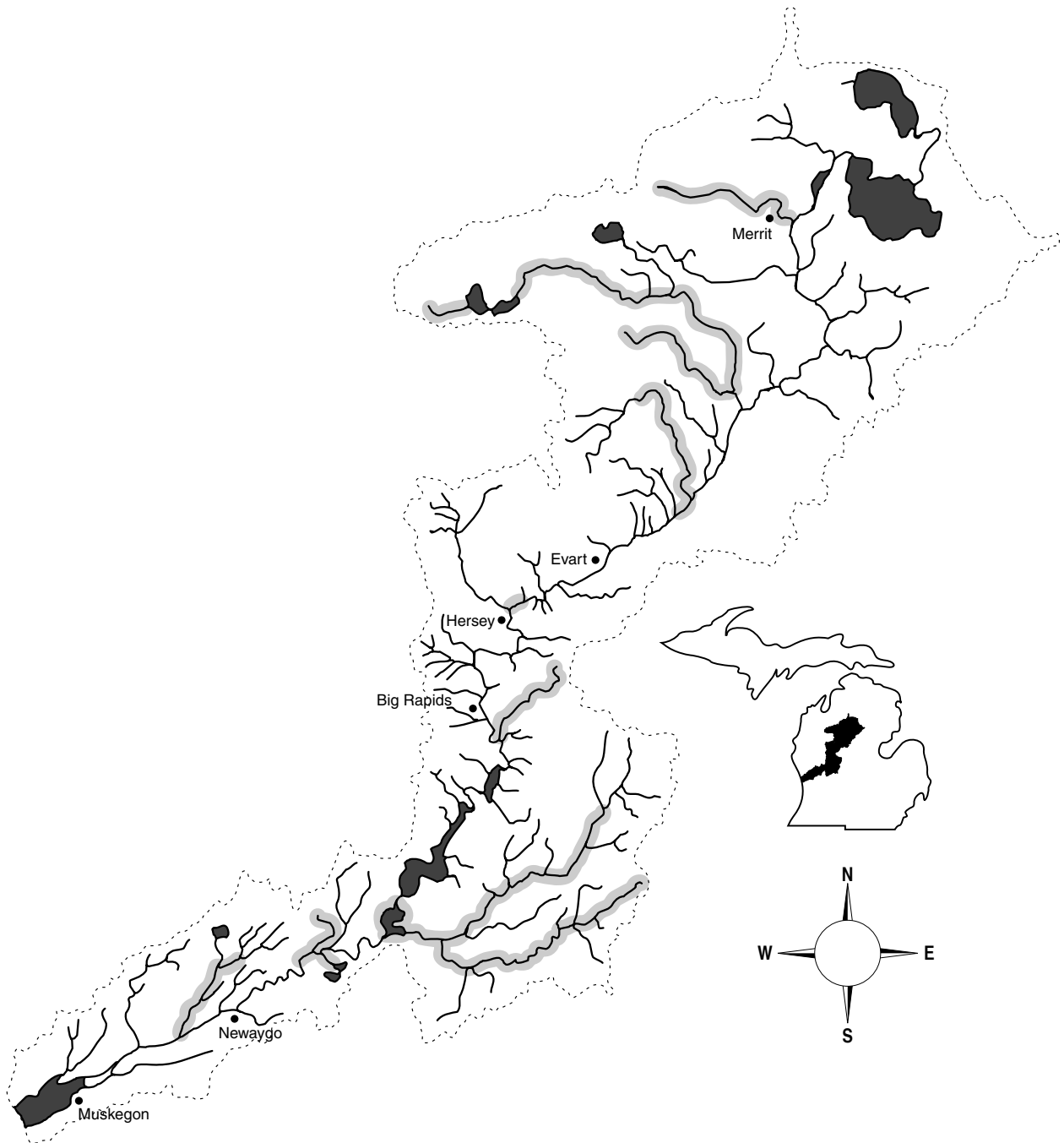
- winter refuge - larger waters



Longnose dace (*Rhinichthys cataractae*)

Habitat:

- feeding - lakes and streams
- high gradient
- gravel or boulder substrate



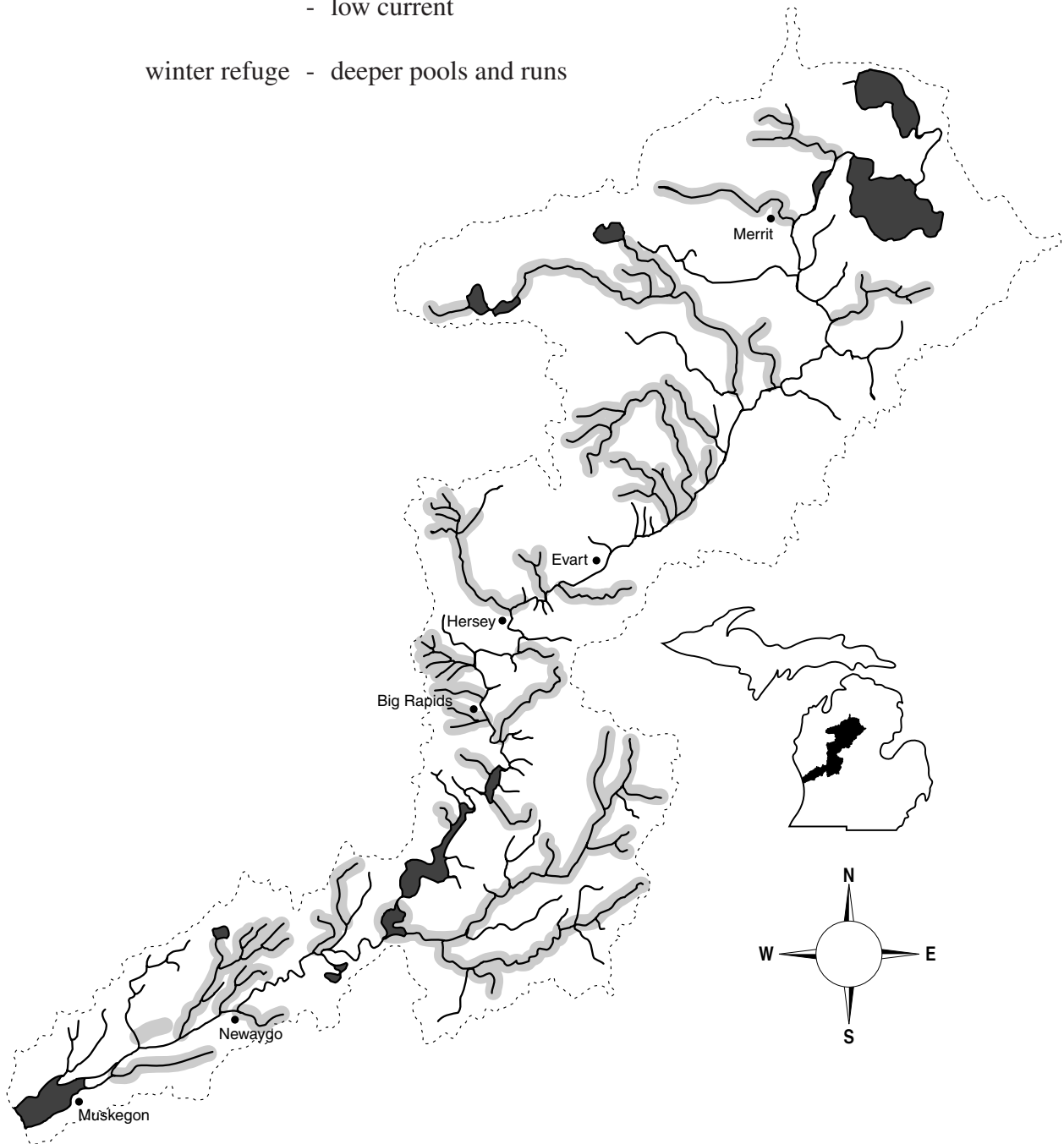
Creek chub (*Semotilus atromaculatus*)

Habitat:

- feeding - streams, rivers, or shore waters of lakes and impoundments
- can tolerate intermittent flows
- tolerates moderate turbidity

- spawning - gravel nests
- low current

- winter refuge - deeper pools and runs

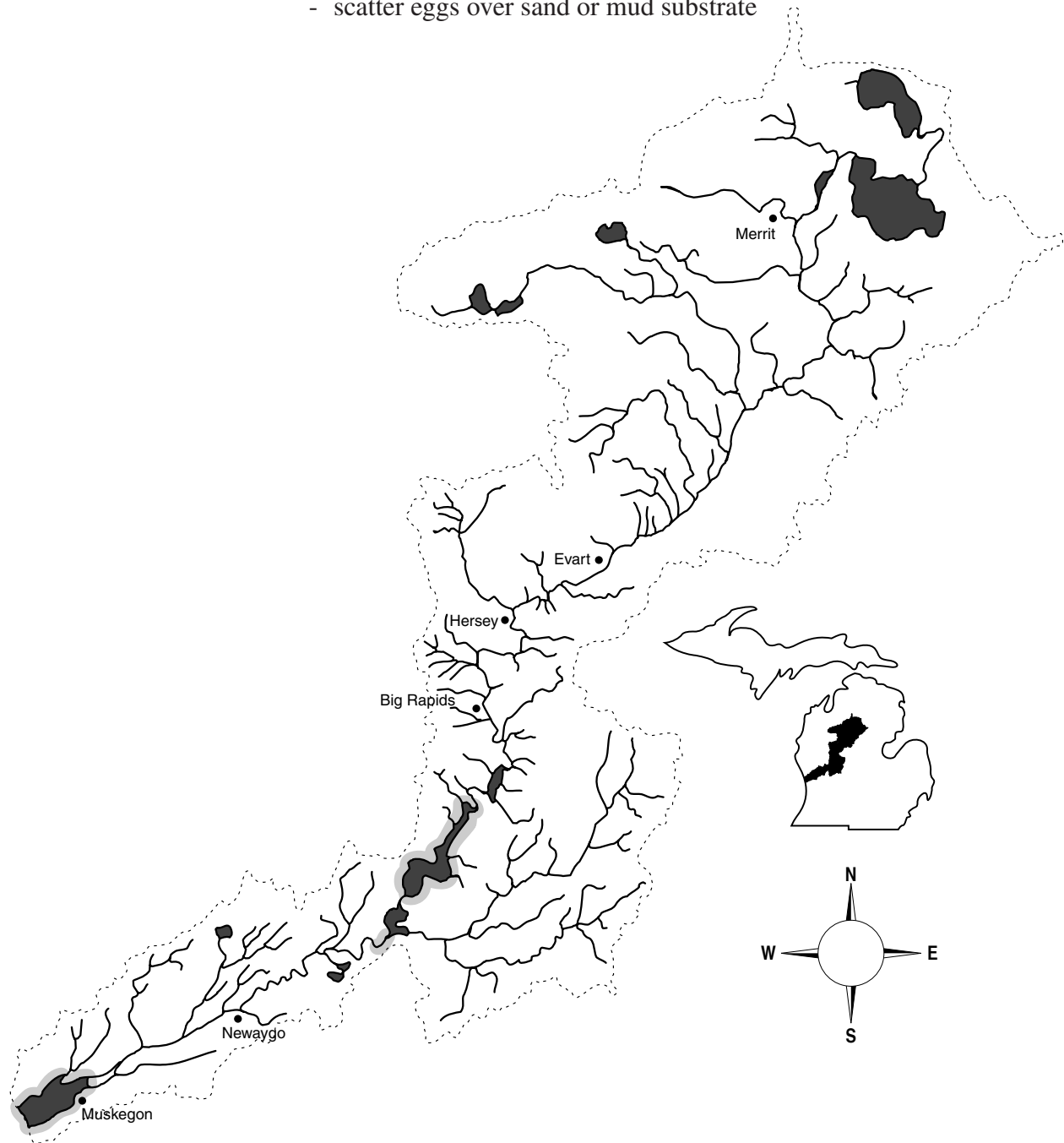


Quillback (*Carpoides cyprinus*)

Habitat:

- feeding - clear to turbid water
- sand, sandy gravel, sandy silt, or clay-silt substrate
- medium- to low-gradient rivers and streams; also lakes and sloughs

- spawning - streams or overflow areas of bends of rivers or bays of lakes
- scatter eggs over sand or mud substrate

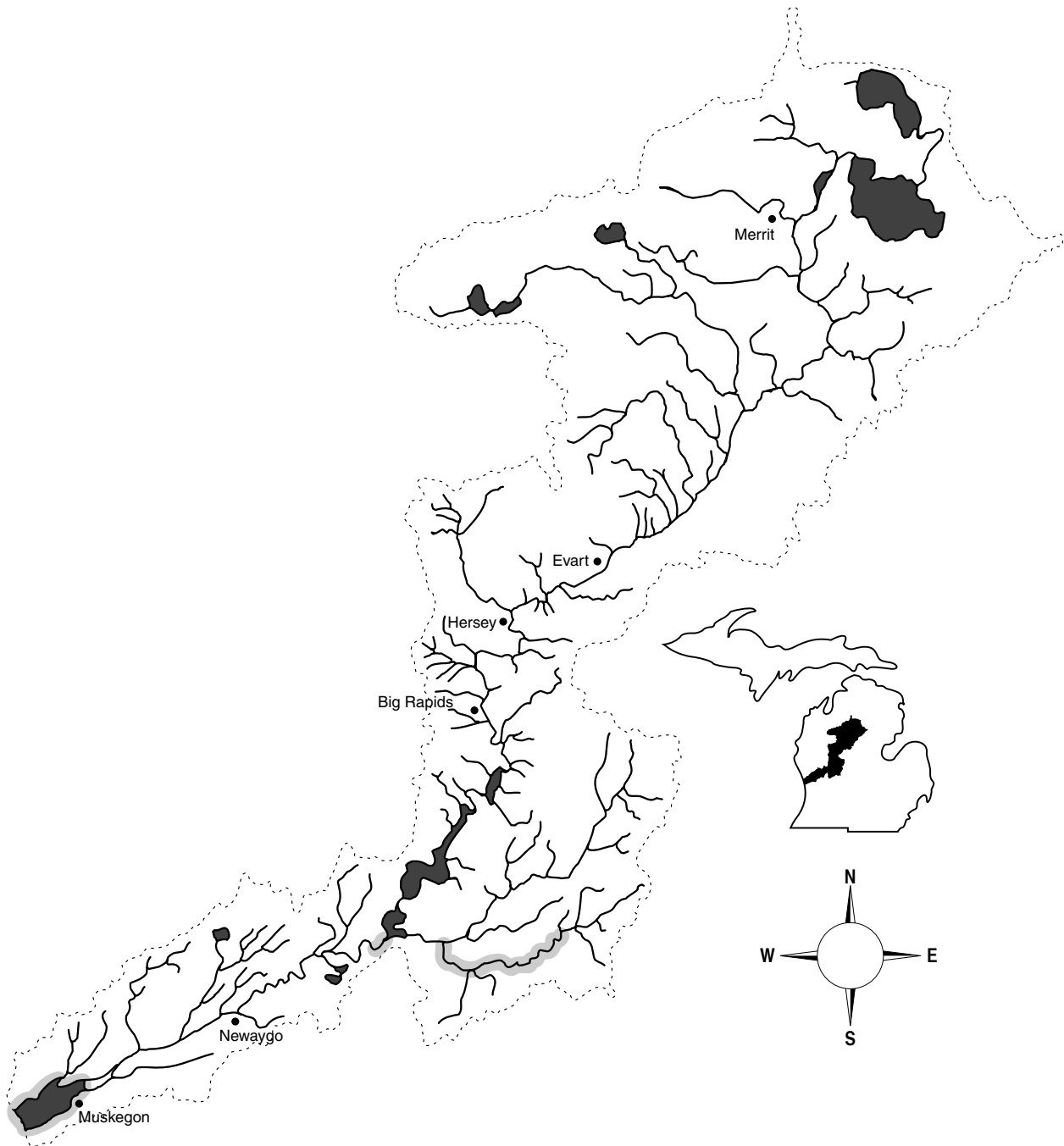


Longnose sucker (*Catostomus catostomus*)

Habitat:

- feeding - clear, cold rivers and lakes

- spawning - in streams or lake shallows
 - current
 - gravel substrate

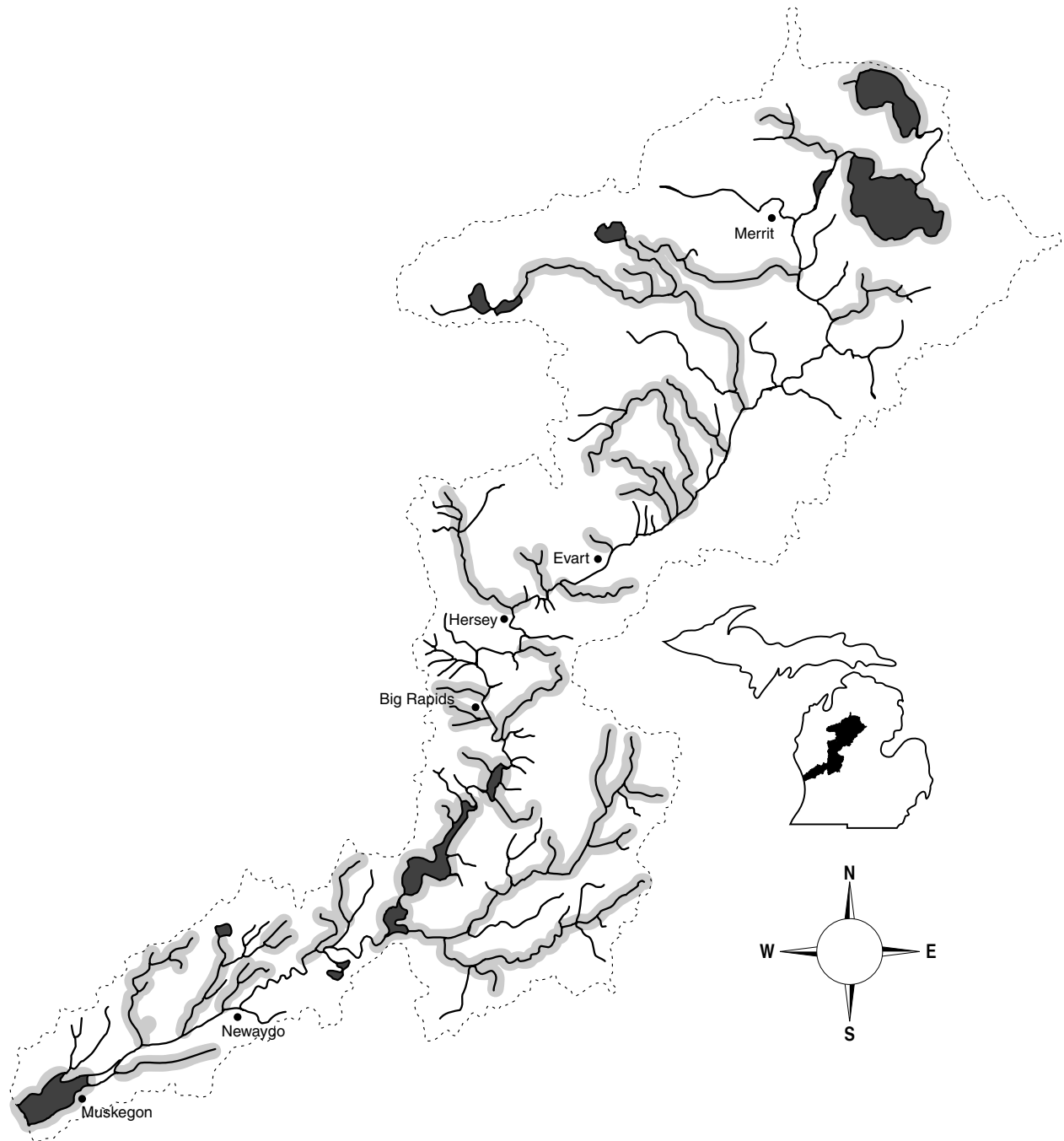


White sucker (*Catostomus commersoni*)

Habitat:

- feeding - streams, rivers, lakes, and impoundments
- can inhabit highly turbid and polluted waters

- spawning - quiet gravelly shallow areas of streams

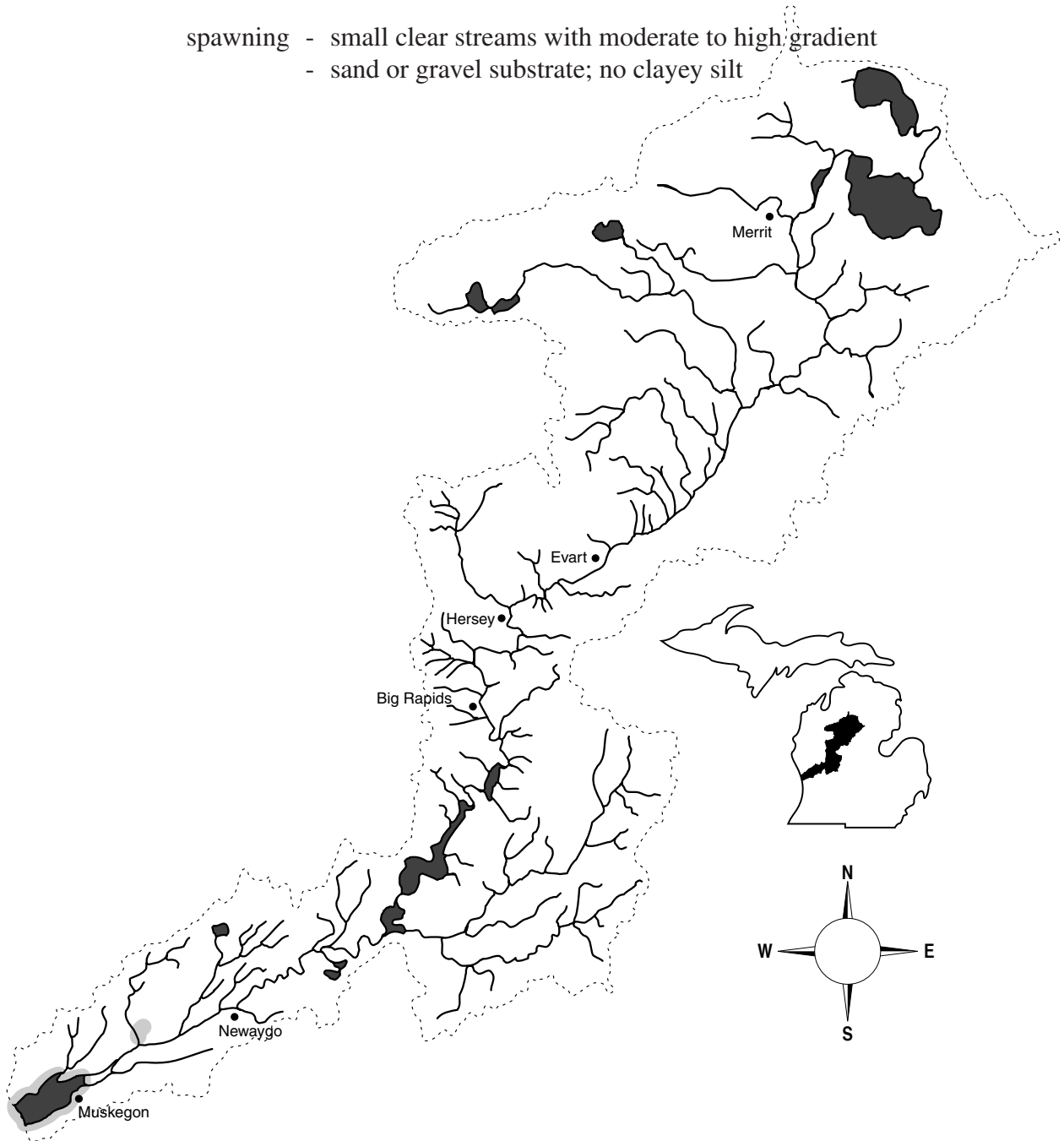


Lake chubsucker (*Erimyzon sucetta*)

Habitat:

- feeding - larger clear streams, rivers, lakes, and impoundments
- cannot tolerate turbid water
- low gradient
- prefers dense vegetation over substrate of sand or silt mixed with organic debris

- spawning - small clear streams with moderate to high gradient
- sand or gravel substrate; no clayey silt



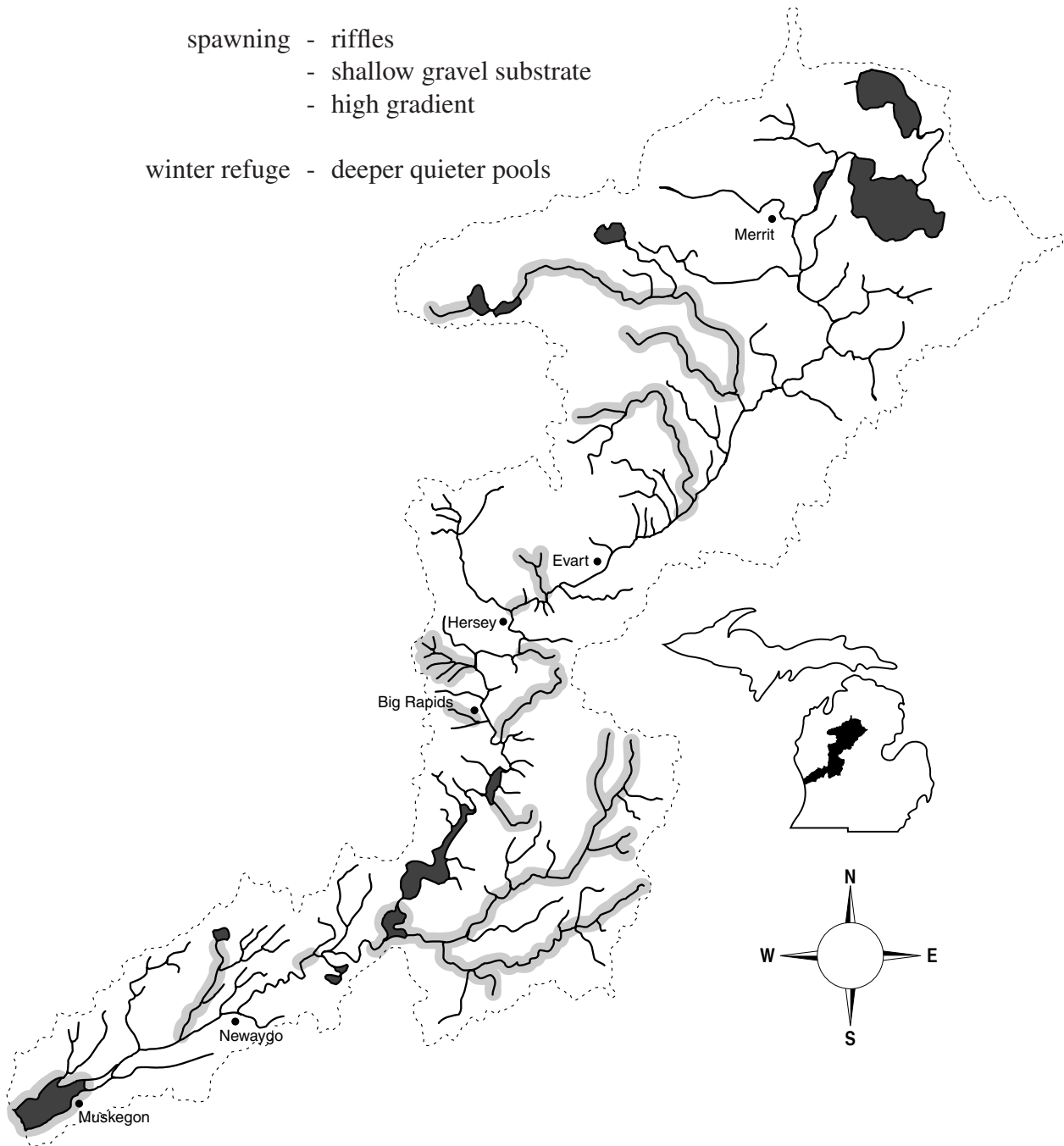
Northern hog sucker (*Hypentelium nigricans*)

Habitat:

- feeding
 - gravel or rubble substrate
 - riffles and adjacent pools of warm shallow streams
 - clear water
 - doesn't like turbidity or siltation
 - avoids profuse amounts of aquatic vegetation

- spawning
 - riffles
 - shallow gravel substrate
 - high gradient

- winter refuge
 - deeper quieter pools

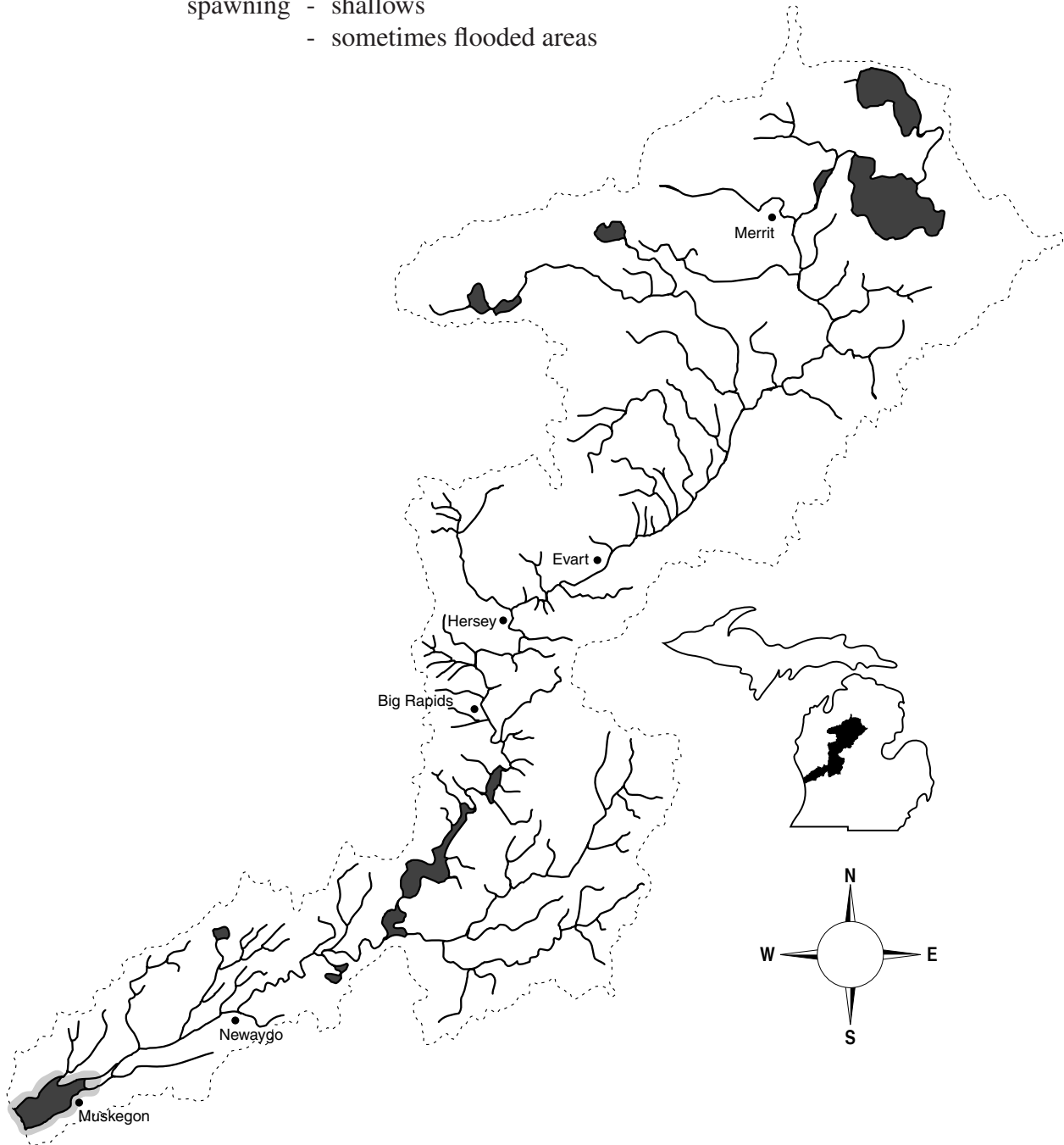


Black buffalo (*Ictiobus niger*)

Habitat:

- feeding - large rivers
- deep fast riffles
- occasionally shallow overflow ponds and sloughs
- varying turbidity over various substrates

- spawning - shallows
- sometimes flooded areas



Spotted sucker (*Minytrema melanops*)

Habitat:

- feeding - clear warm rivers (pools, backwaters) with little current
 - abundant vegetation
 - soft substrate with organic debris
 - intolerant of turbidity
- spawning - riffles

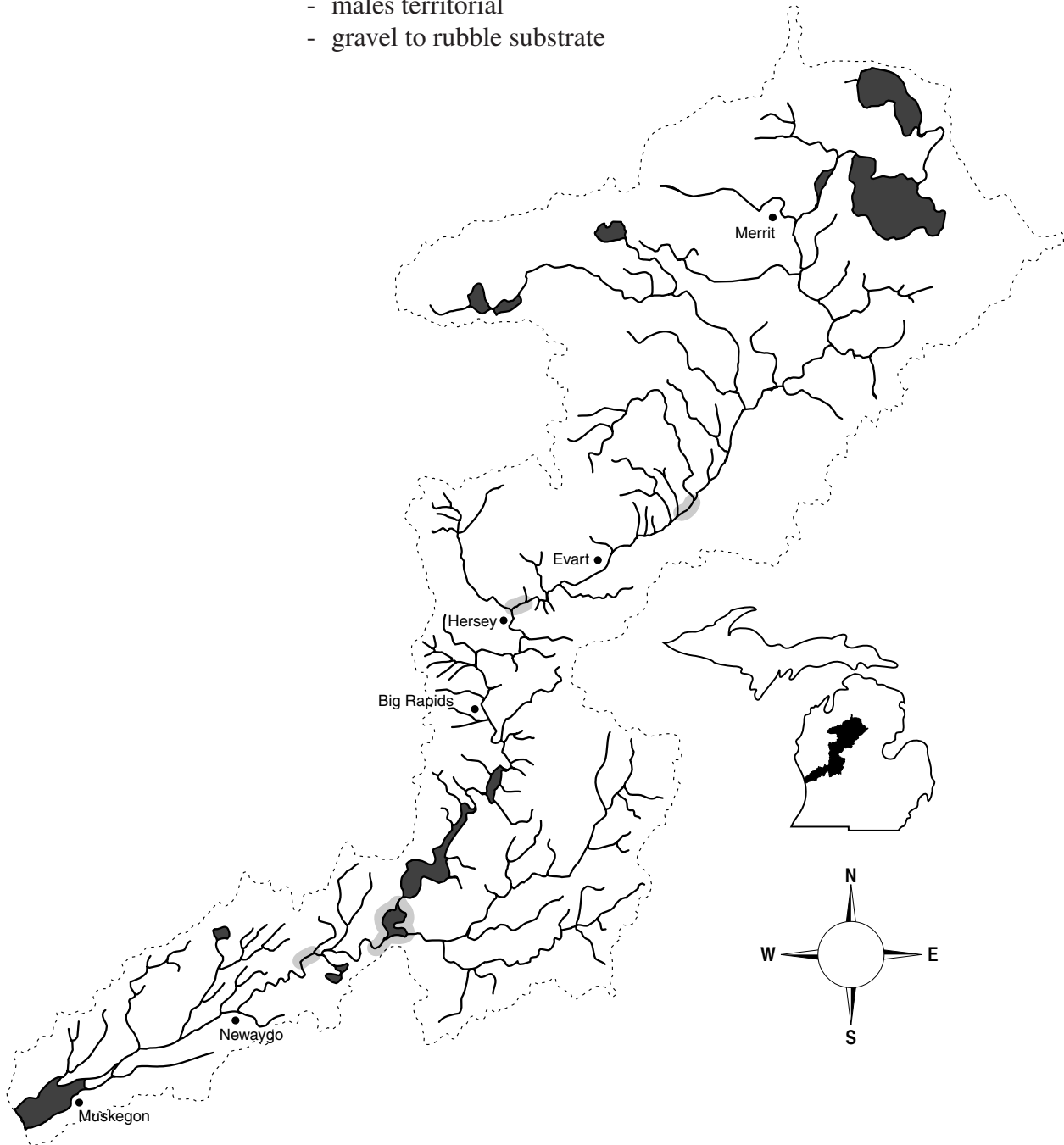


Silver redhorse (*Moxostoma anisurum*)

Habitat:

- feeding - streams, rivers, lakes, and impoundments
- low current
- pollution and turbidity intolerant

- spawning - swift current in rivers, do not spawn in tributaries
- males territorial
- gravel to rubble substrate

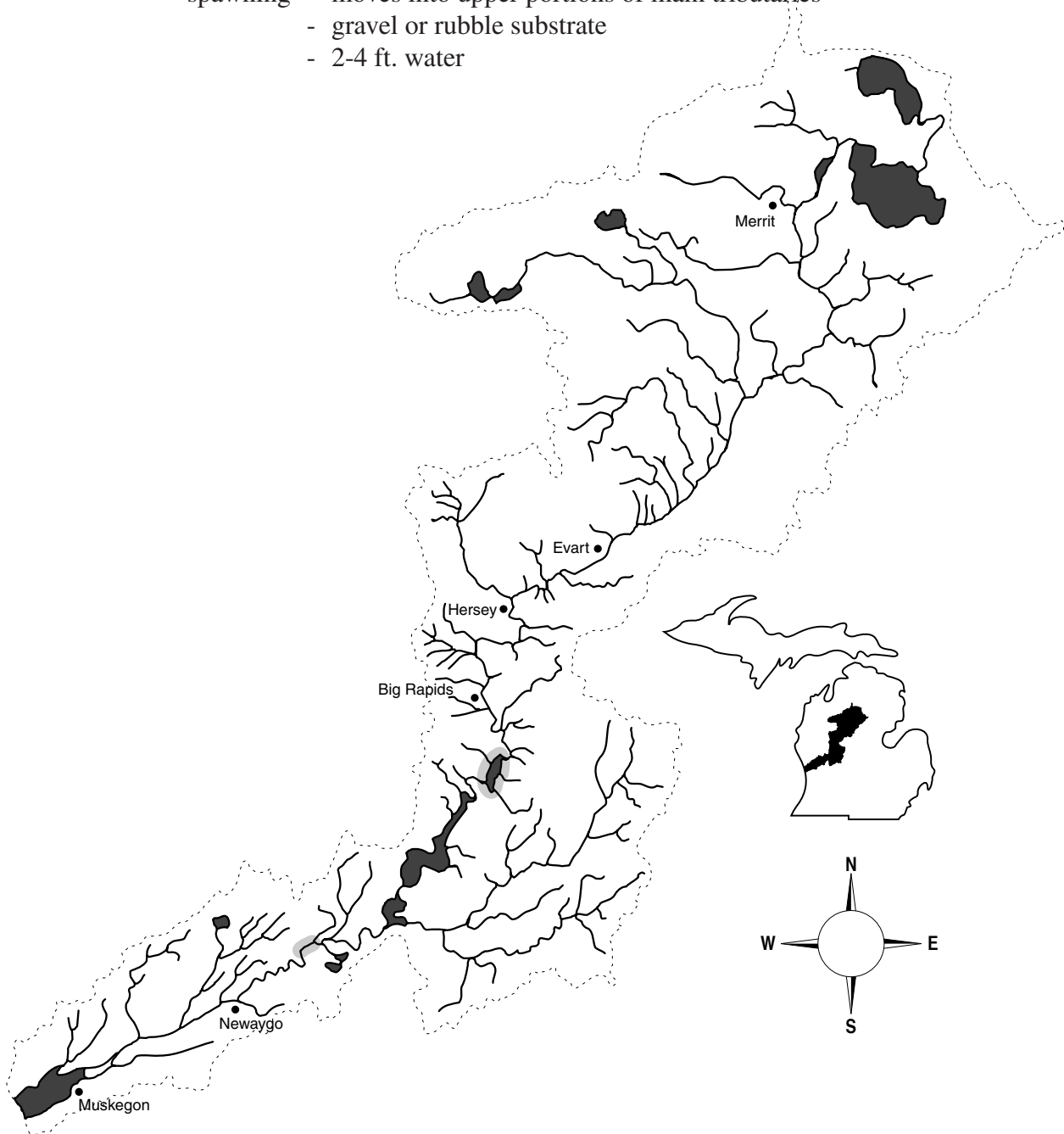


River redhorse (*Moxostoma carinatum*) - threatened

Habitat:

- feeding
 - hard silt-free substrate such as gravel and rubble
 - moderate to fast current
 - large rivers, lower portions of main tributaries, reservoirs, and pools

- spawning
 - moves into upper portions of main tributaries
 - gravel or rubble substrate
 - 2-4 ft. water



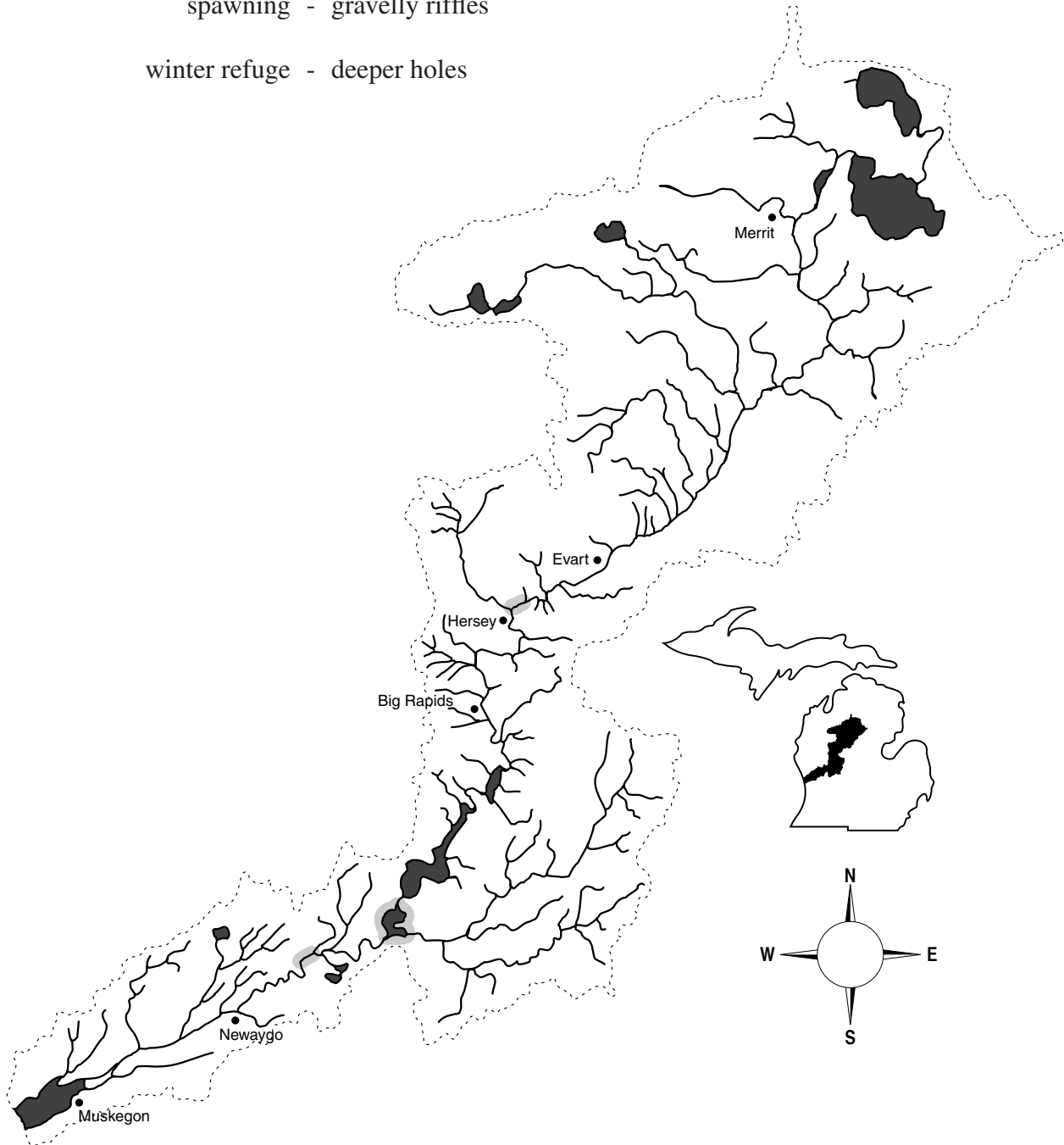
Black redhorse (*Moxostoma duquesnei*)

Habitat:

- feeding - gravel substrate
- clear water, intolerant of siltation, turbidity, and low gradients
- medium size streams
- cooler swifter streams and short rocky pools with current

- spawning - gravelly riffles

- winter refuge - deeper holes



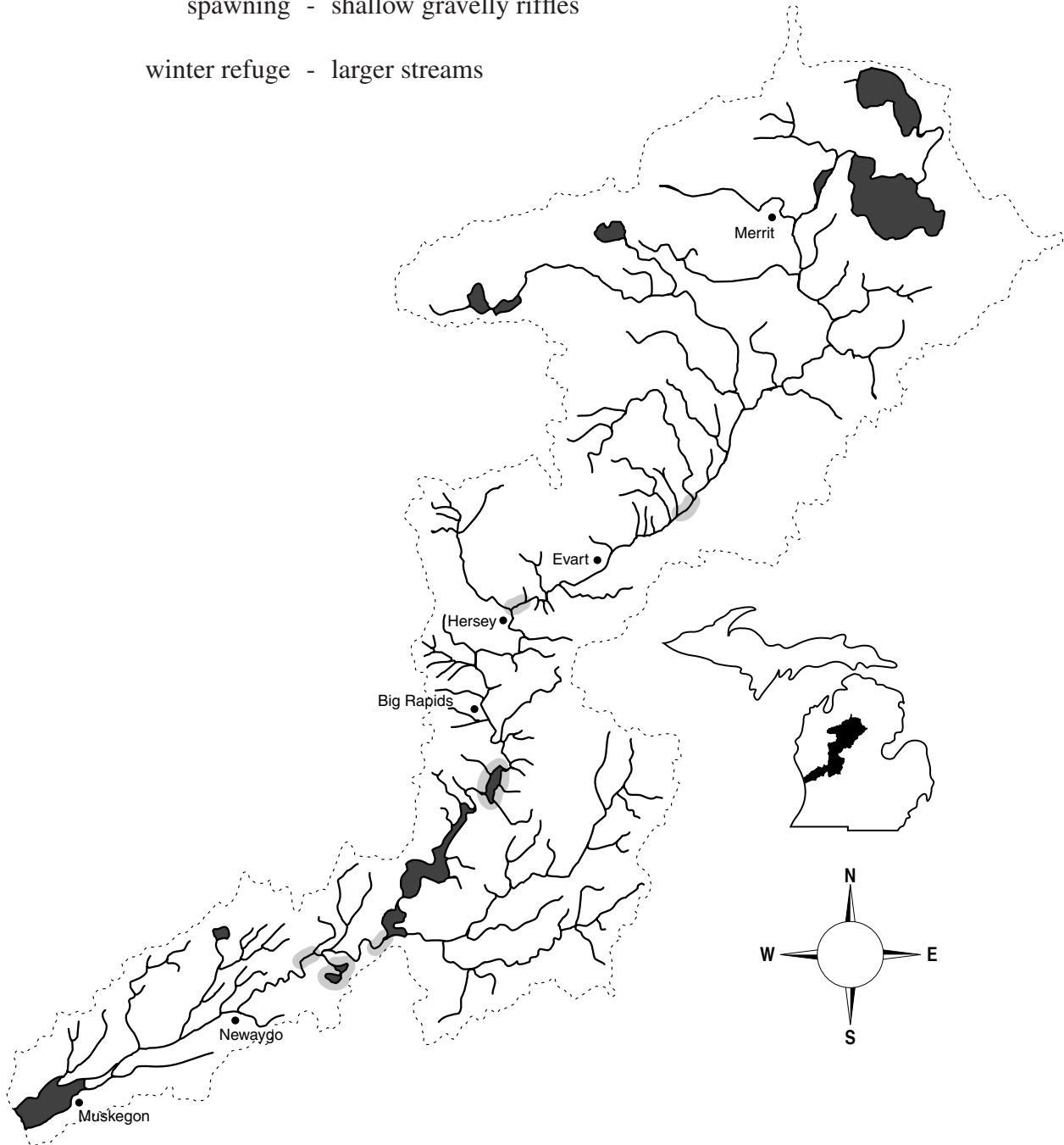
Golden redhorse (*Moxostoma erythrurum*)

Habitat:

- feeding - warm medium gradient streams and rivers
- clear riffly streams
- medium size streams and rivers
- tolerates some turbidity and silt

- spawning - shallow gravelly riffles

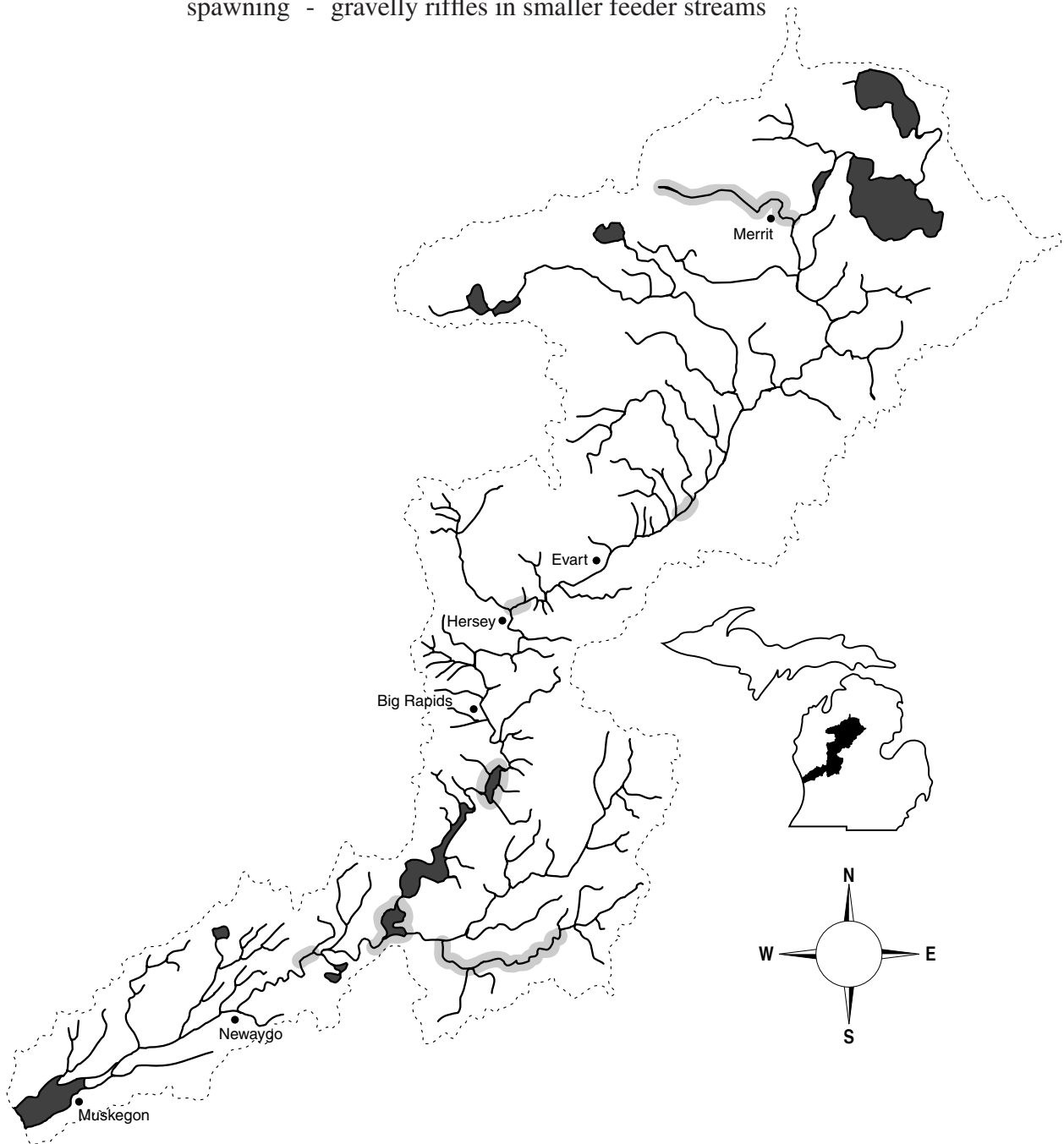
- winter refuge - larger streams



Shorthead redhorse (*Moxostoma macrolepidotum*)

Habitat:

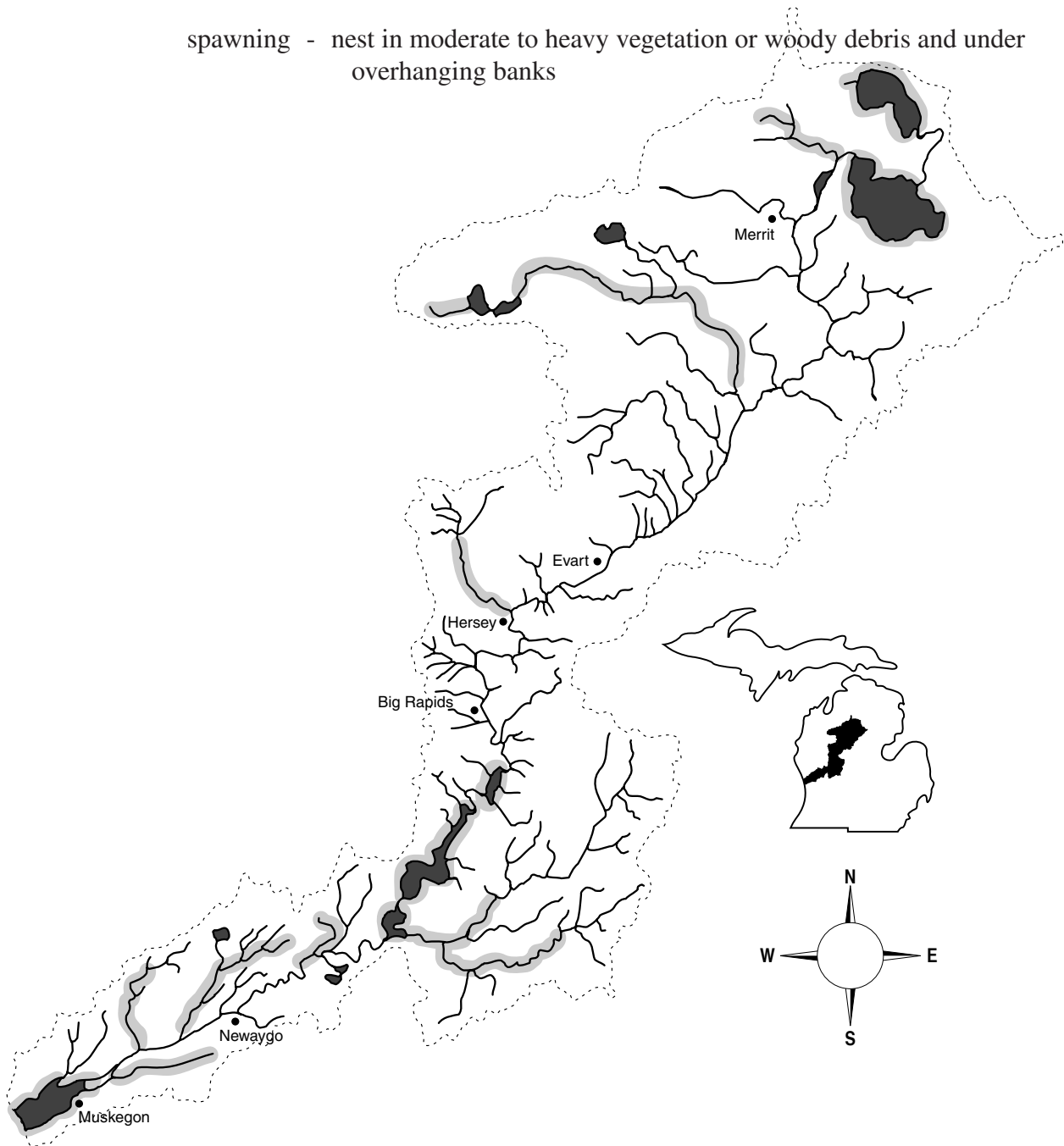
- feeding - downstream sections of large rivers, lakes, and impoundments
 - rocky substrates
 - swift water near riffles
 - clear to slightly turbid water
- spawning - gravelly riffles in smaller feeder streams



Black bullhead (*Ameiurus melas*)

Habitat:

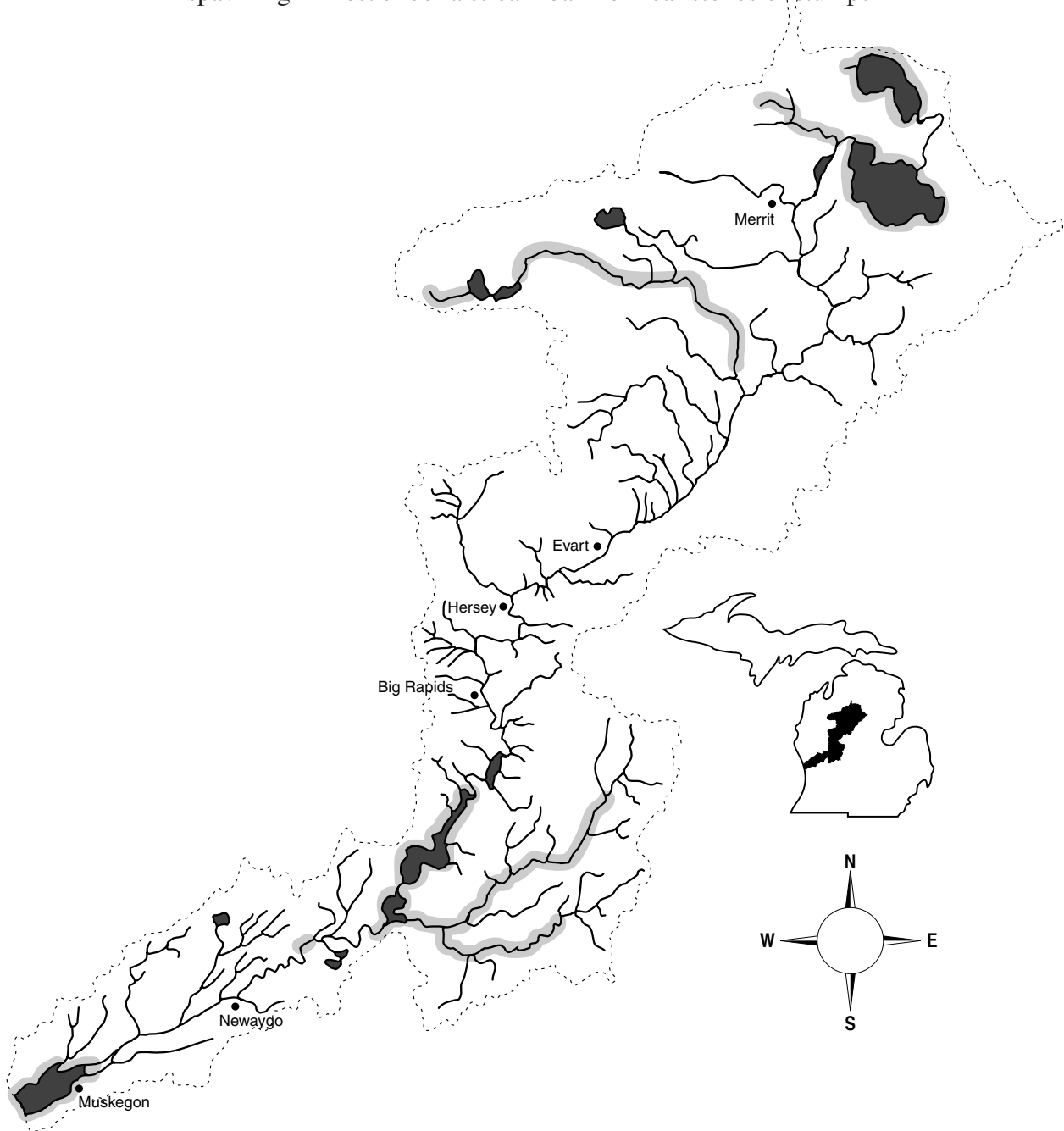
- feeding - turbid water
 - silt bottom
 - low gradient small to medium streams, pools, and headwaters of large rivers; also in lakes and impoundments
 - can tolerate very warm water and very low dissolved oxygen
- spawning - nest in moderate to heavy vegetation or woody debris and under overhanging banks



Yellow bullhead (*Ameiurus natalis*)

Habitat:

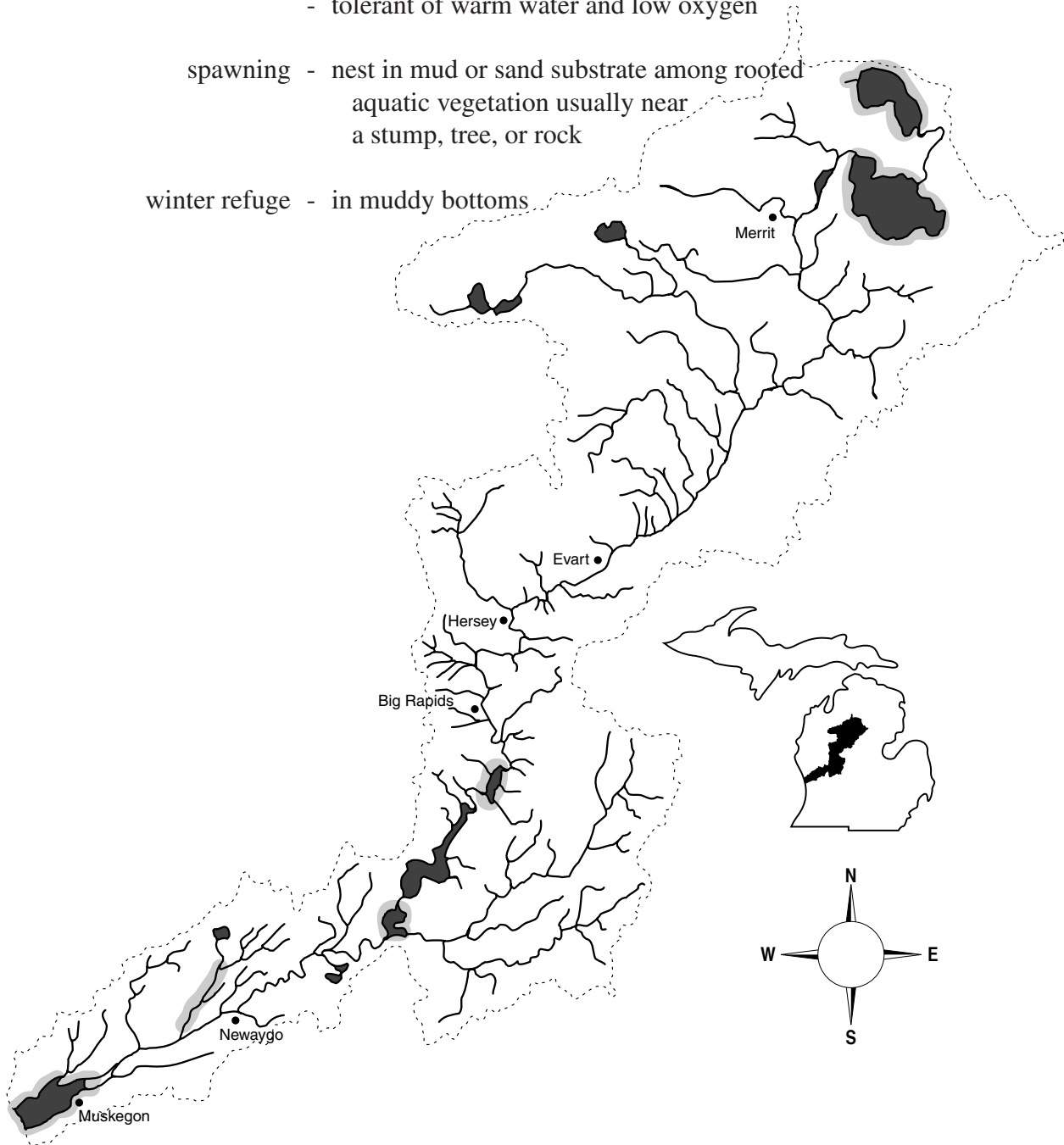
- feeding - clear flowing water
 - heavy vegetation
 - low gradient streams, lakes, and impoundments
 - tolerant of low oxygen
- spawning - nest under a stream bank or near stones or stumps



Brown bullhead (*Ameiurus nebulosus*)

Habitat:

- feeding - larger streams and rivers, lakes and impoundments
 - clear cool water with little clayey silt
 - moderate amounts of aquatic vegetation
 - sand, gravel, or muck substrate
 - not tolerant of turbid water
 - tolerant of warm water and low oxygen
- spawning - nest in mud or sand substrate among rooted aquatic vegetation usually near a stump, tree, or rock
- winter refuge - in muddy bottoms

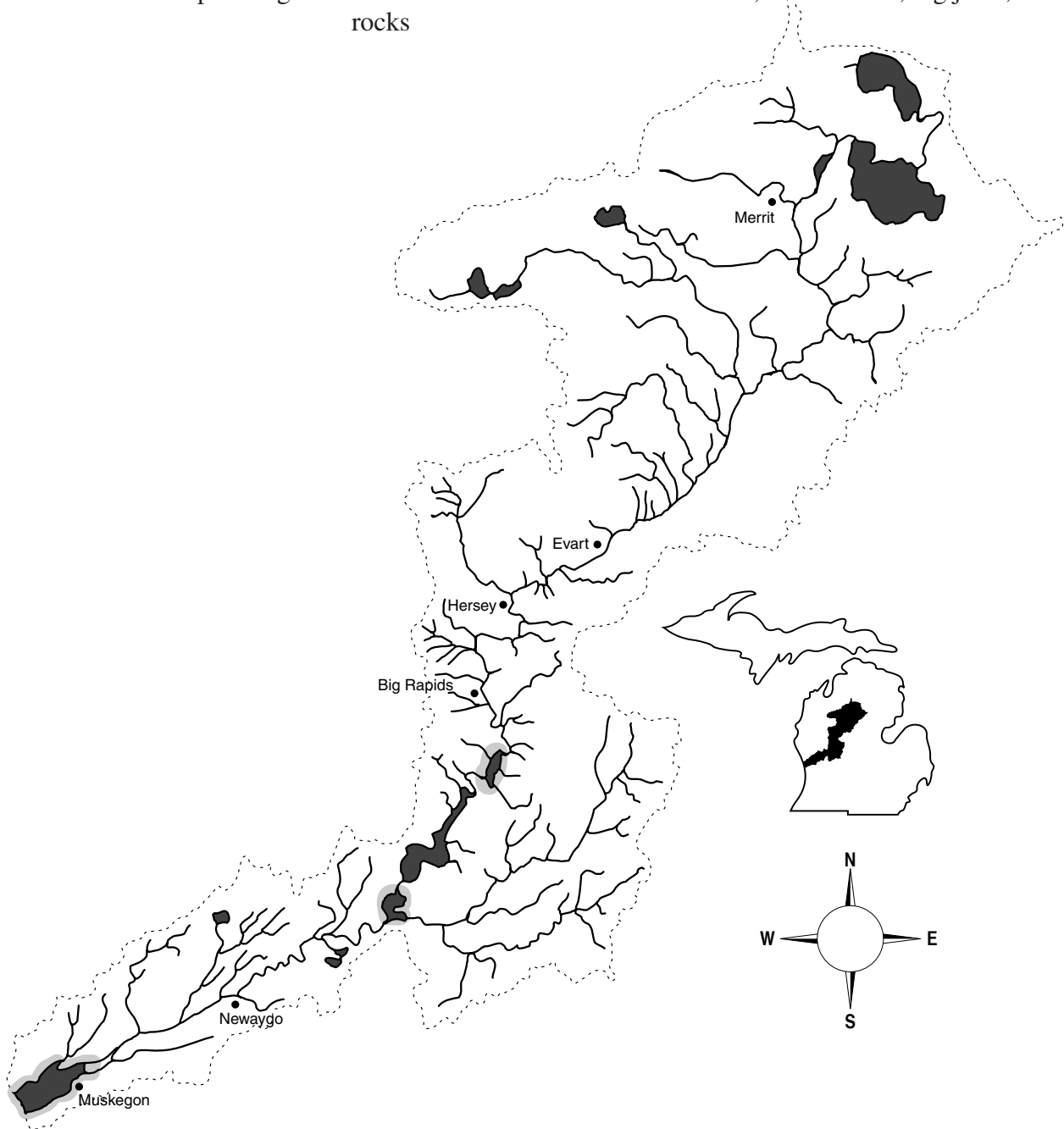


Channel catfish (*Ictalurus punctatus*)

Habitat:

- feeding - moderately-clear, deeper waters of rivers, lakes, and impoundments
 - sand, gravel, or rubble substrate
 - low to moderate gradient

- spawning - secluded semi-dark areas such as holes, under banks, log jams, or rocks

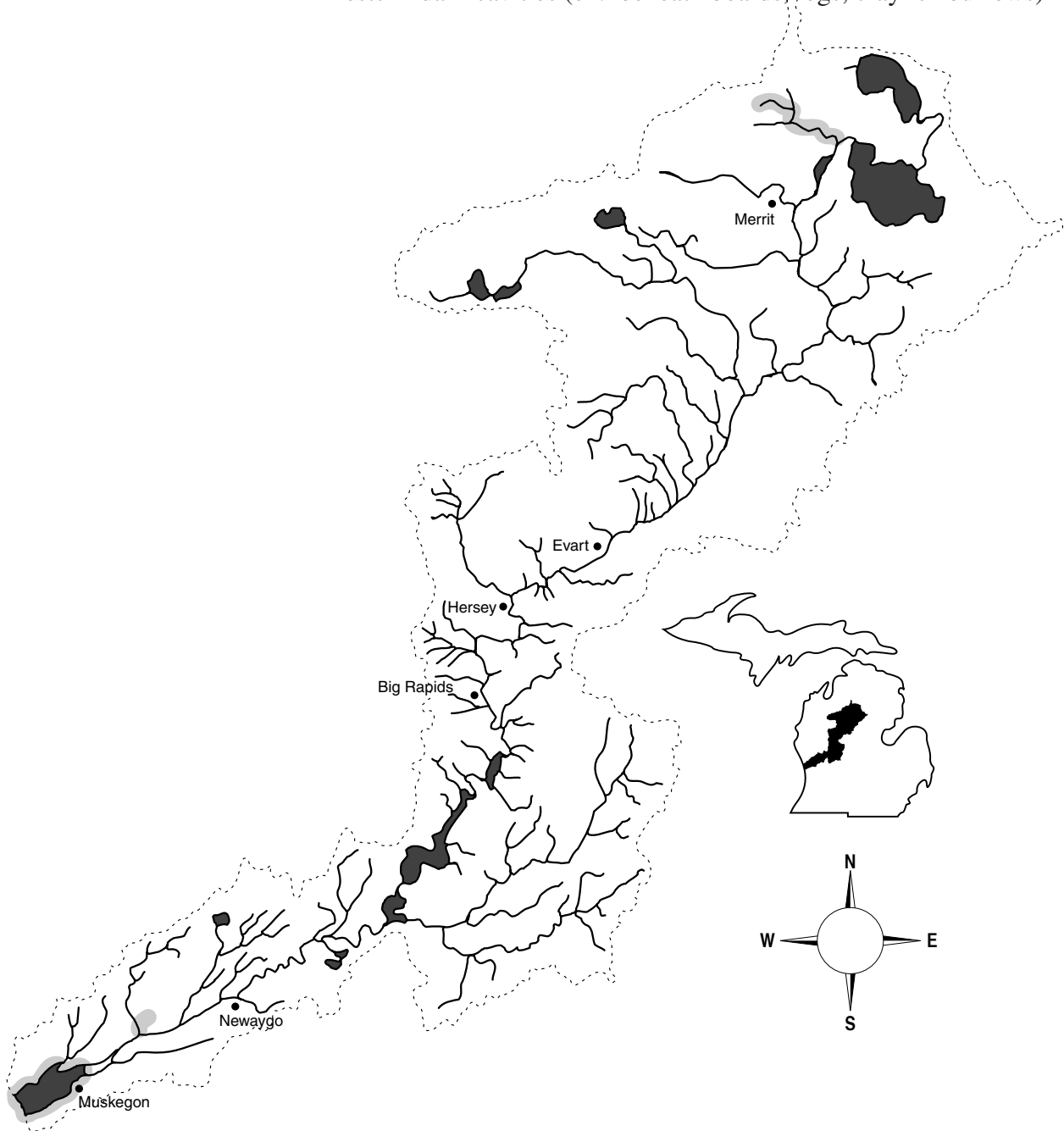


Tadpole madtom (*Noturus gyrinus*)

Habitat:

- feeding
 - vegetative cover in low-moderate current waters
 - muddy substrate with extensive vegetation
 - clear waters of streams, rivers, and lakes

- spawning
 - mostly in rivers, sometimes shallows of lakes
 - nests in dark cavities (ex: beneath boards, logs, crayfish burrows)



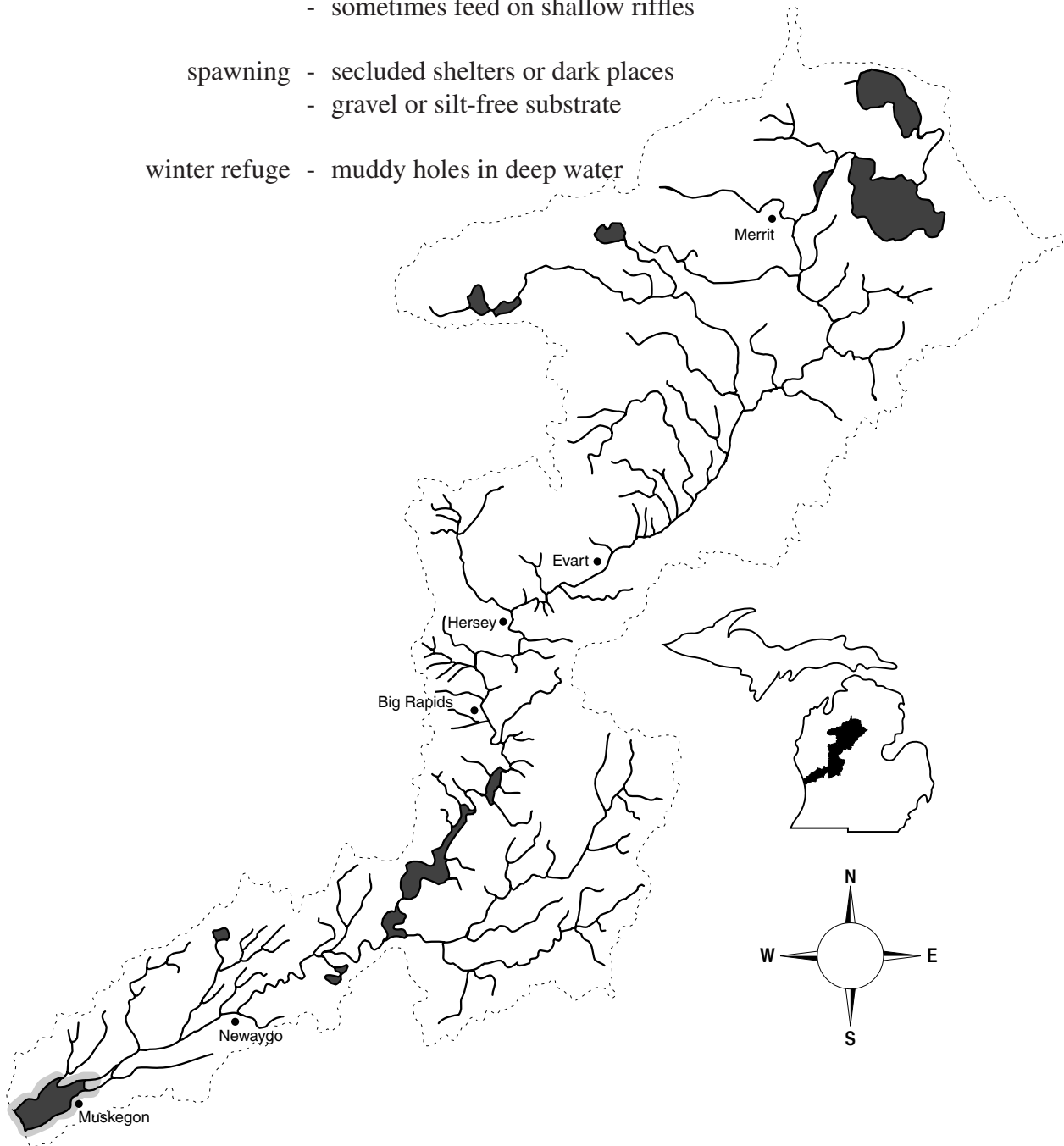
Flathead catfish (*Pylodictis olivaris*)

Habitat:

- feeding - (young) shallow riffles in fast current
- deep pools with a lot of woody cover
- deep riffles
- low gradient and current
- prefer silt-free substrate
- sometimes feed on shallow riffles

- spawning - secluded shelters or dark places
- gravel or silt-free substrate

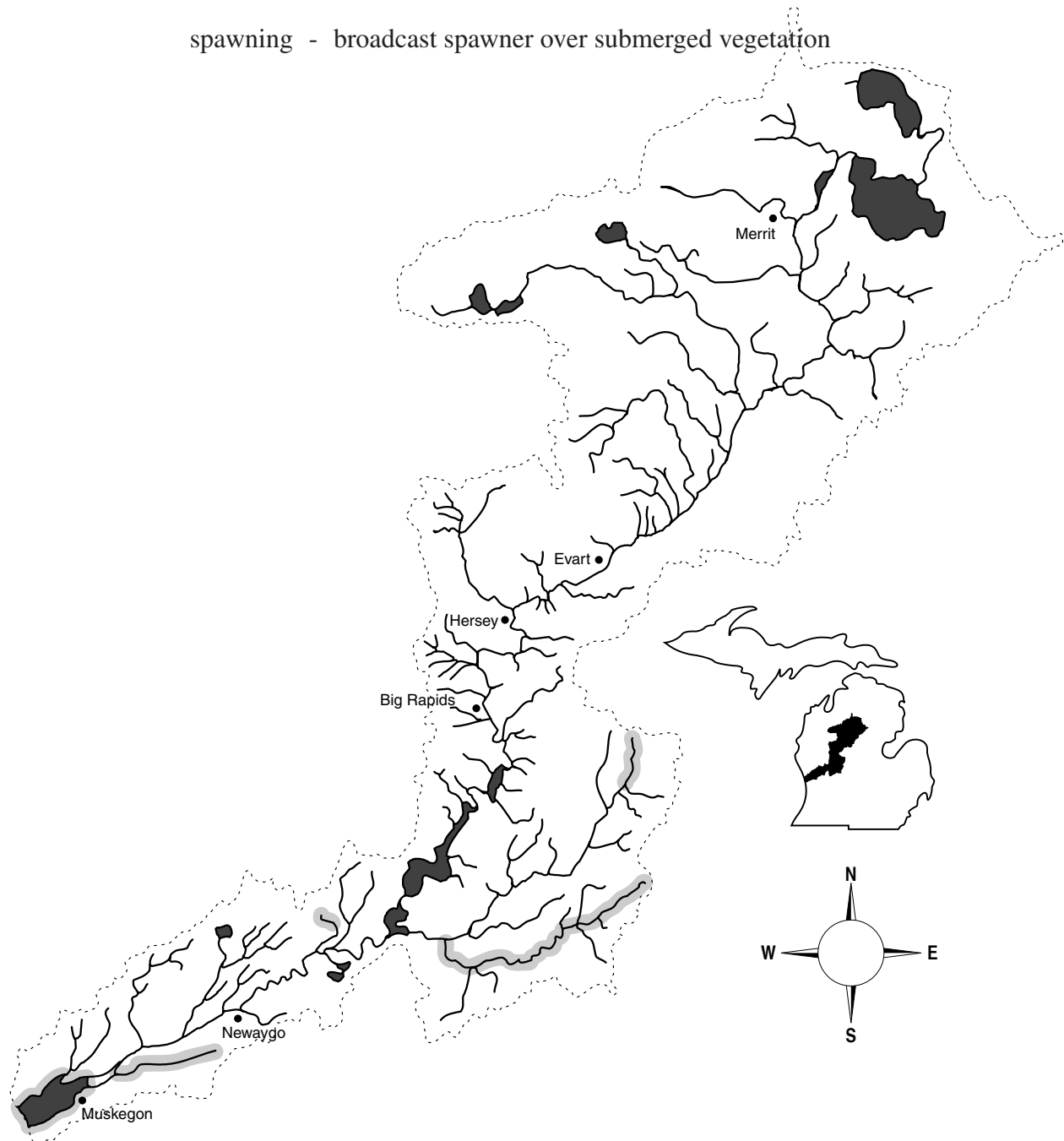
- winter refuge - muddy holes in deep water



Grass pickerel (*Esox americanus vermiculatus*)

Habitat:

- feeding - juveniles: along shore
 - adults: in deeper portions of streams, rivers, lakes, and impoundments
 - clear water, little current, dense vegetation
 - tolerates low oxygen concentrations
- spawning - broadcast spawner over submerged vegetation

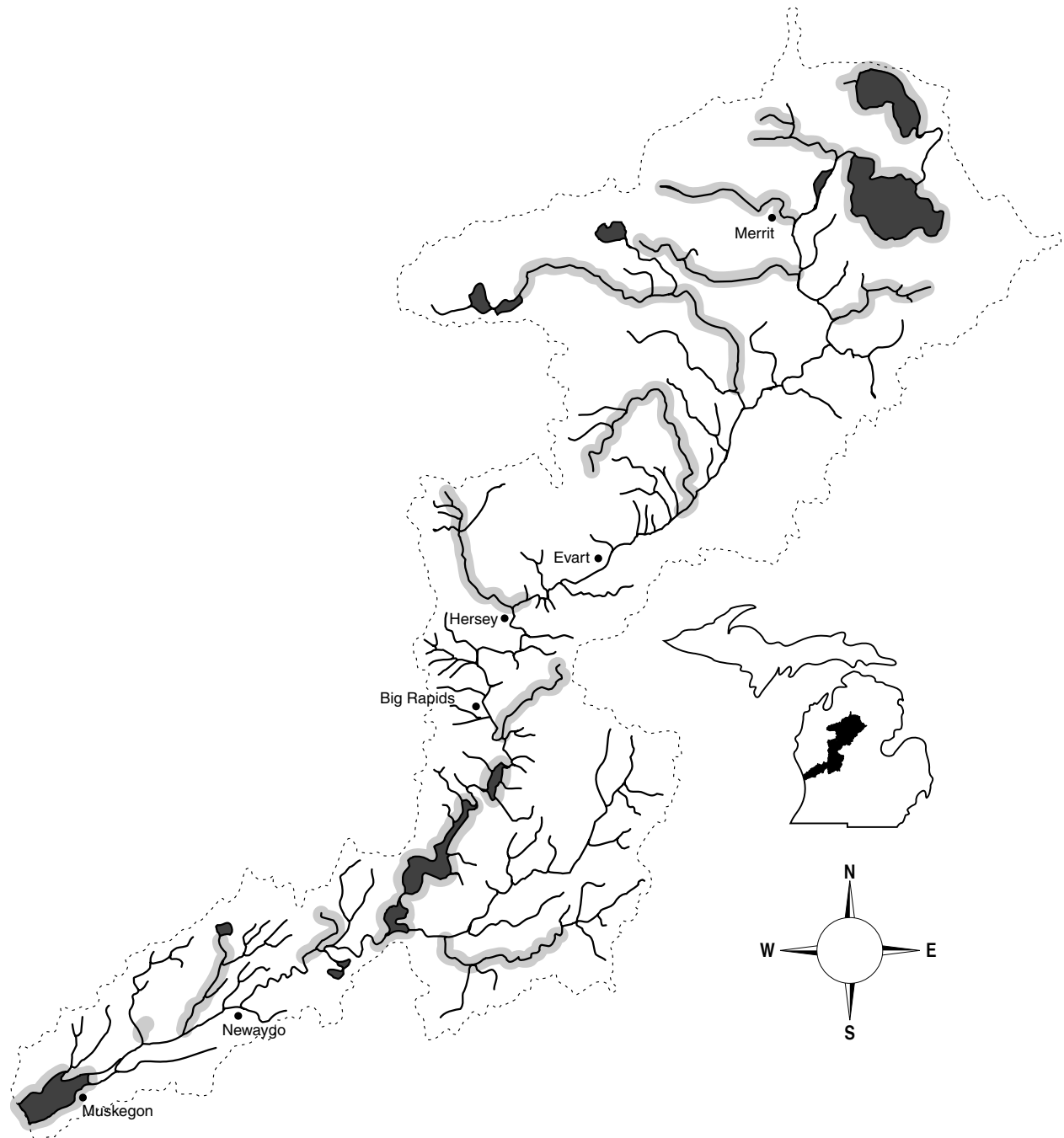


Northern pike (*Esox lucius*)

Habitat:

- feeding - cool to moderately warm streams, rivers, lakes, and impoundments
- vegetation in slow to moderate current

- spawning - submerged vegetation with slow current in shallow water

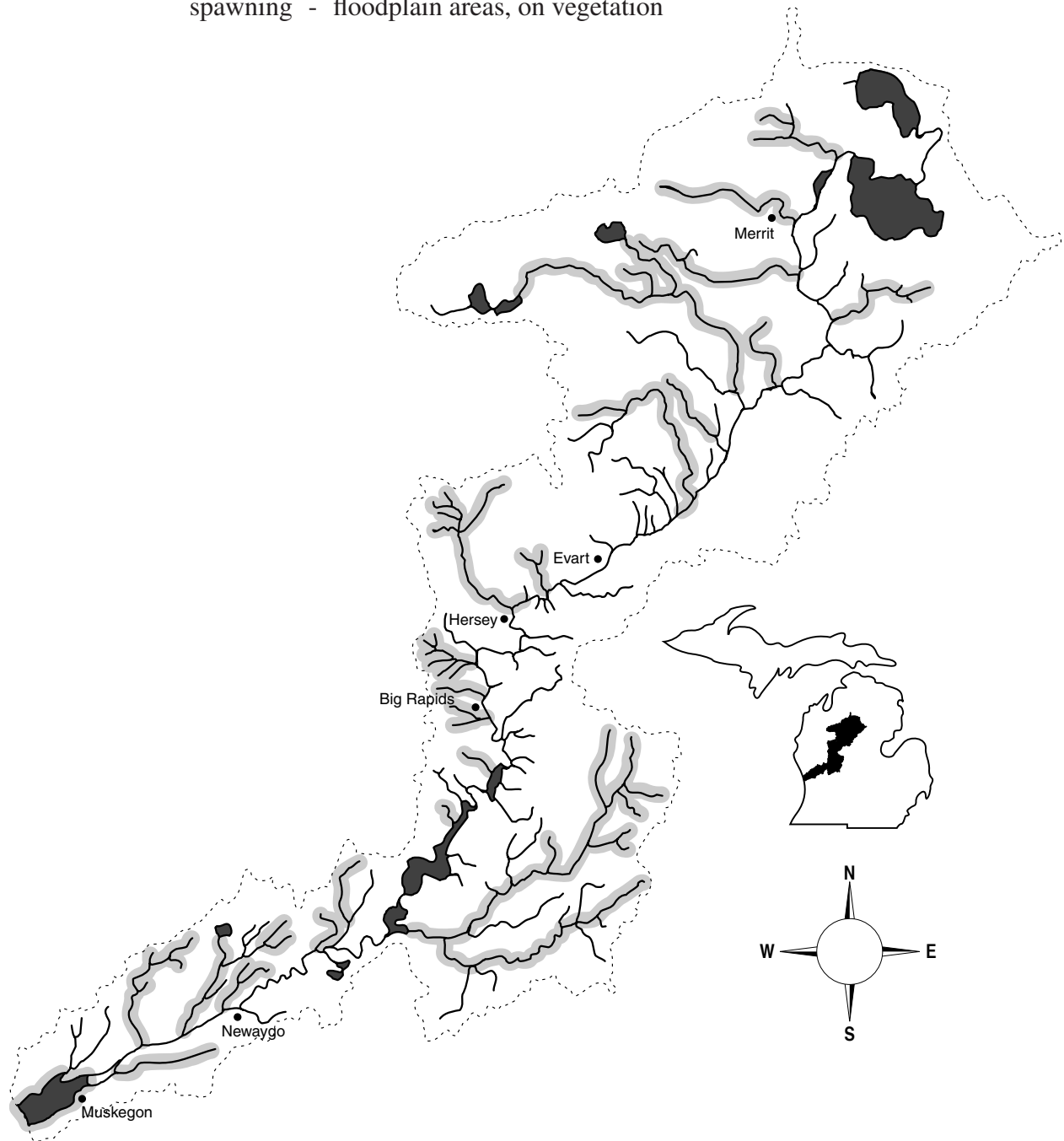


Central mudminnow (*Umbra limi*)

Habitat:

- feeding - undisturbed clear, low-gradient streams or rivers and lakes and impoundments
 - organic debris, muck, or peat substrates
 - aquatic vegetation

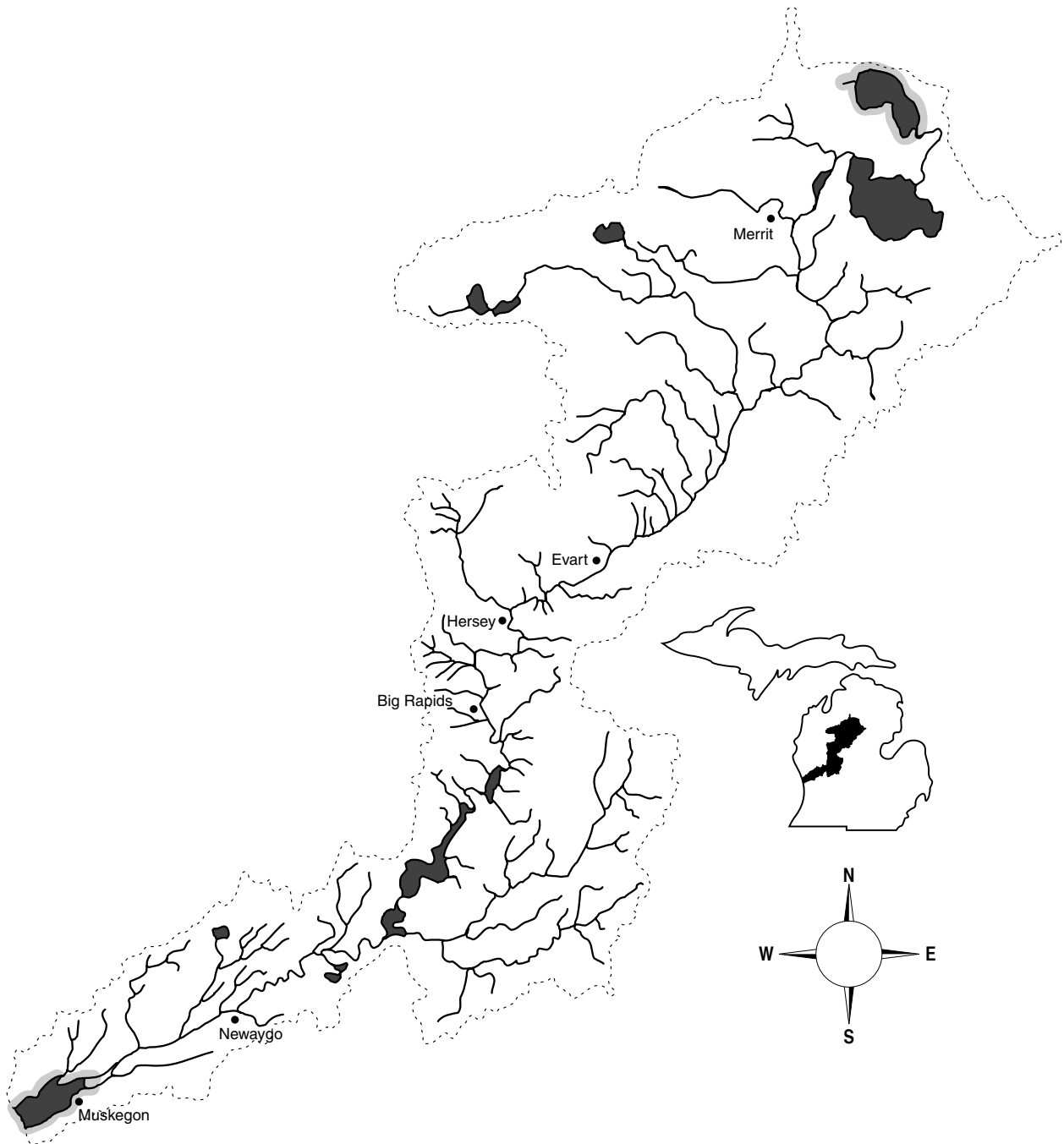
- spawning - floodplain areas, on vegetation



Rainbow Smelt (*Osmerus mordax*)

Habitat:

- feeding - midwater of lakes; 42-192 ft. in Lake Michigan
- spawning - in streams or off-shore shoals in Lake Michigan
 - gravel substrate
 - swift current



Cisco {Lake herring} (*Coregonus artedii*)

Habitat:

- feeding - deep cool lakes, preferably oligotrophic
- spawning - usually in lakes
 - 3 to 6 feet of water with no vegetation
 - often over gravel or stony substrate



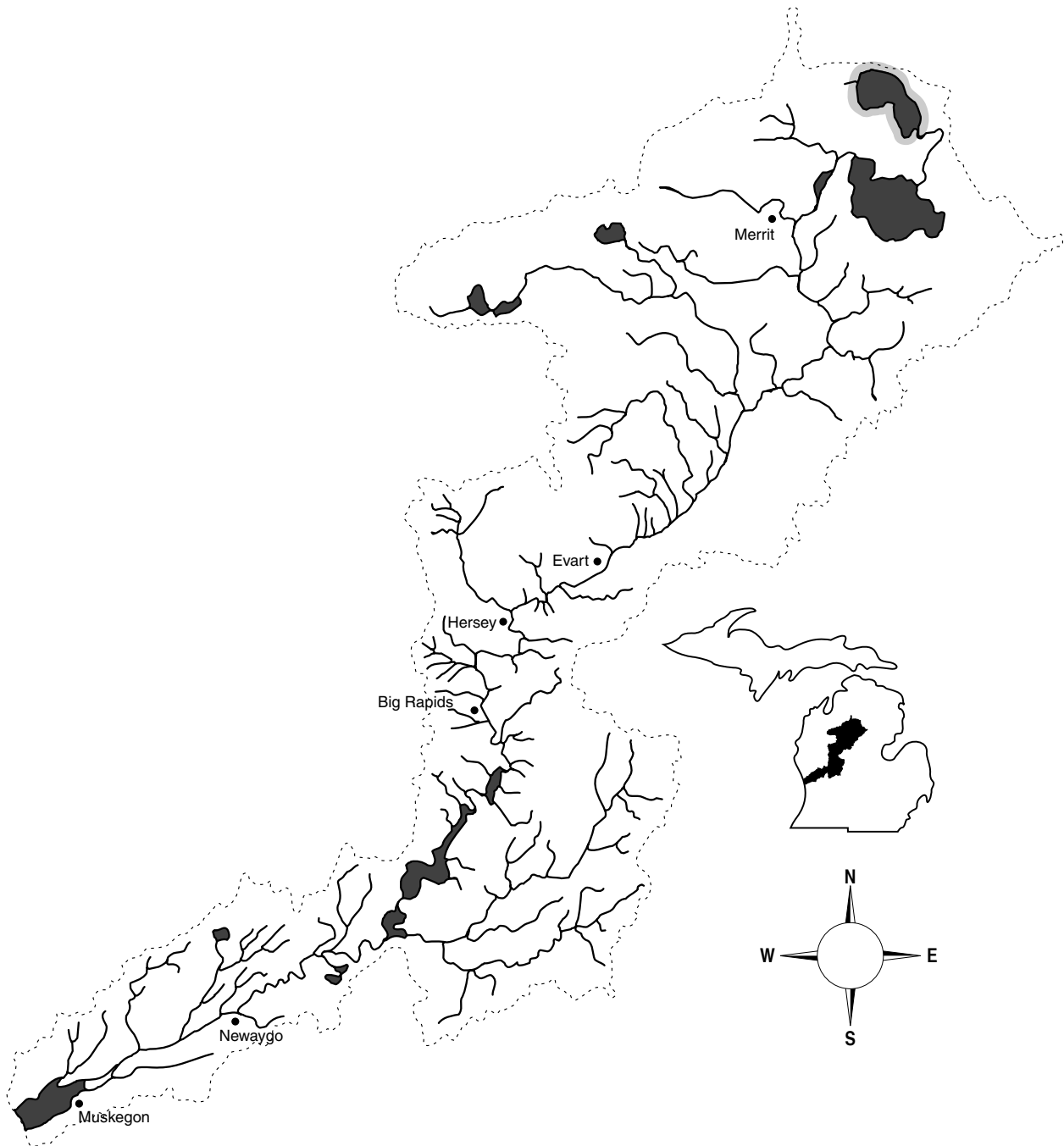
Lake whitefish (*Coregonus dupeaformis*)

Habitat:

feeding - cold deep lakes; Lake Michigan

spawning - shallow water (<25 feet)

- hard or stony substrate

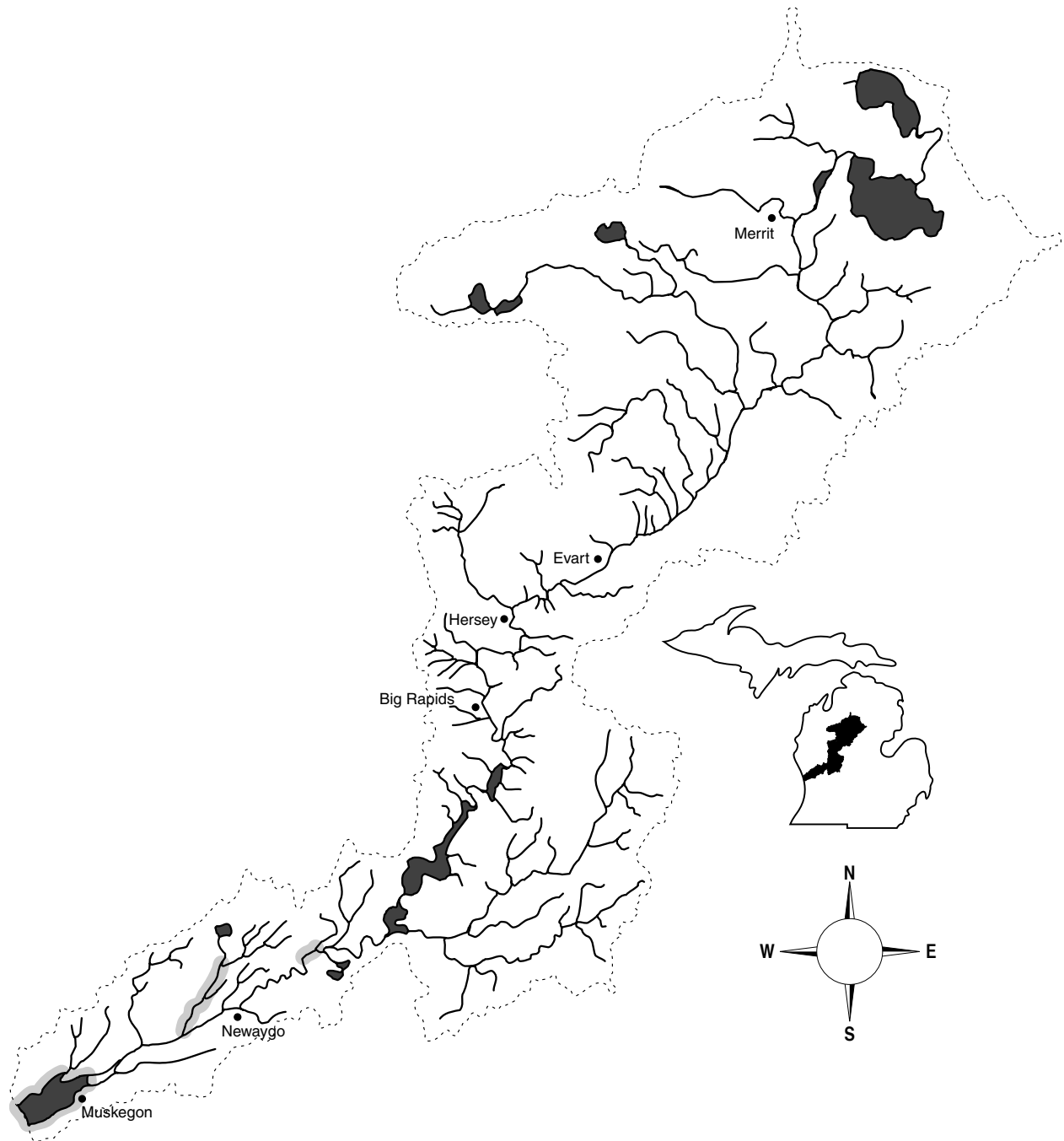


Coho salmon (*Oncorhynchus kisutch*)

Habitat:

- feeding - adults: Lake Michigan
- young: shallow gravel substrate in cold streams, later into pools

- spawning - cold streams and rivers
- swifter water of shallow gravelly substrate

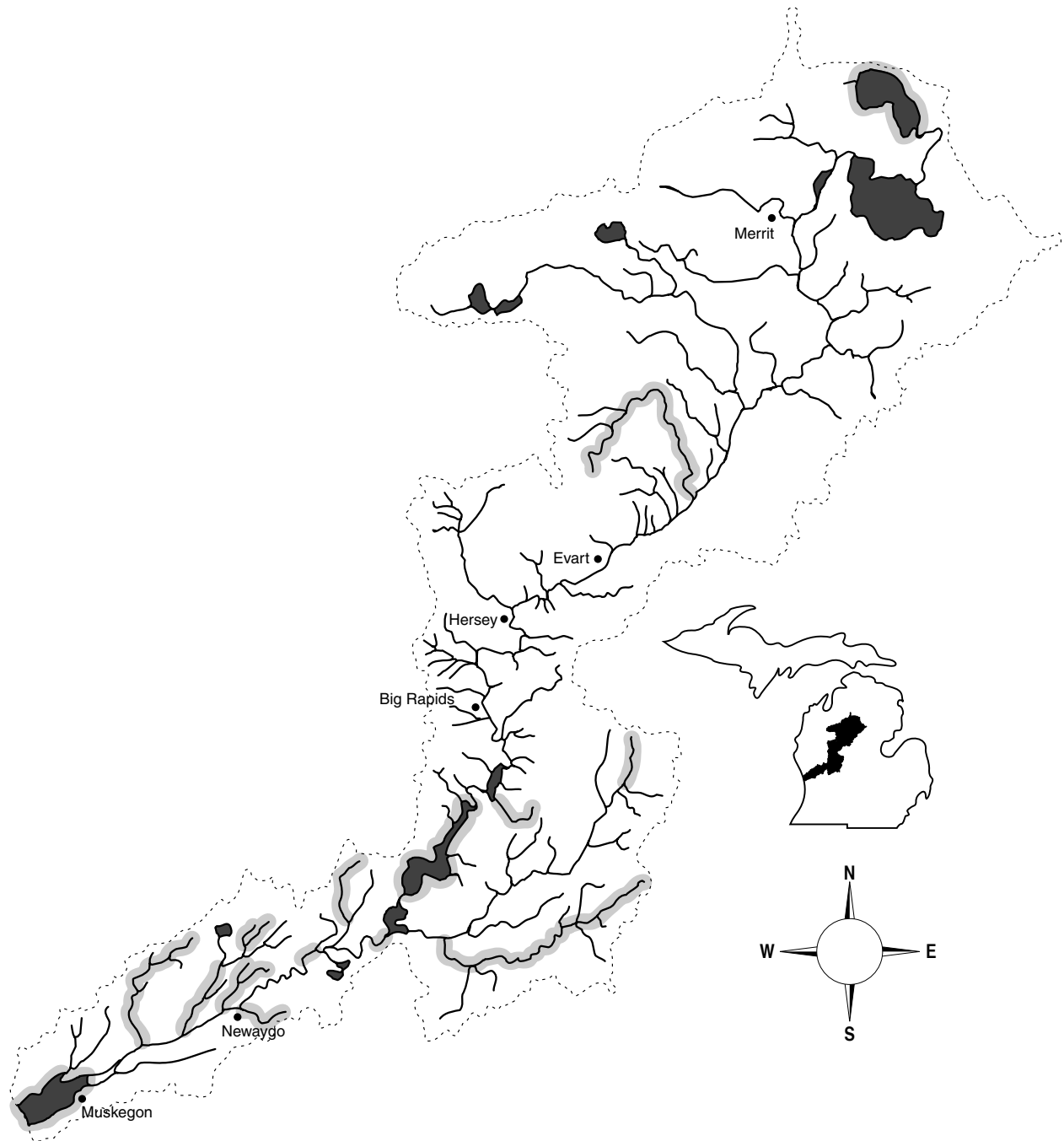


Rainbow trout (*Oncorhynchus mykiss*)

Habitat:

- feeding - cold clear water of rivers and Lake Michigan
- moderate current

- spawning - gravelly riffles above a pool
- smaller tributaries

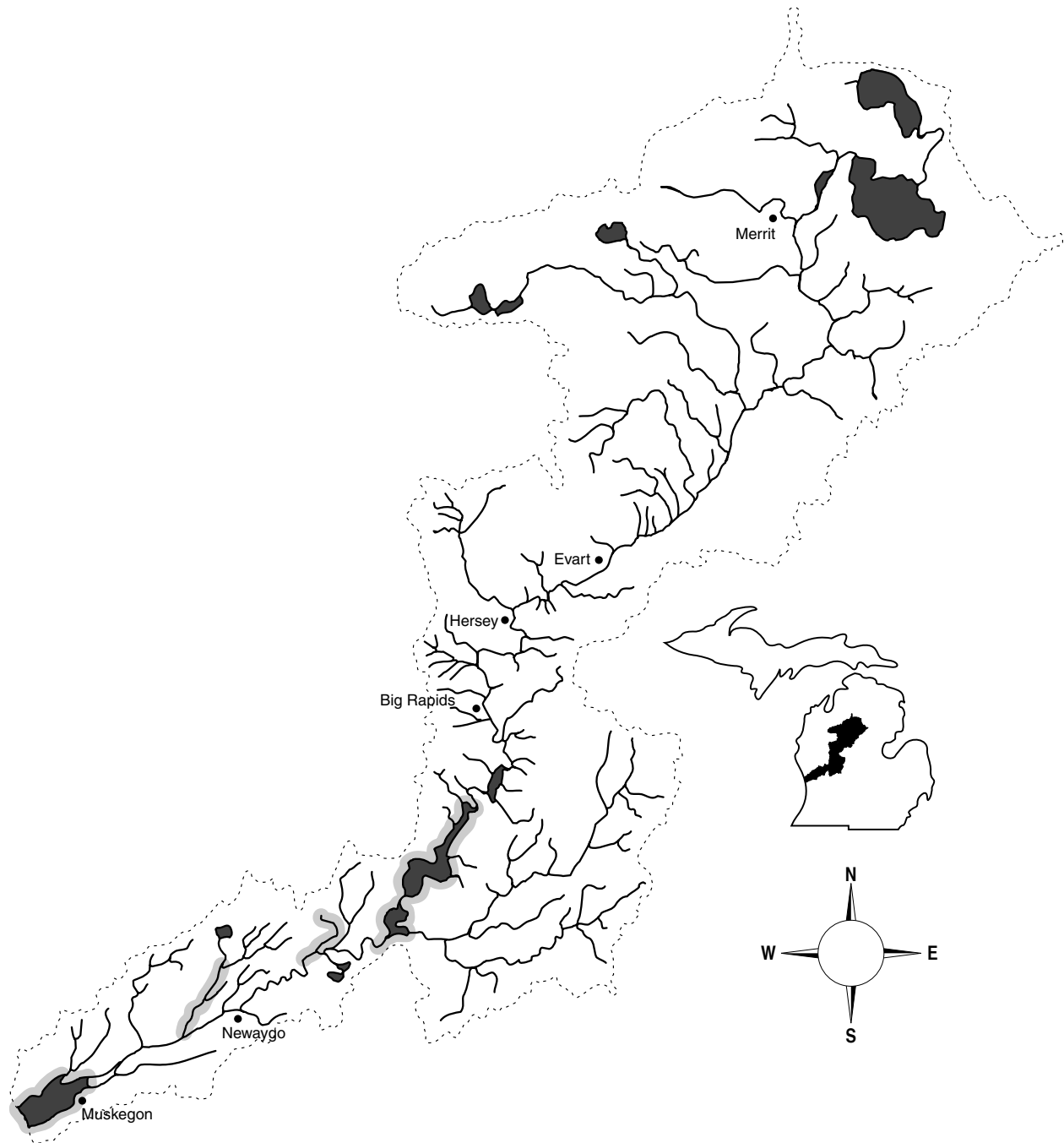


Chinook salmon (*Oncorhynchus tshawytscha*)

Habitat:

- feeding - adults: Lake Michigan
- young: shallow gravel substrate in cool streams, later into pools

- spawning - gravelly substrate in cool streams

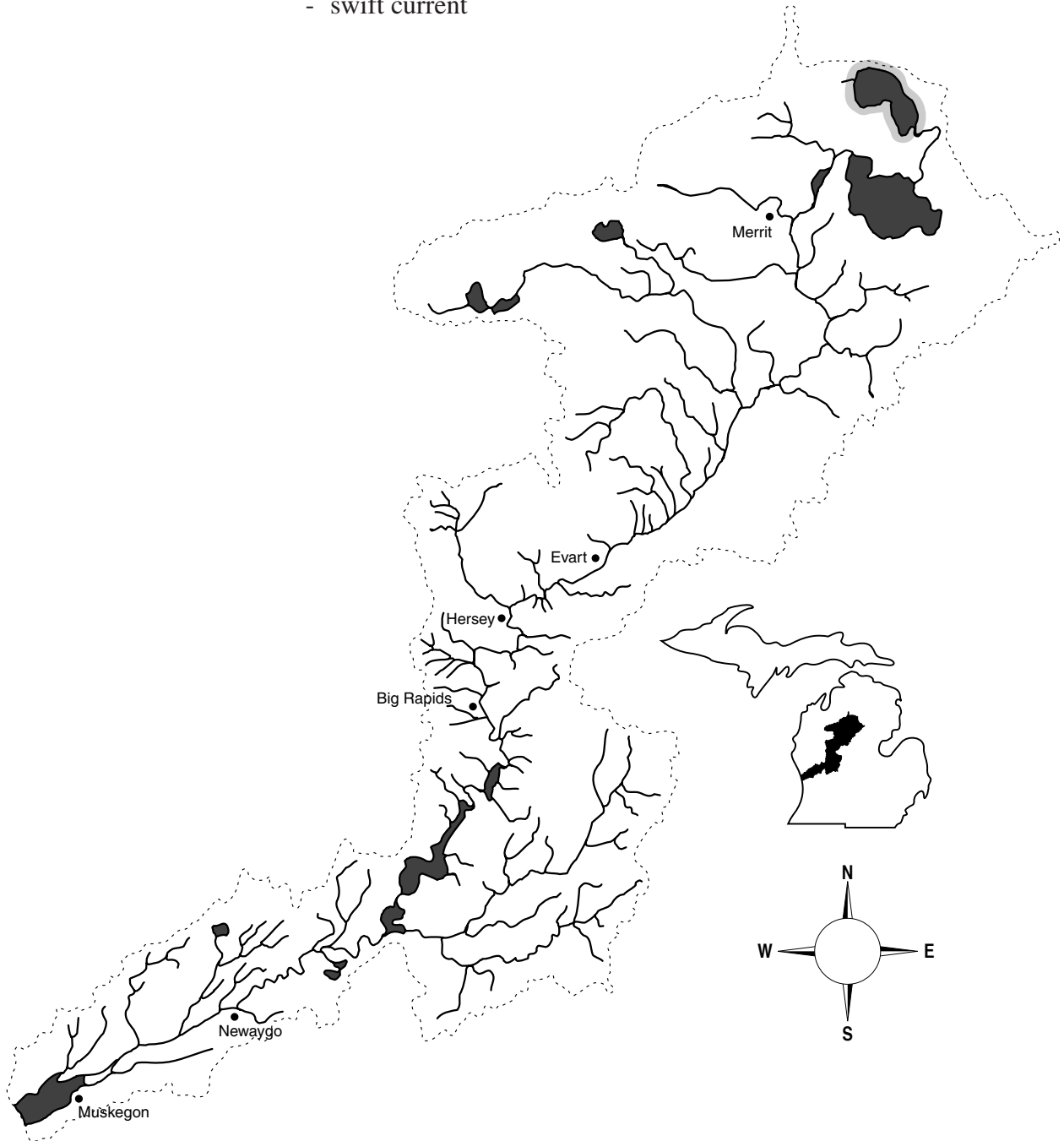


Atlantic salmon (*Salmo salar*)

Habitat:

- feeding - young: gravel substrate streams
- adults: Lake Michigan

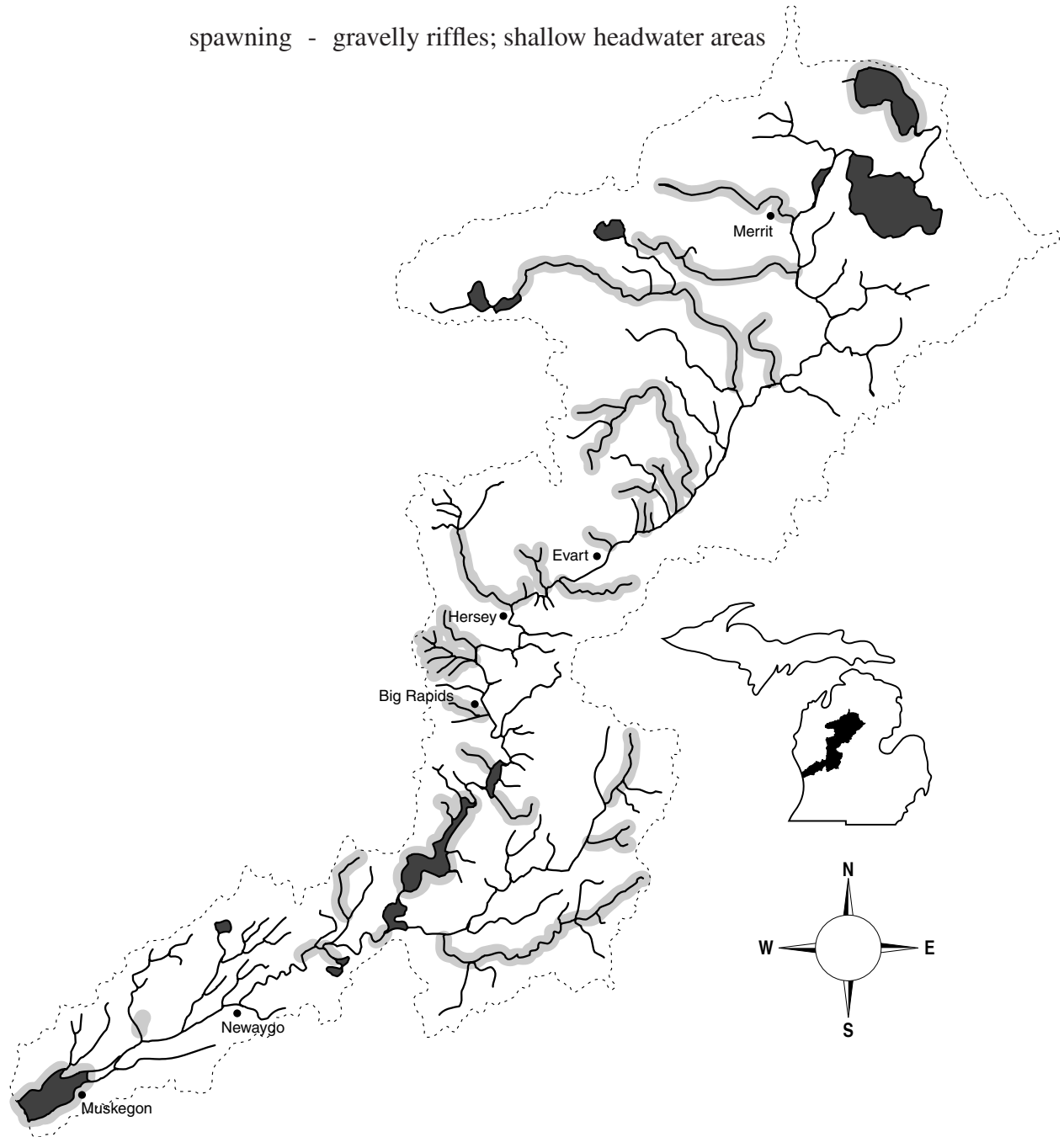
- spawning - streams and rivers
- nests in gravel substrate
- swift current



Brown trout (*Salmo trutta*)

Habitat:

- feeding - cold, clear streams, rivers, and lakes (not >70°F)
 - medium to swift current in streams
 - does not tolerate silt well
 - prefers few individuals and species around
 - abundance of aquatic and land insects
- spawning - gravelly riffles; shallow headwater areas

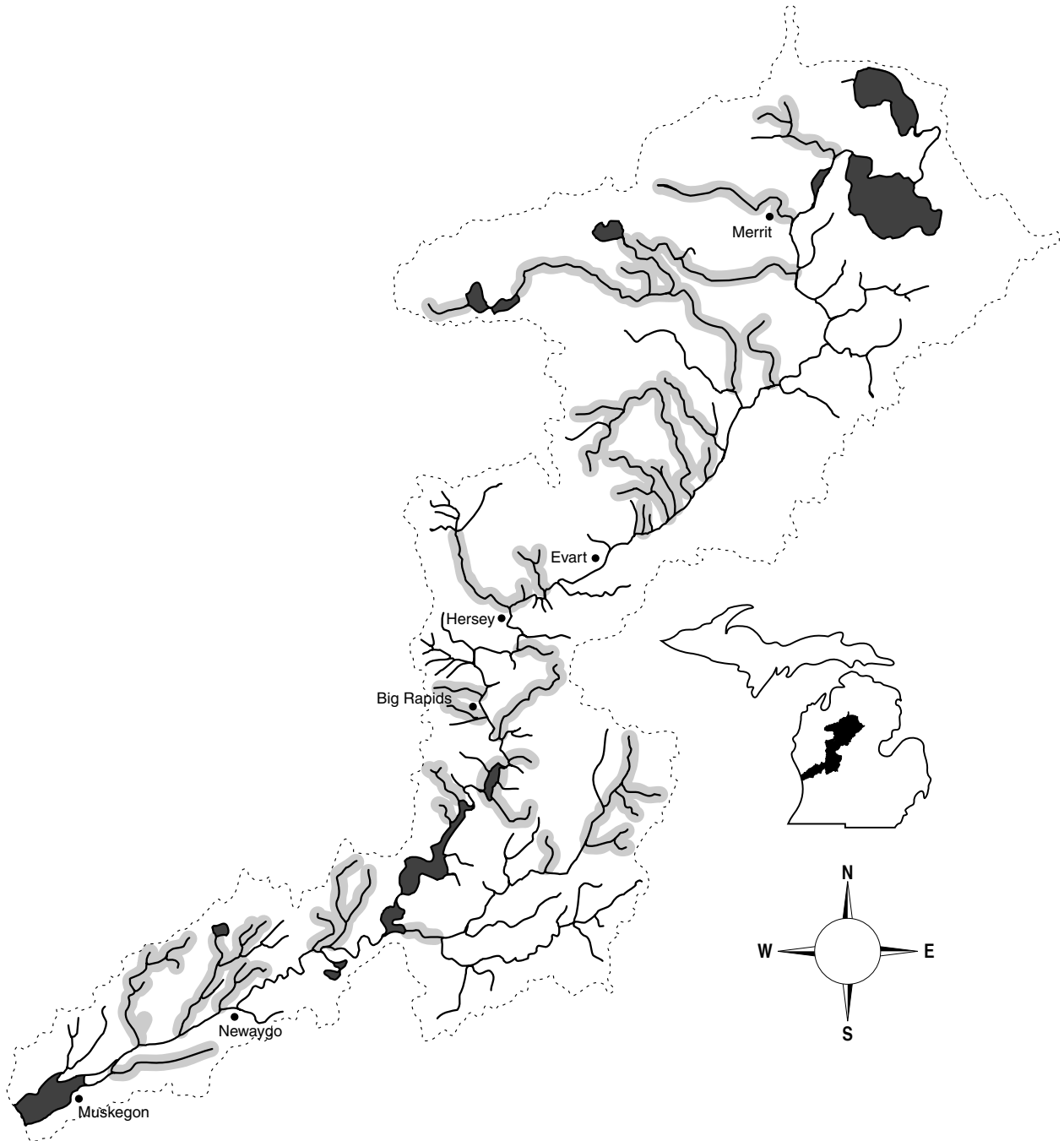


Brook trout (*Salvelinus fontinalis*)

Habitat:

- feeding - cold, clear streams, rivers, and lakes (not >65°F)
- low current
- well oxygenated water

- spawning - gravelly riffles; shallow or headwater streams

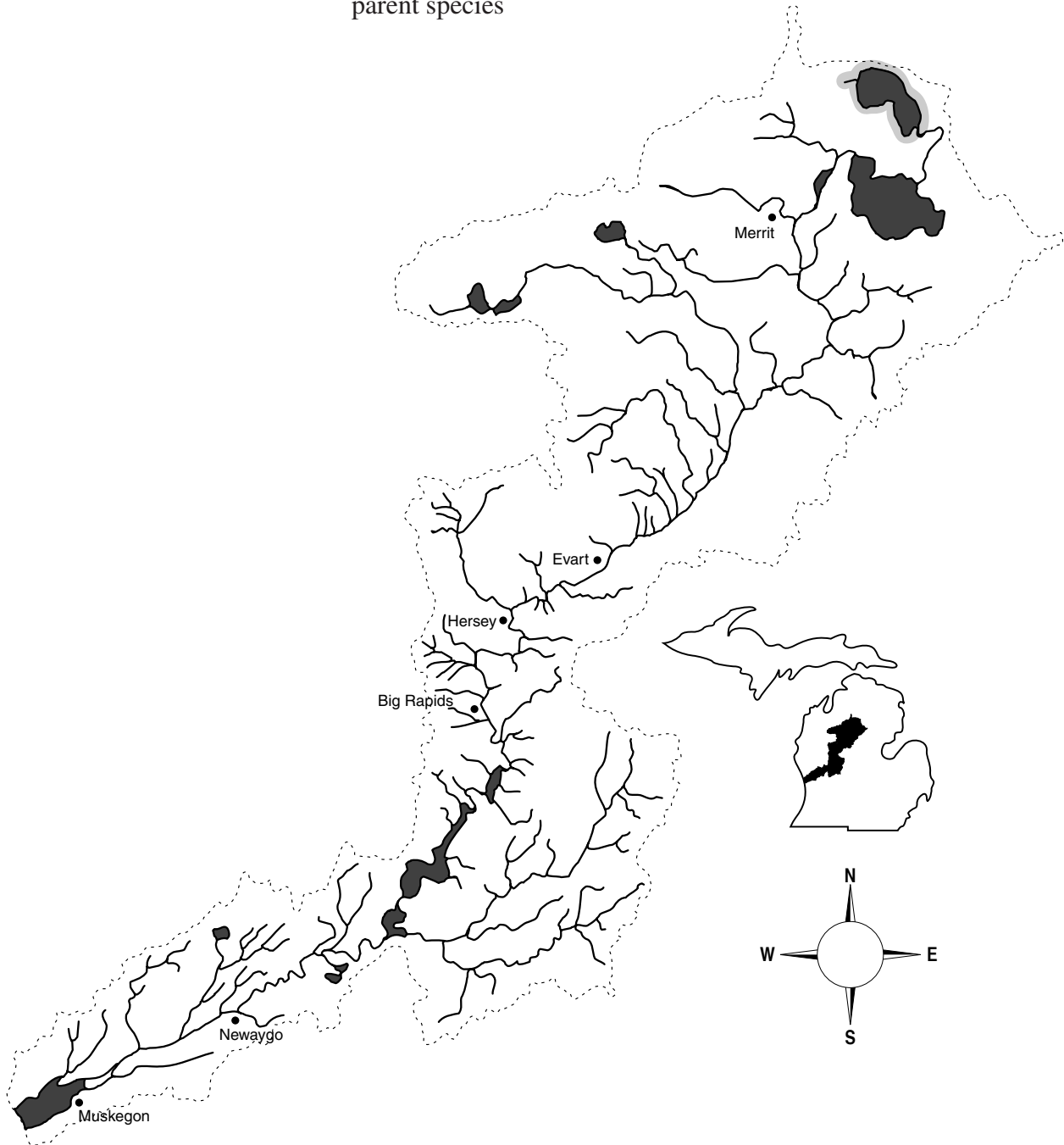


Splake (*Salvelinus fontinalis* x *Salvelinus namaycush*)

Habitat:

- feeding - littoral habitat
- cool water lakes; also Lake Michigan

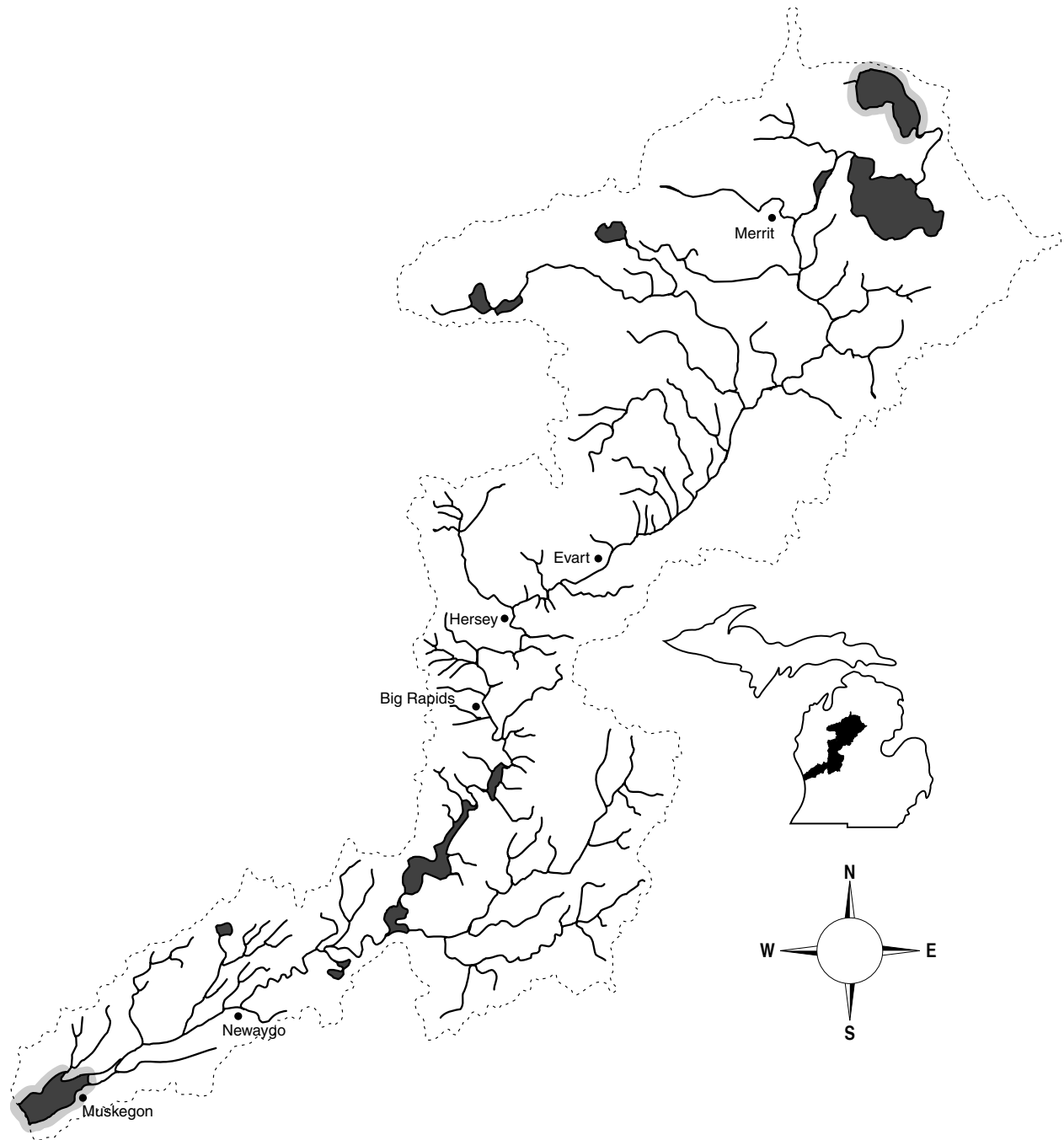
- spawning - hatchery produced cross of brook and lake trout
- offspring usually fertile, but with lower fecundity than either parent species



Lake trout (*Salvelinus namaycush*)

Habitat:

- feeding - cold lakes and rivers
- spawning - large boulder or rubble substrate
- shallow water of lakes and rivers

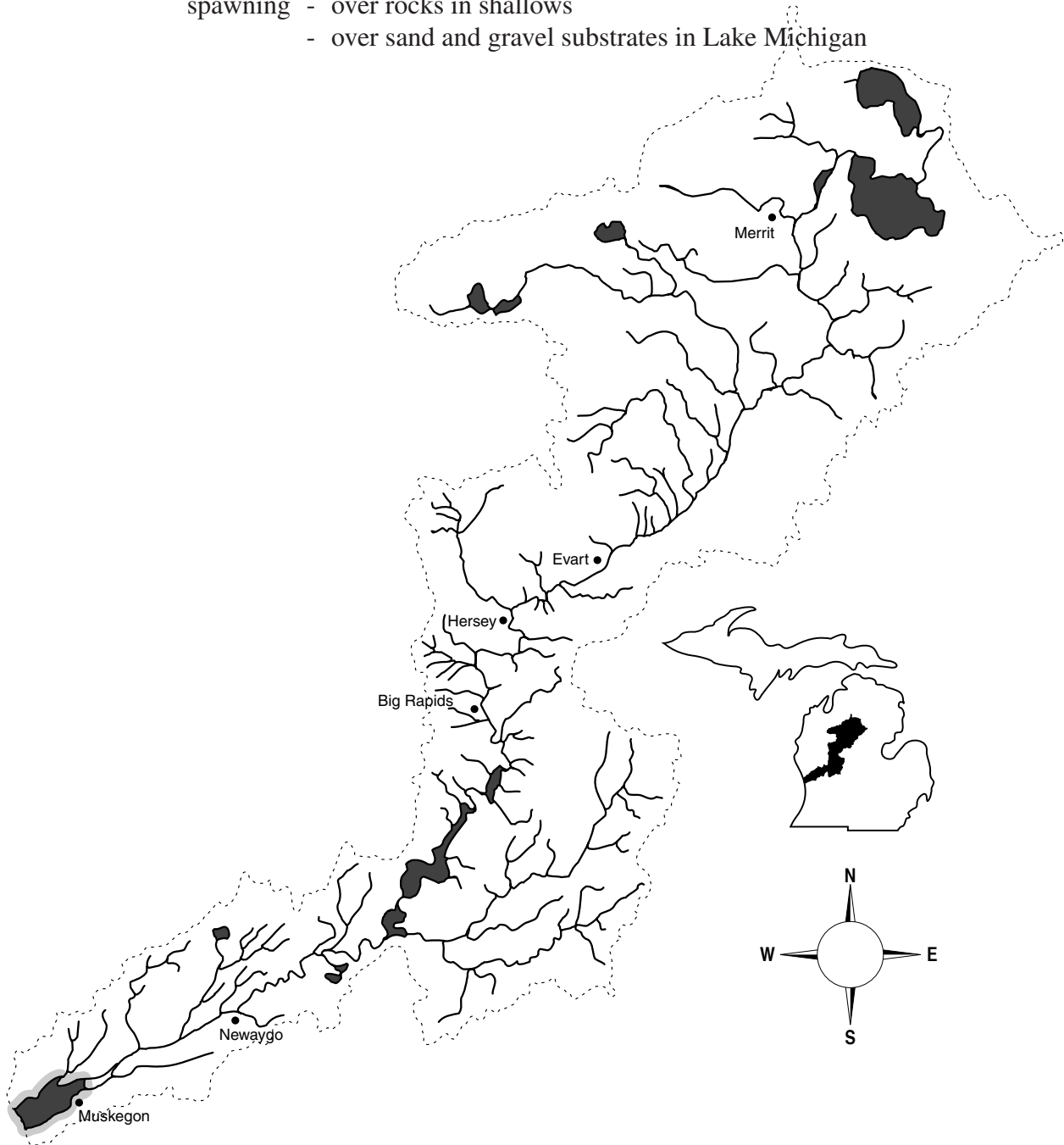


Trout-perch (*Percopsis omiscomaycus*)

Habitat:

- feeding
 - clean sand or fine gravel substrate
 - long deep pools in low gradient streams and Lake Michigan
 - highly intolerant of clayey silts
 - avoids rooted aquatic vegetation

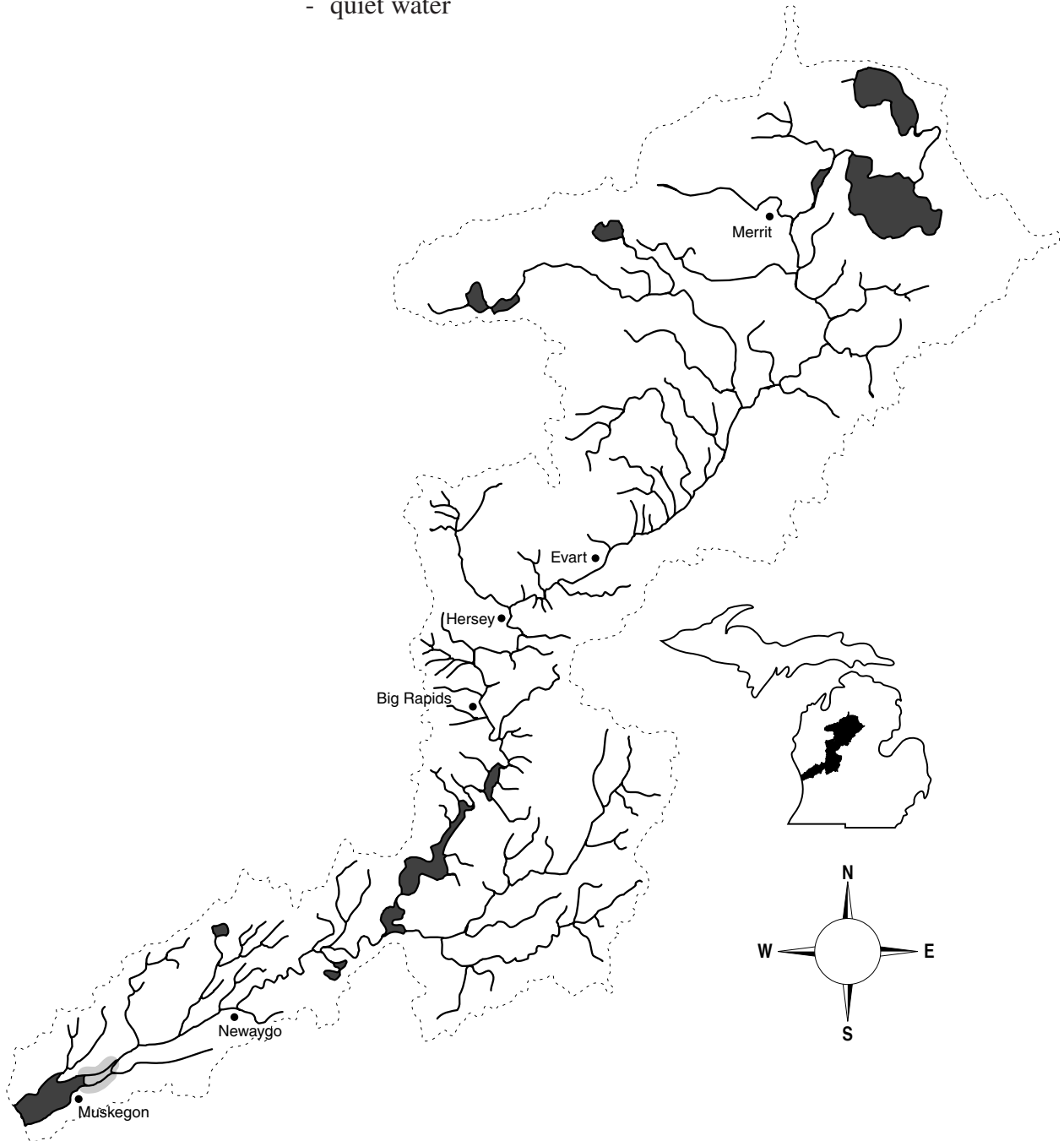
- spawning
 - over rocks in shallows
 - over sand and gravel substrates in Lake Michigan



Pirate perch (*Aphredoderus sayanus*)

Habitat:

- feeding - oxbows, overflow ponds, marshes, estuaries, pools
- medium to large rivers
- low gradient
- sand or muck substrates covered with organic debris
- pools bordered by emergent aquatic vegetation
- quiet water

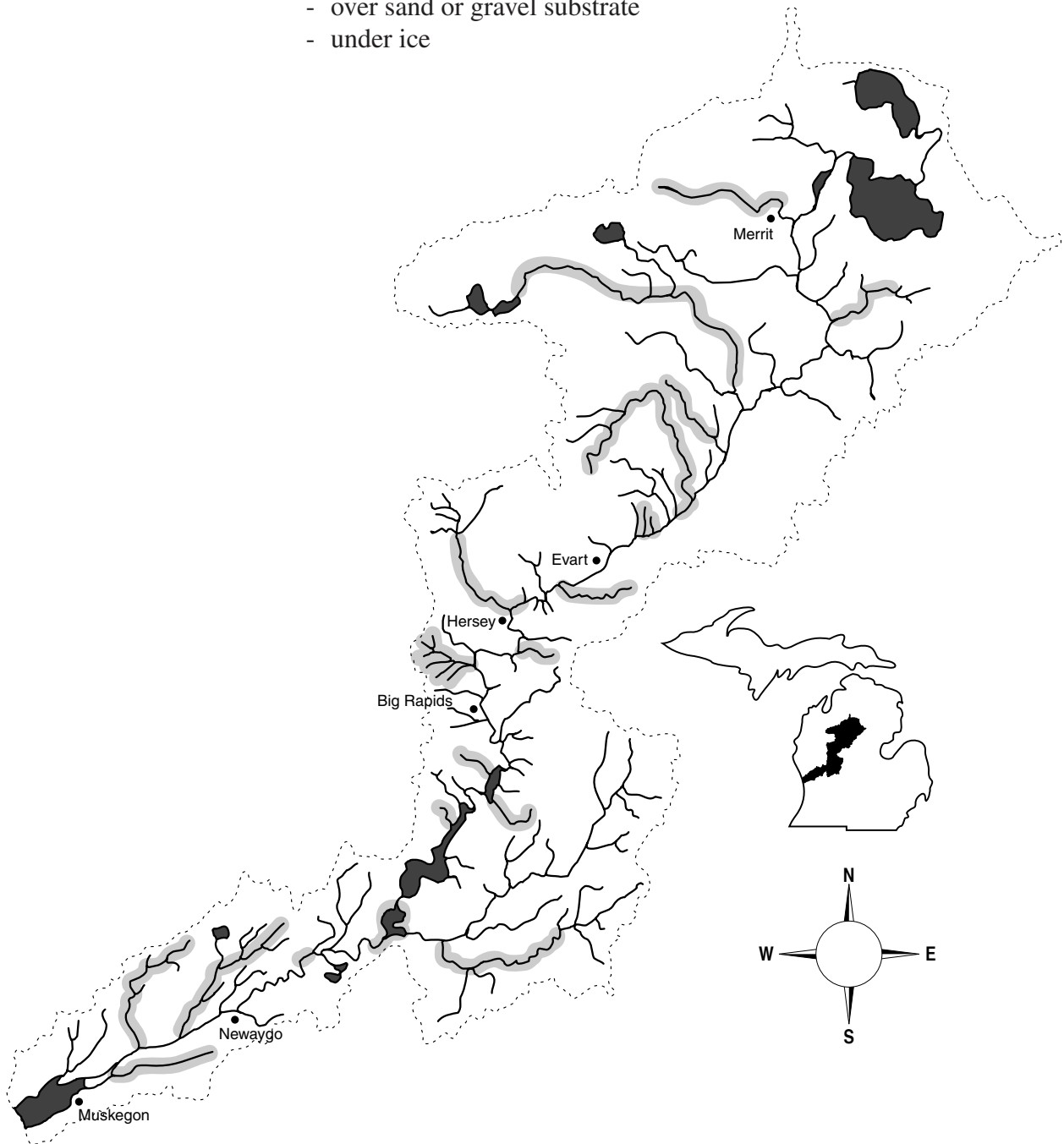


Burbot (*Lota lota*)

Habitat:

- feeding - deep cold lakes and large cool rivers
- mud, sand, rubble, boulder, silt, and gravel substrates

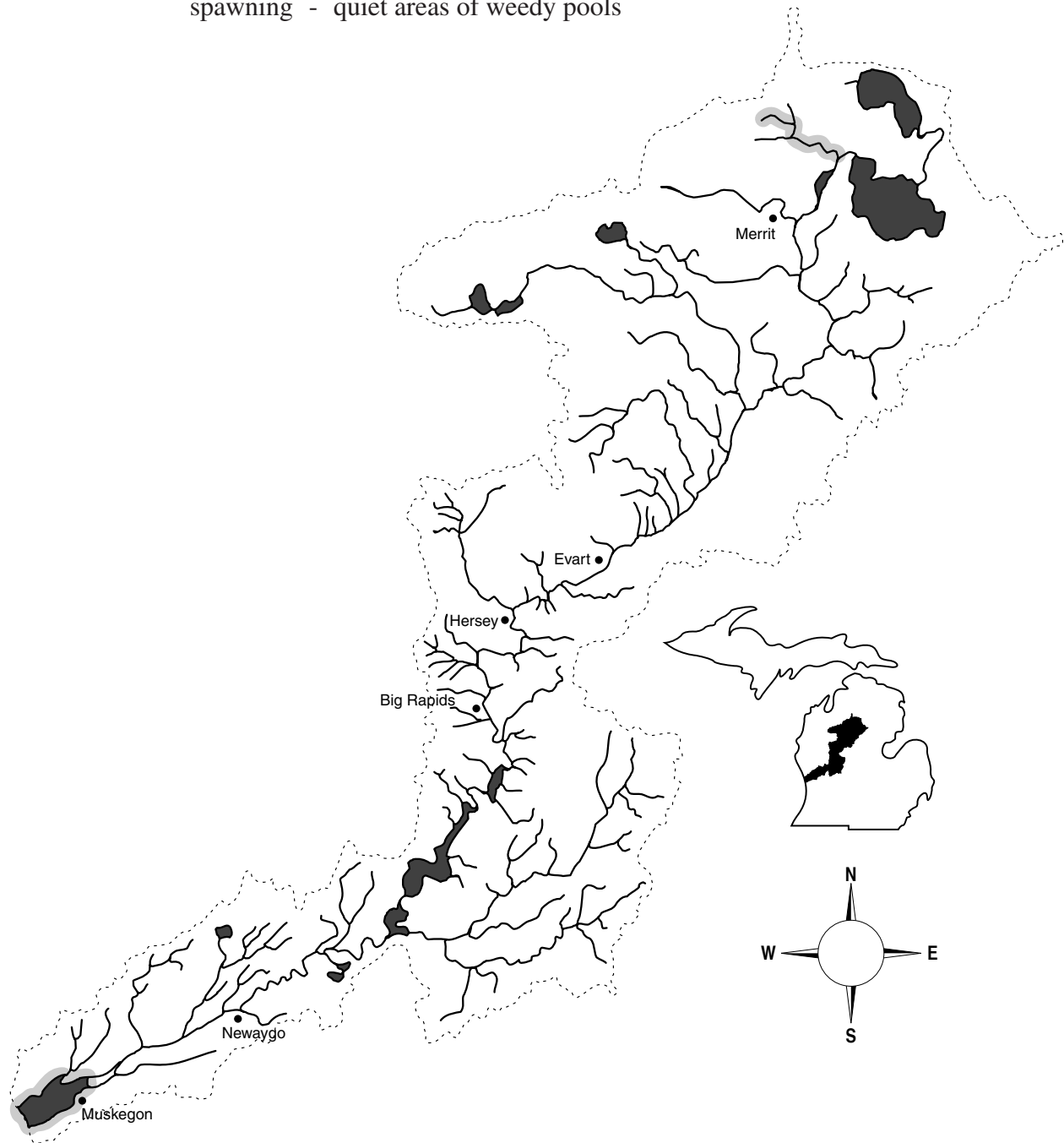
- spawning - in 1 to 4 feet of water in shallow bays or on shoals 5-10 feet deep
usually in lakes, sometimes rivers
- over sand or gravel substrate
- under ice



Banded killifish (*Fundulus diaphanus*)

Habitat:

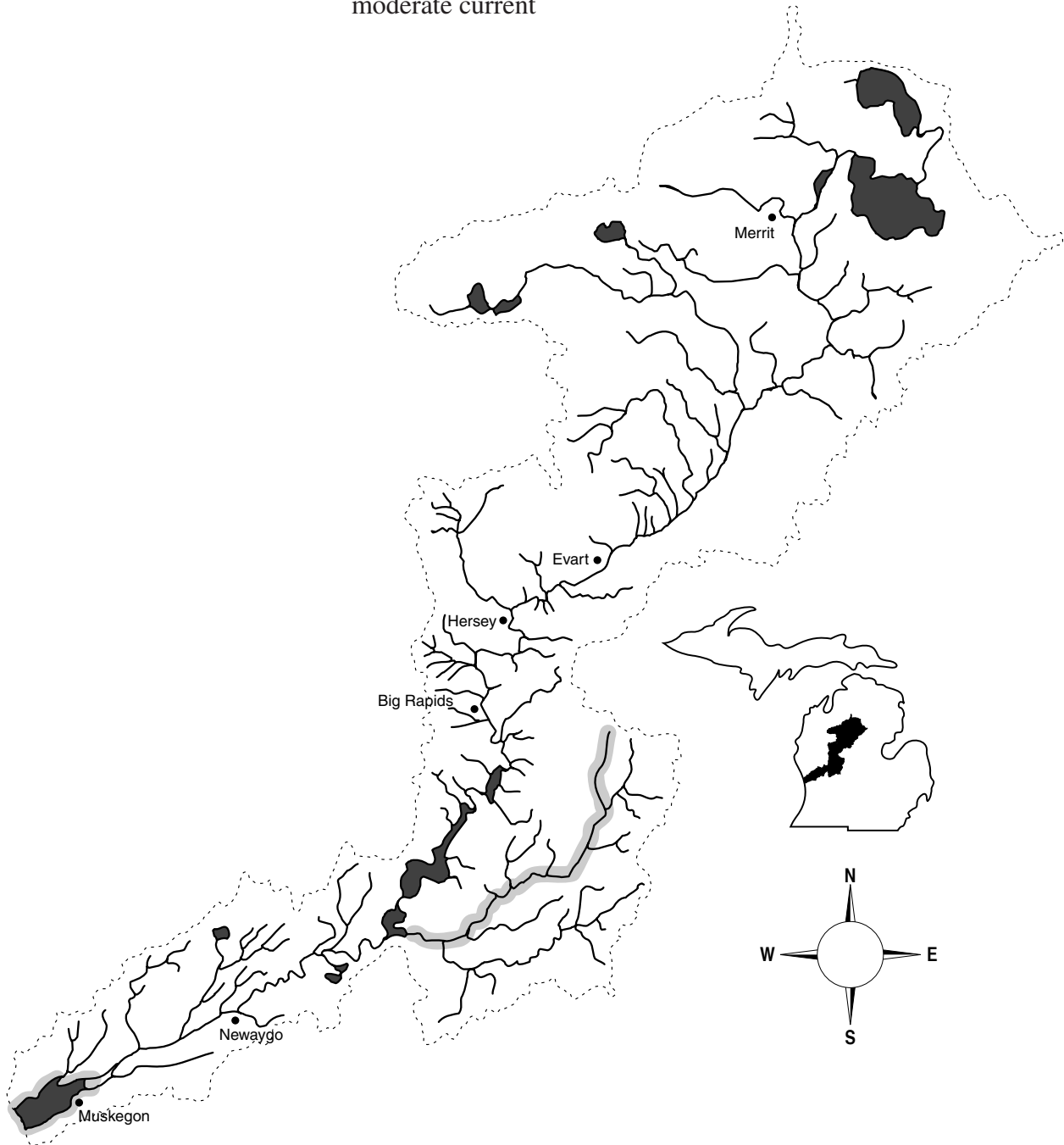
- feeding - quiet backwaters at the mouths of streams and lakes
 - substrate of sand, gravel, and a few boulders
 - also found over detritus substrate where patches of submerged aquatic vegetation are present
- spawning - quiet areas of weedy pools



Brook silverside (*Labidesthes sicculus*)

Habitat:

- feeding - clear, warm pools in streams and rivers; also lakes
 - does not tolerate turbidity
 - most frequently at surface
-
- spawning - in and around aquatic vegetation or over gravel substrate with a moderate current

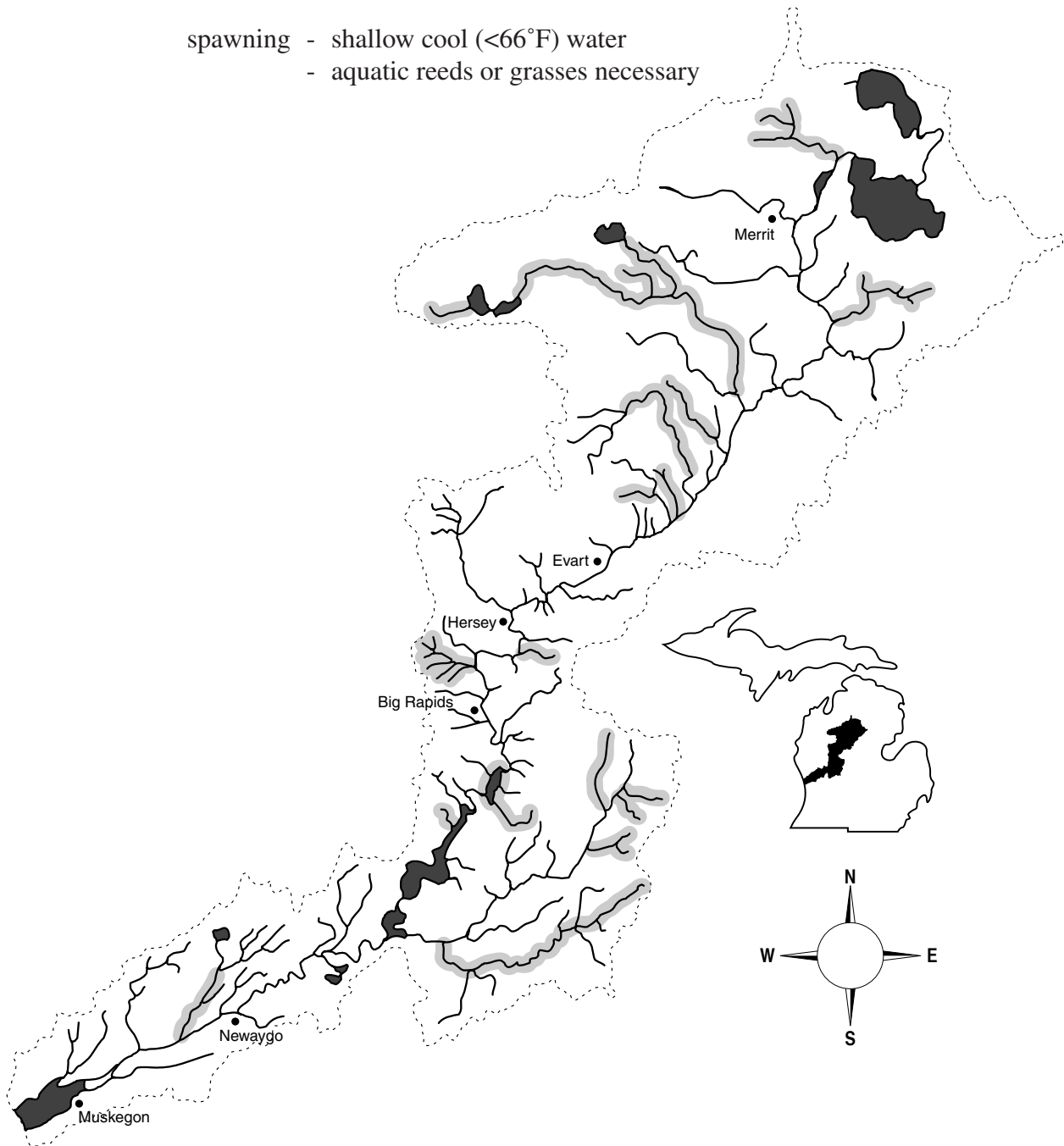


Brook stickleback (*Cluaea inconstans*)

Habitat:

- feeding - clear, cold, densely vegetated streams, and swampy margins of lakes
- low gradient
- muck, peat, or marl substrate
- not tolerant of turbidity

- spawning - shallow cool (<66°F) water
- aquatic reeds or grasses necessary

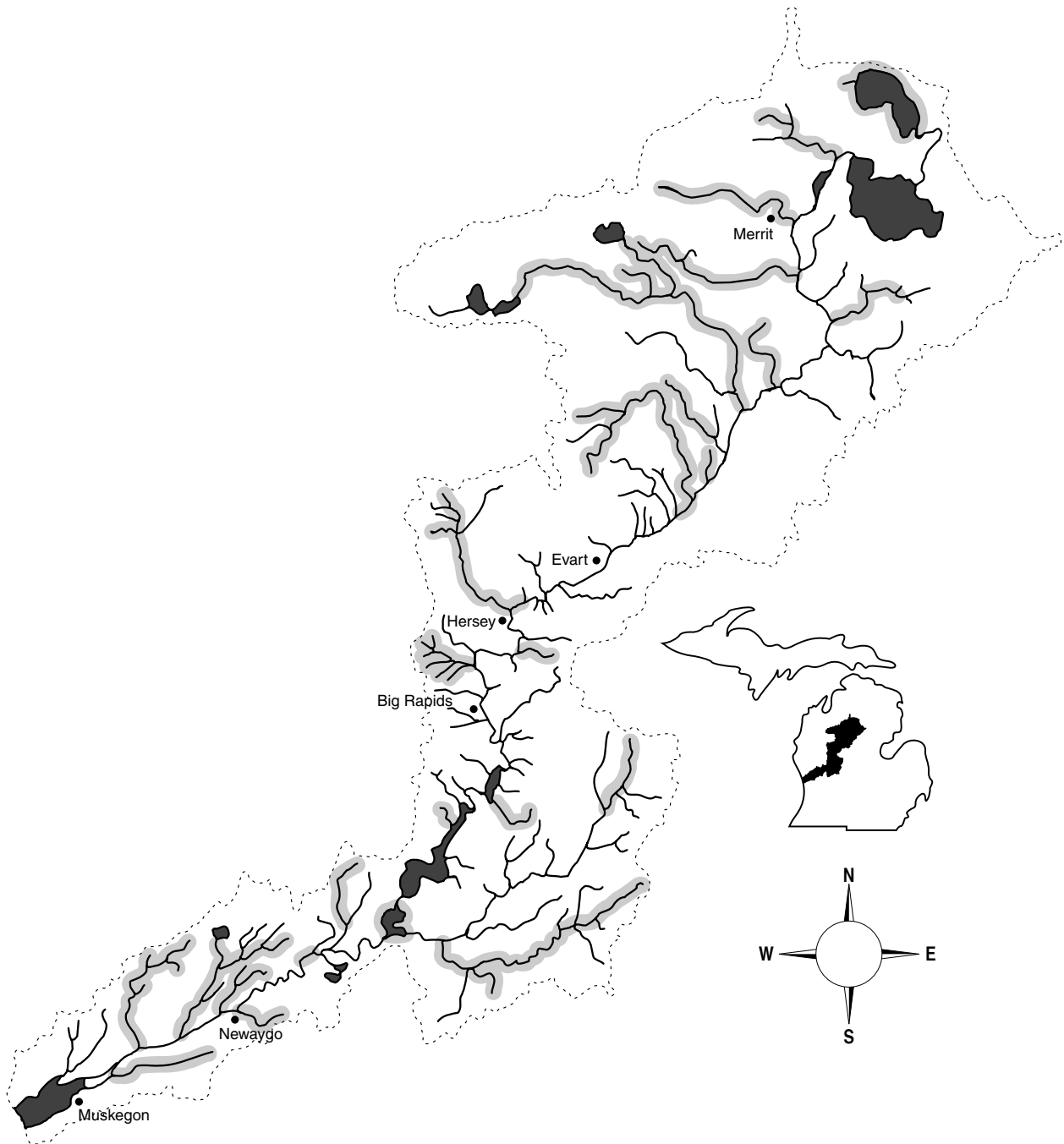


Mottled sculpin (*Cottus bairdi*)

Habitat:

- feeding - cool to cold streams
- riffle and rock substrates preferred
- clear to slightly turbid shallow water

- spawning - nests under logs or rock

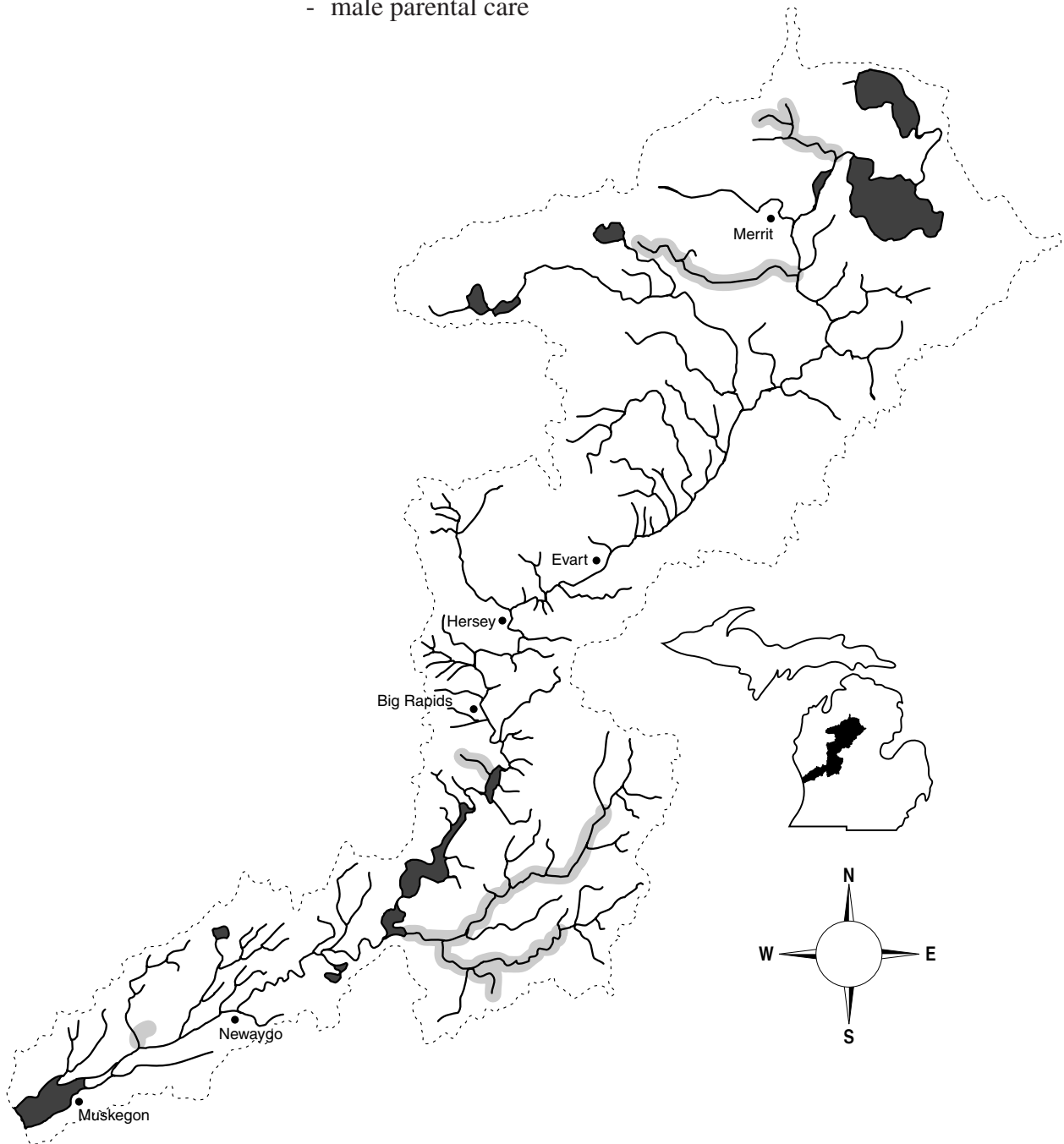


Slimy sculpin (*Cottus cognatus*)

Habitat:

- feeding - cool lakes, impoundments, rivers, and streams
- gravel or rock substrate

- spawning - nest in shallow areas of lakes
- gravel substrate or rock ledge
- male parental care



White perch (*Morone americana*)

Habitat:

feeding - clear, warm water of low-gradient streams, lakes, and impoundments

spawning - shallow water over firm substrate

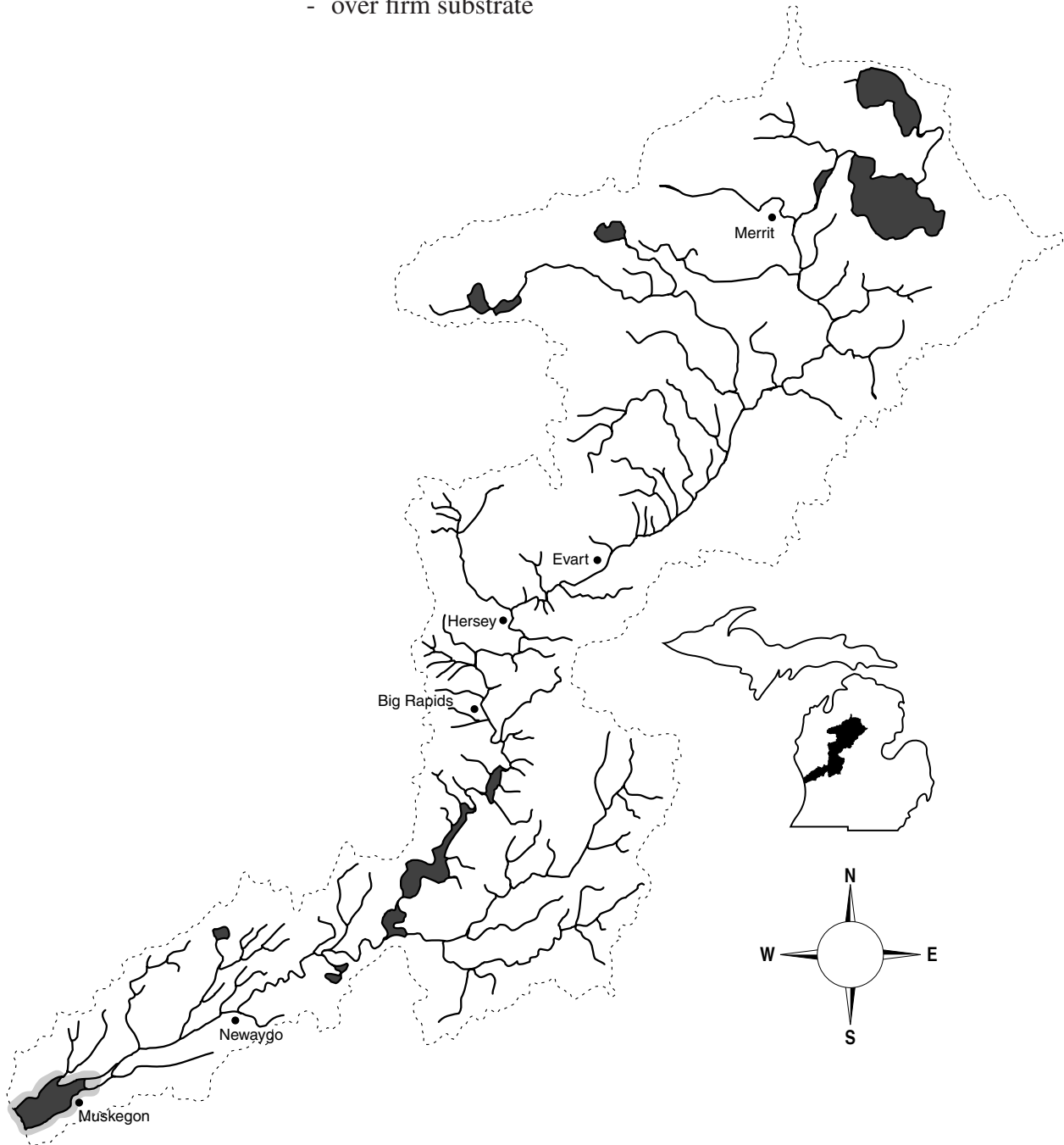


White bass (*Morone chrysops*)

Habitat:

- feeding - large lakes, impoundments, and Lake Michigan
- clear water of 30 feet or less depth
- firm substrate

- spawning - tributary streams or shallow water of lakes
- over firm substrate



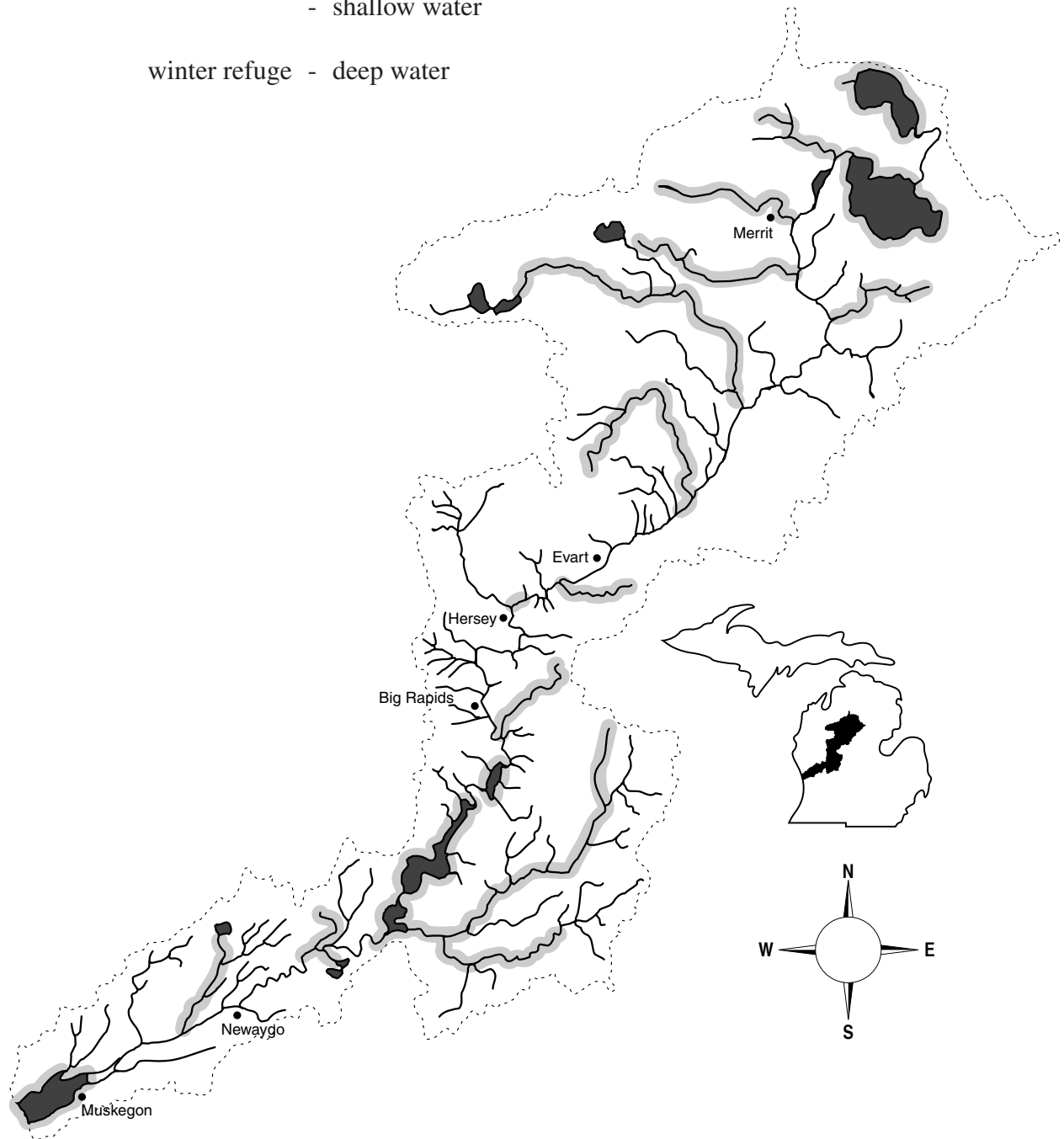
Rock bass (*Ambloplites rupestris*)

Habitat:

- feeding - clear, cool streams, rivers, and lakes
 - rocky to sand substrate
 - woody or vegetative cover

- spawning - sand or gravel nests
 - shallow water

- winter refuge - deep water

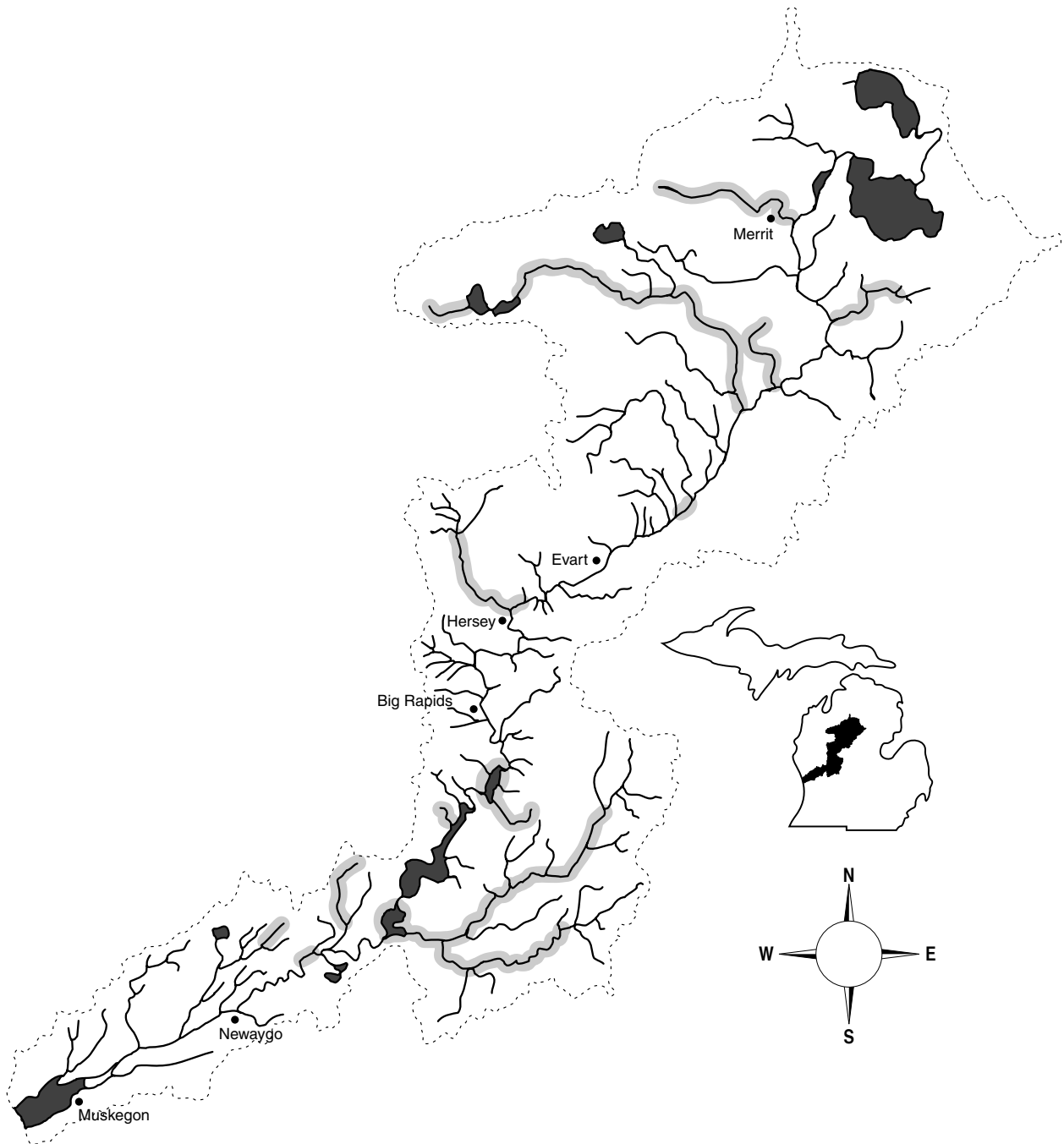


Green sunfish (*Lepomis cyanellus*)

Habitat:

- feeding - impoundments and lakes, and low-current streams and rivers
- no substrate preference

- spawning - nests in shallow areas sheltered by rocks, logs, or aquatic vegetation

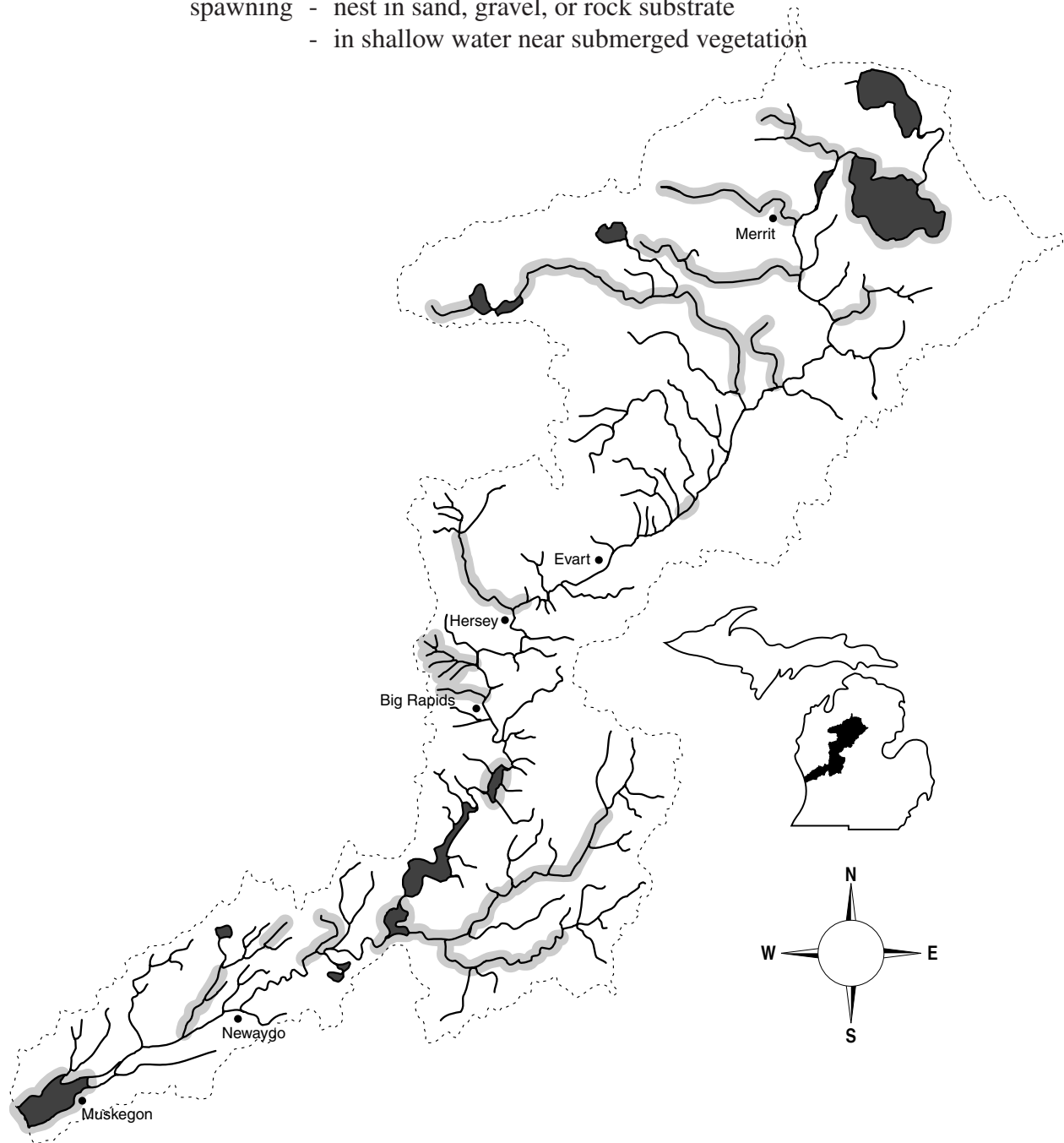


Pumpkinseed sunfish (*Lepomis gibbosus*)

Habitat:

- feeding - non-flowing clear water in streams and rivers; also lakes and impoundments
- muck or sand partly covered with organic debris substrate
- dense beds of submerged aquatic vegetation

- spawning - nest in sand, gravel, or rock substrate
- in shallow water near submerged vegetation

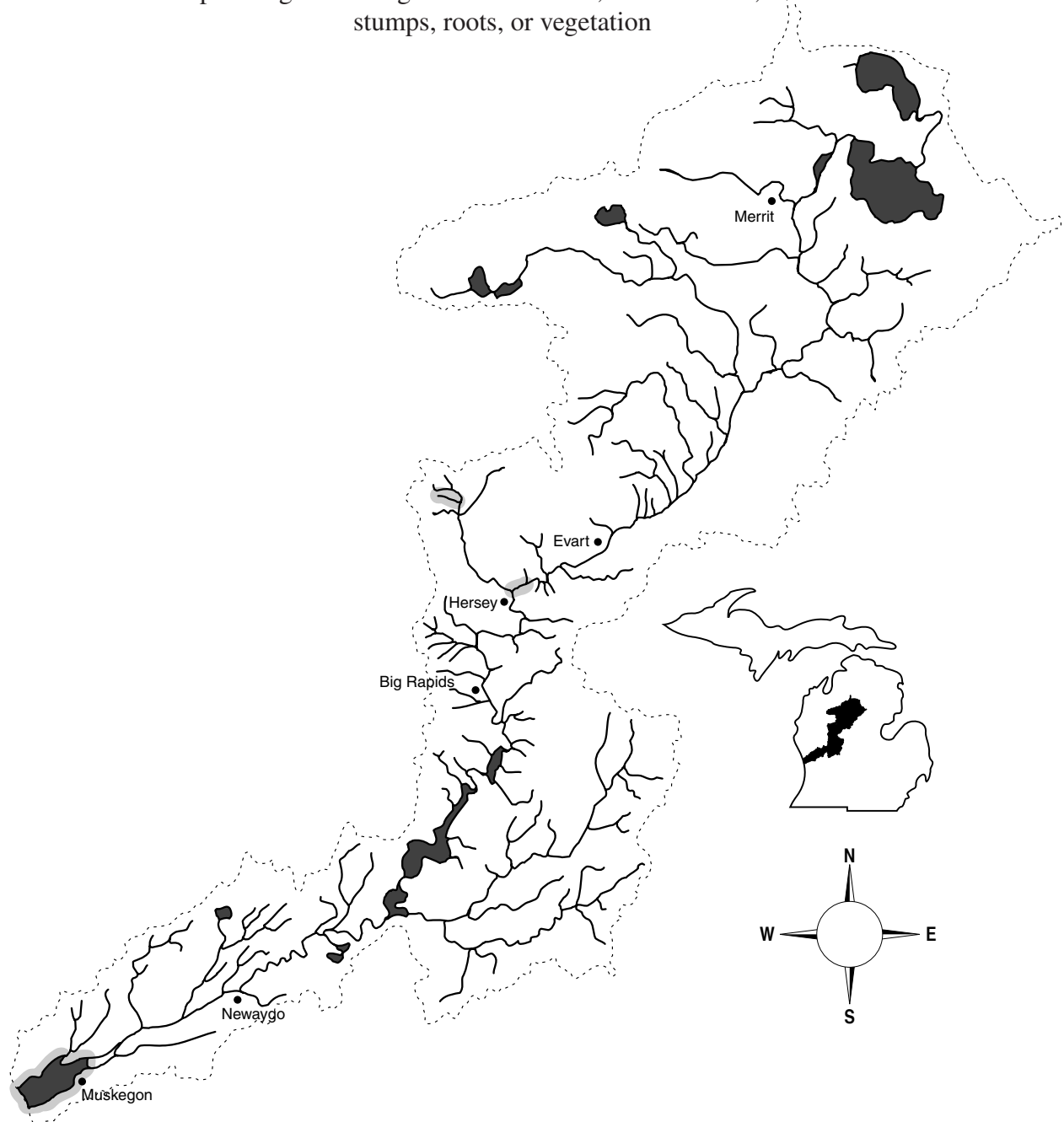


Warmouth (*Lepomis gulosus*)

Habitat:

- feeding - clear lakes and impoundments and very low-gradient streams
- abundant aquatic vegetation
- silt-free water
- mucky substrate often covered with organic debris

- spawning - nesting sites in loose silt, sand with silt, or rubble over silt near stumps, roots, or vegetation



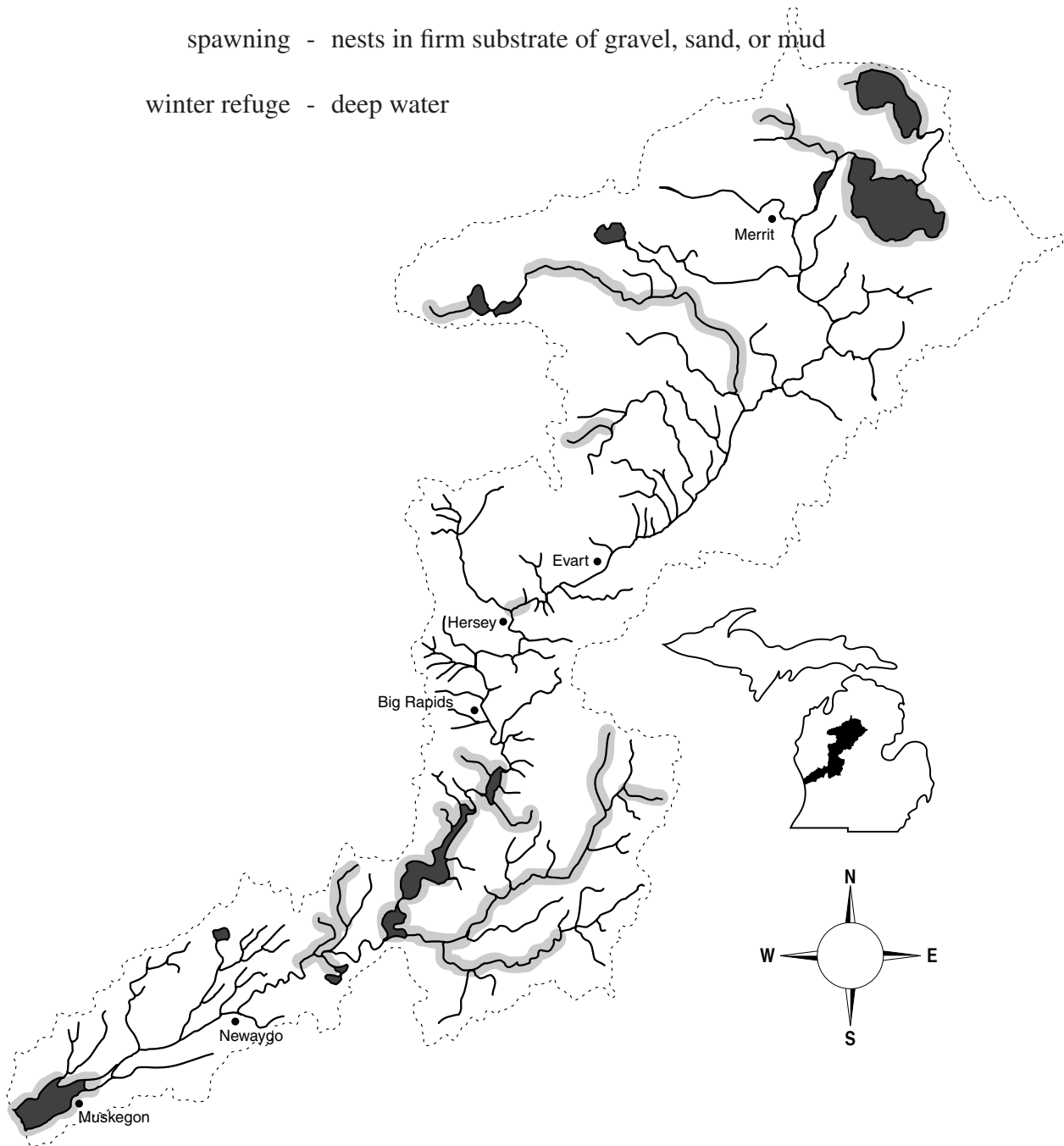
Bluegill (*Lepomis macrochirus*)

Habitat:

- feeding - non-flowing clear streams and rivers; also lakes and impoundments
- sand, gravel, or muck containing organic debris substrate
- scattered beds of aquatic vegetation
- cannot tolerate low oxygen or continuous high turbidity and siltation

- spawning - nests in firm substrate of gravel, sand, or mud

- winter refuge - deep water

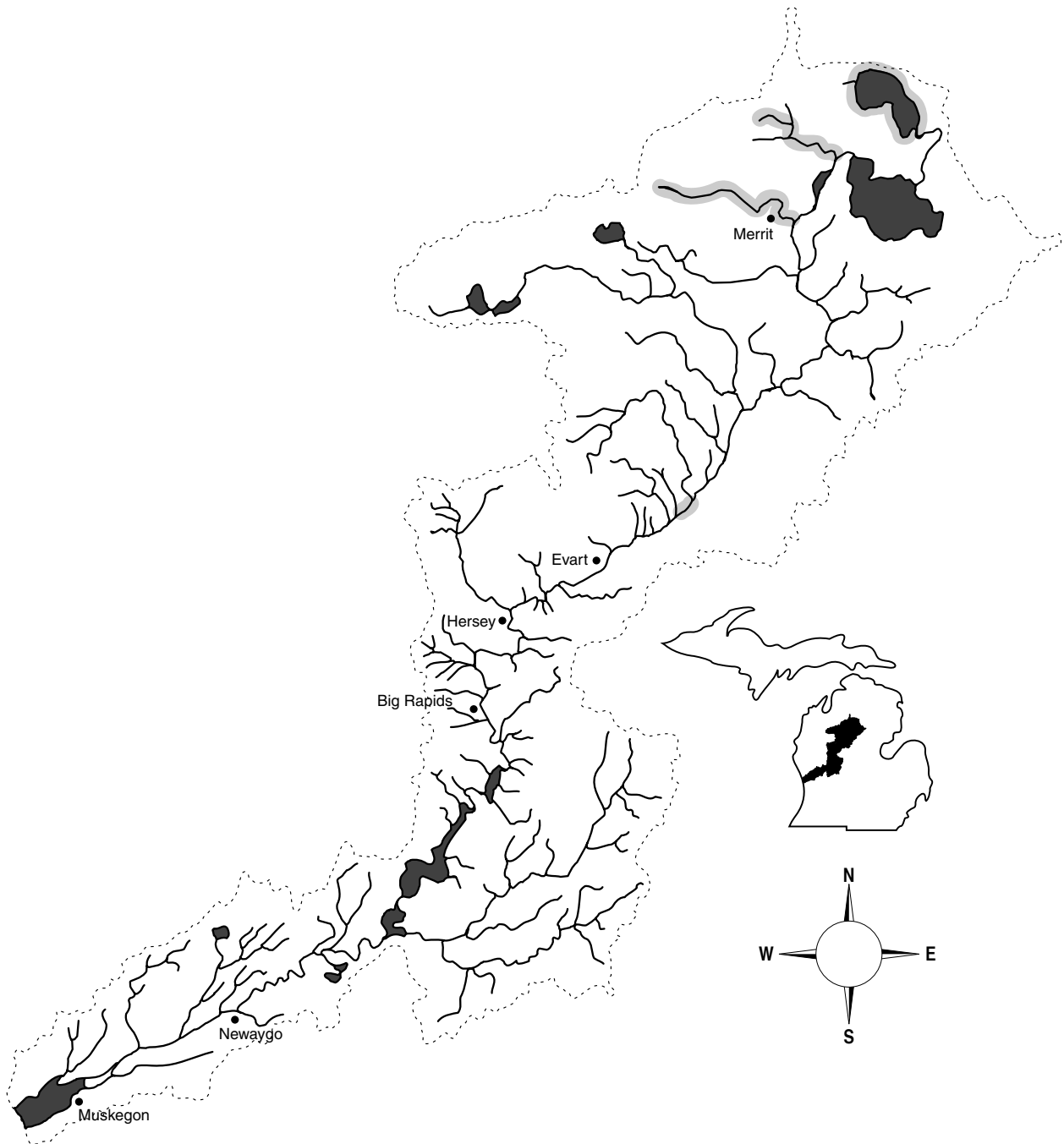


Longear sunfish (*Lepomis megalotis*)

Habitat:

- feeding - clear moderate-sized shallow streams with moderate vegetation
- rocky substrates
- little to no current

- spawning - nests in gravel, sand, or hard rock substrate



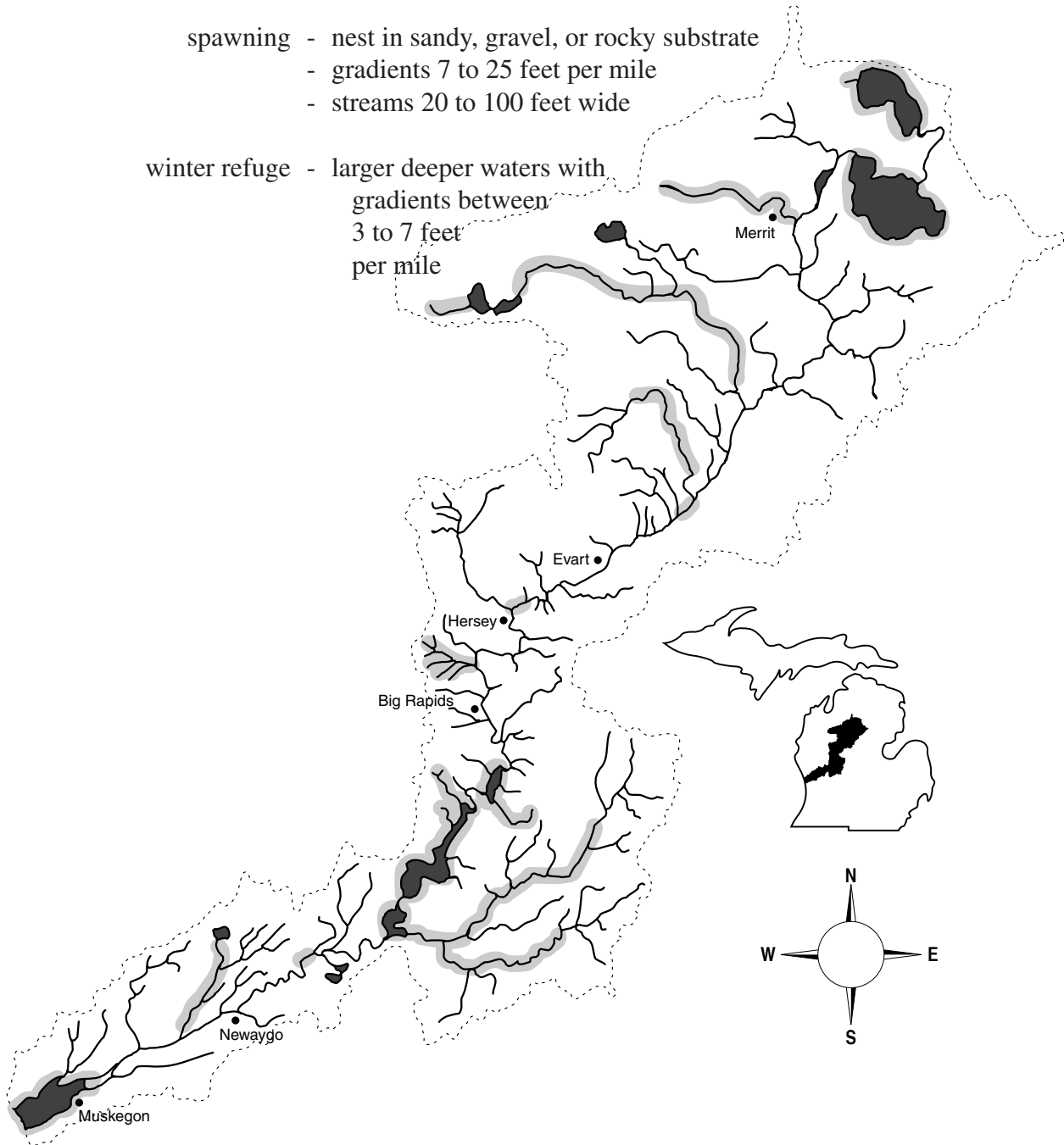
Smallmouth bass (*Micropterus dolomieu*)

Habitat:

- feeding
 - clear, cool, deep lakes and rivers
 - streams where 40% consists of riffles over clean gravel, boulder, or bedrock substrate
 - in pools with a current and >4 feet of depth
 - gradients between 4 and 25 feet per mile

- spawning
 - nest in sandy, gravel, or rocky substrate
 - gradients 7 to 25 feet per mile
 - streams 20 to 100 feet wide

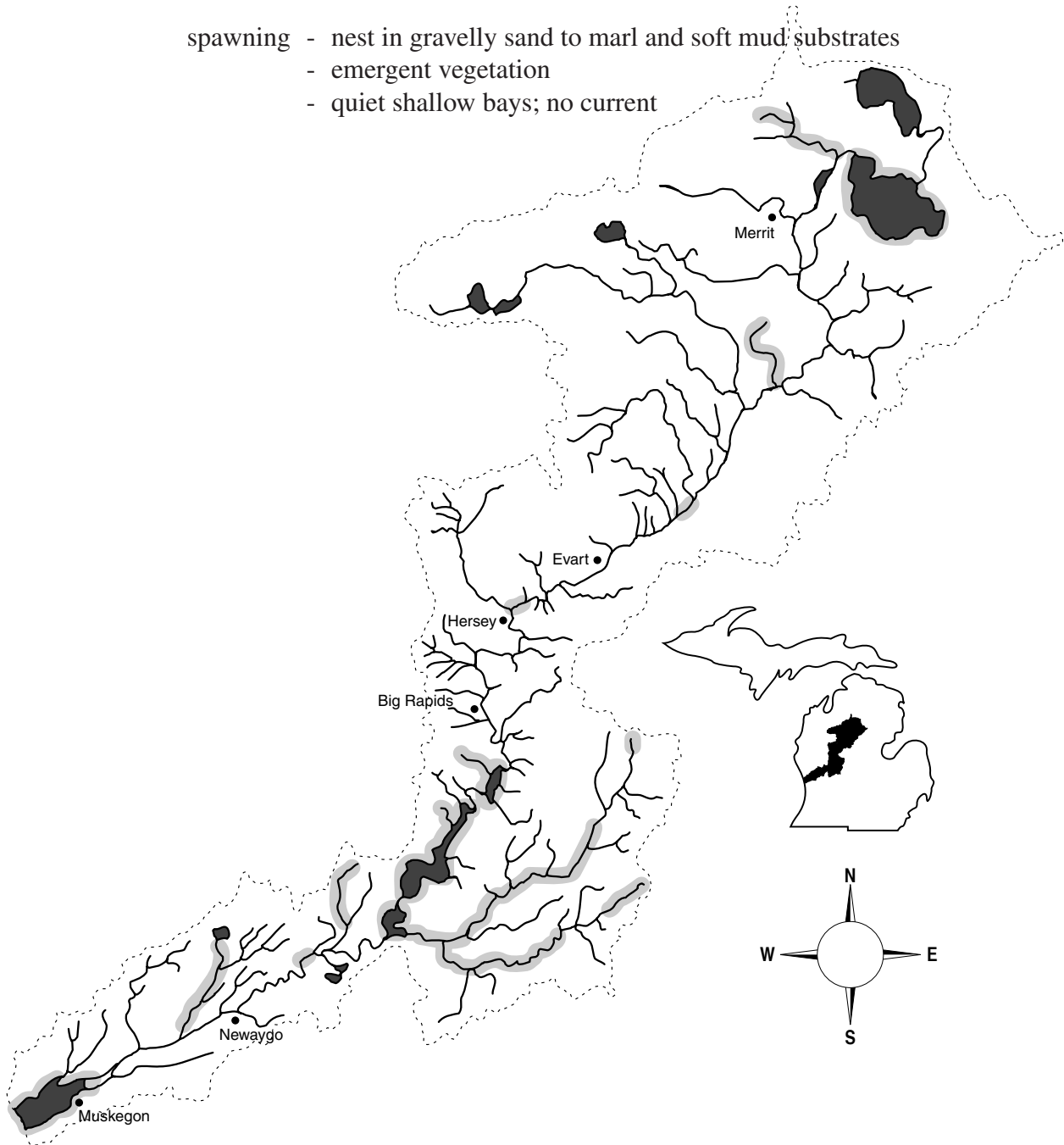
- winter refuge
 - larger deeper waters with gradients between 3 to 7 feet per mile



Largemouth bass (*Micropterus salmoides*)

Habitat:

- feeding - non-flowing clear waters - lakes, impoundments, and pools of streams
 - abundant aquatic vegetation
 - soft muck, organic debris, gravel, sand, and hard non-flocculent clay substrates
-
- spawning - nest in gravelly sand to marl and soft mud substrates
 - emergent vegetation
 - quiet shallow bays; no current

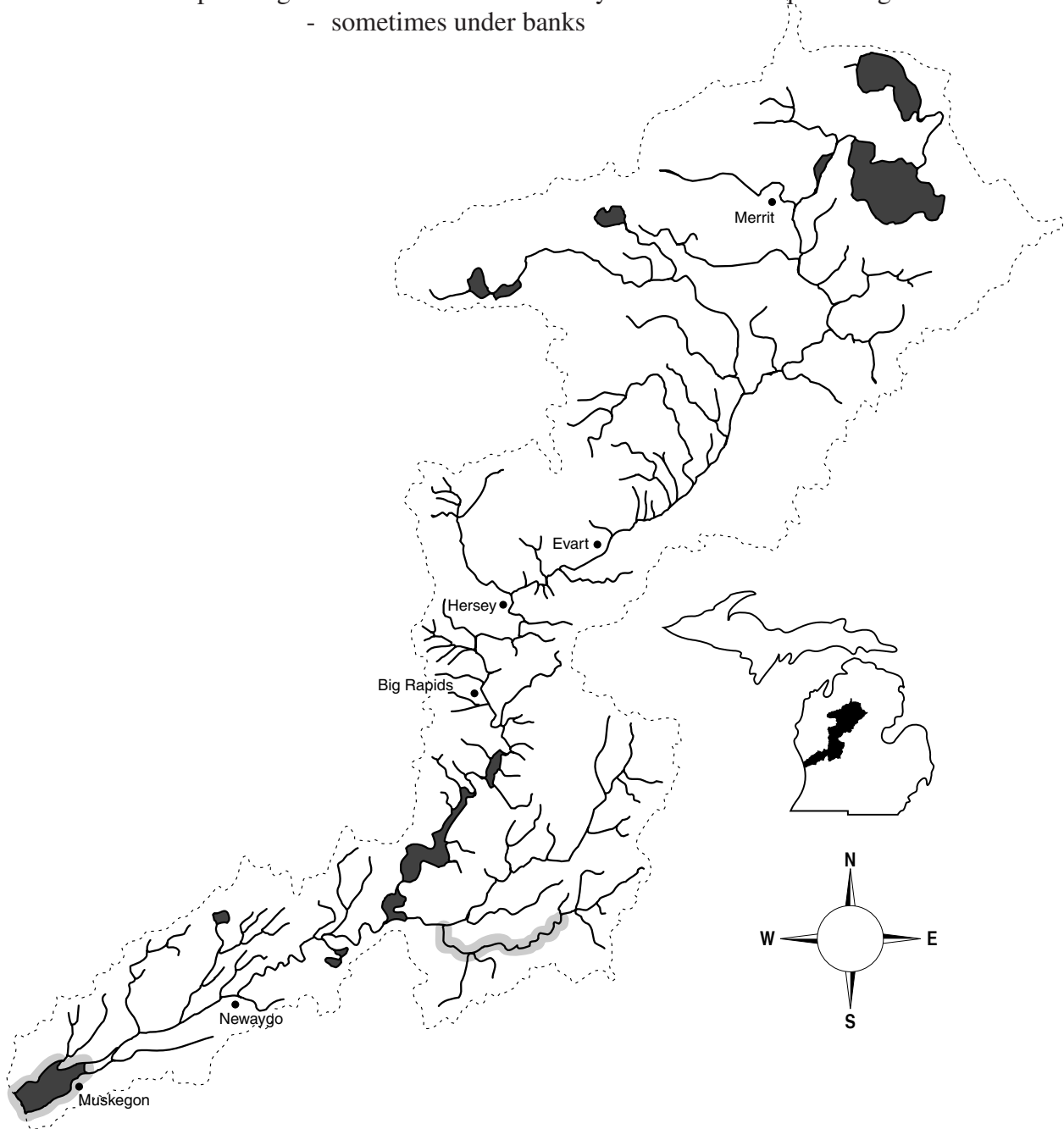


White crappie (*Pomoxis annularis*)

Habitat:

- feeding
 - lakes and impoundments >5 acres
 - sluggish pools of moderate to large low-gradient rivers
 - no substrate preference
 - can tolerate severe turbidity and rapid siltation

- spawning
 - various substrates usually beside rooted aquatic vegetation
 - sometimes under banks

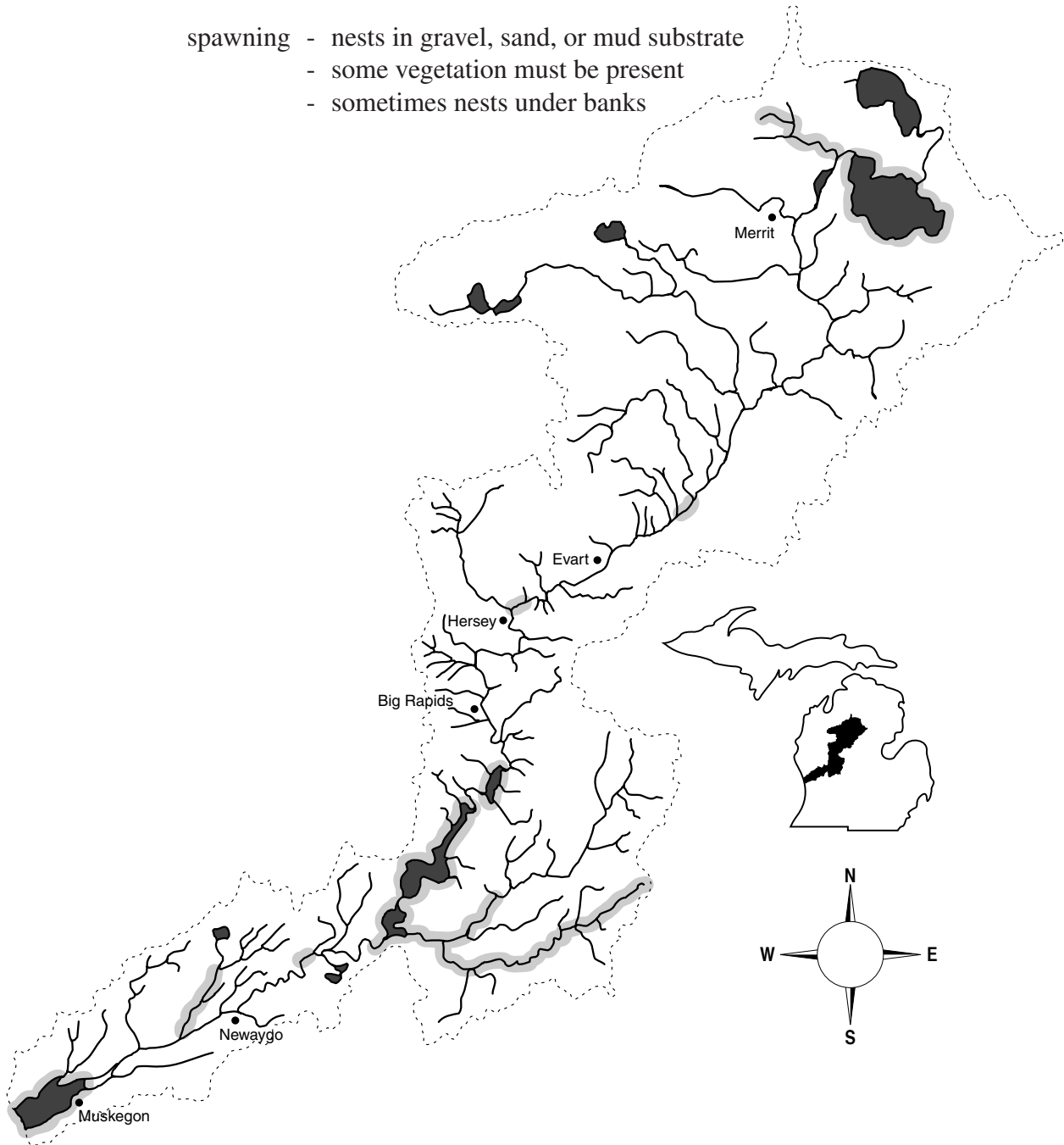


Black crappie (*Pomoxis nigromaculatus*)

Habitat:

- feeding - larger clear non-silty low-gradient rivers; also in lakes and impoundments
- clean hard sand or muck substrate
- associated with submerged aquatic vegetation
- does not tolerate silt or turbidity well

- spawning - nests in gravel, sand, or mud substrate
- some vegetation must be present
- sometimes nests under banks

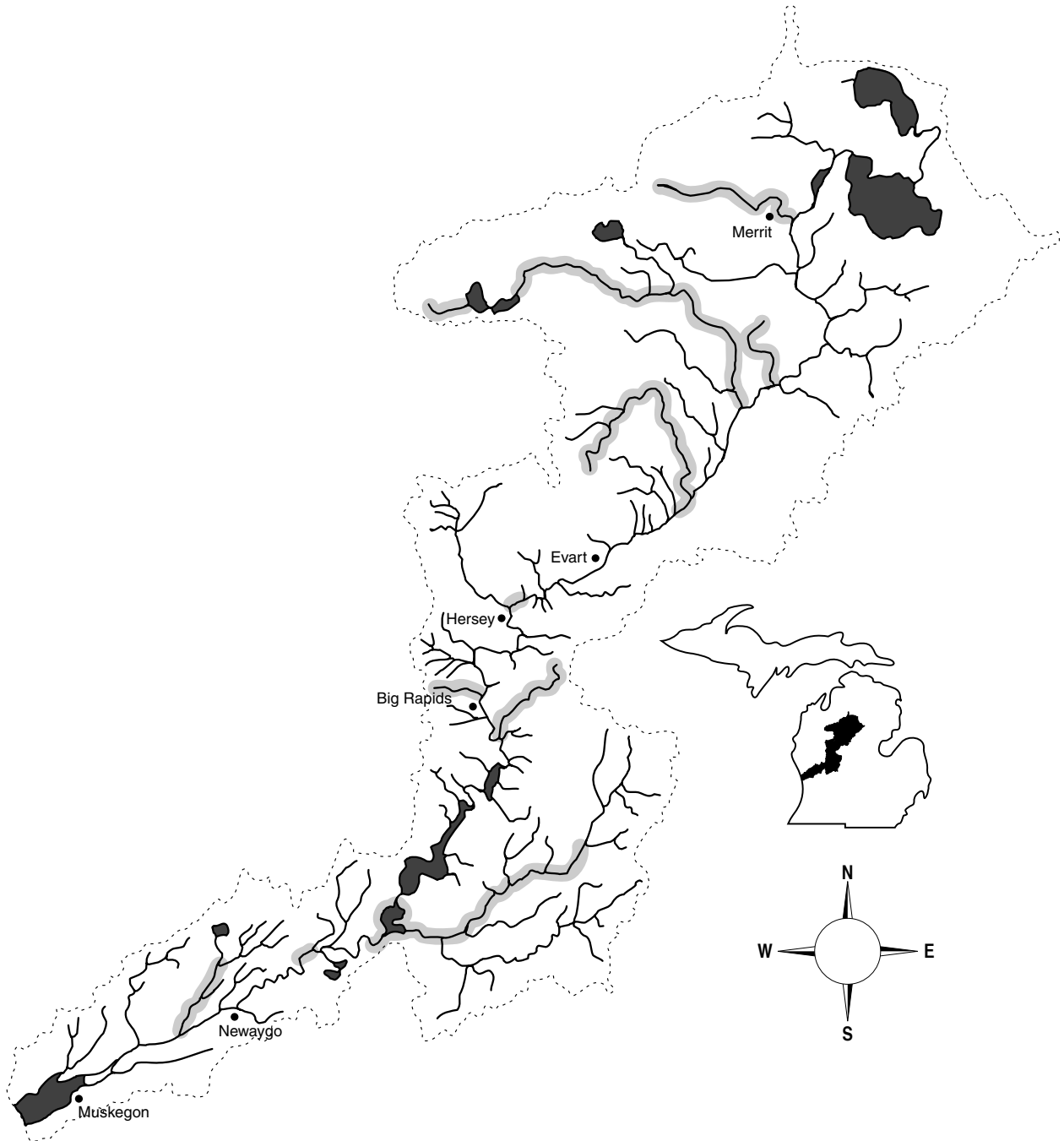


Rainbow darter (*Etheostoma caeruleum*)

Habitat:

- feeding - gravelly high gradient riffles
- clear, moderate to large streams
- in shallows (average 1 foot)

- spawning - gravel or rubble riffles

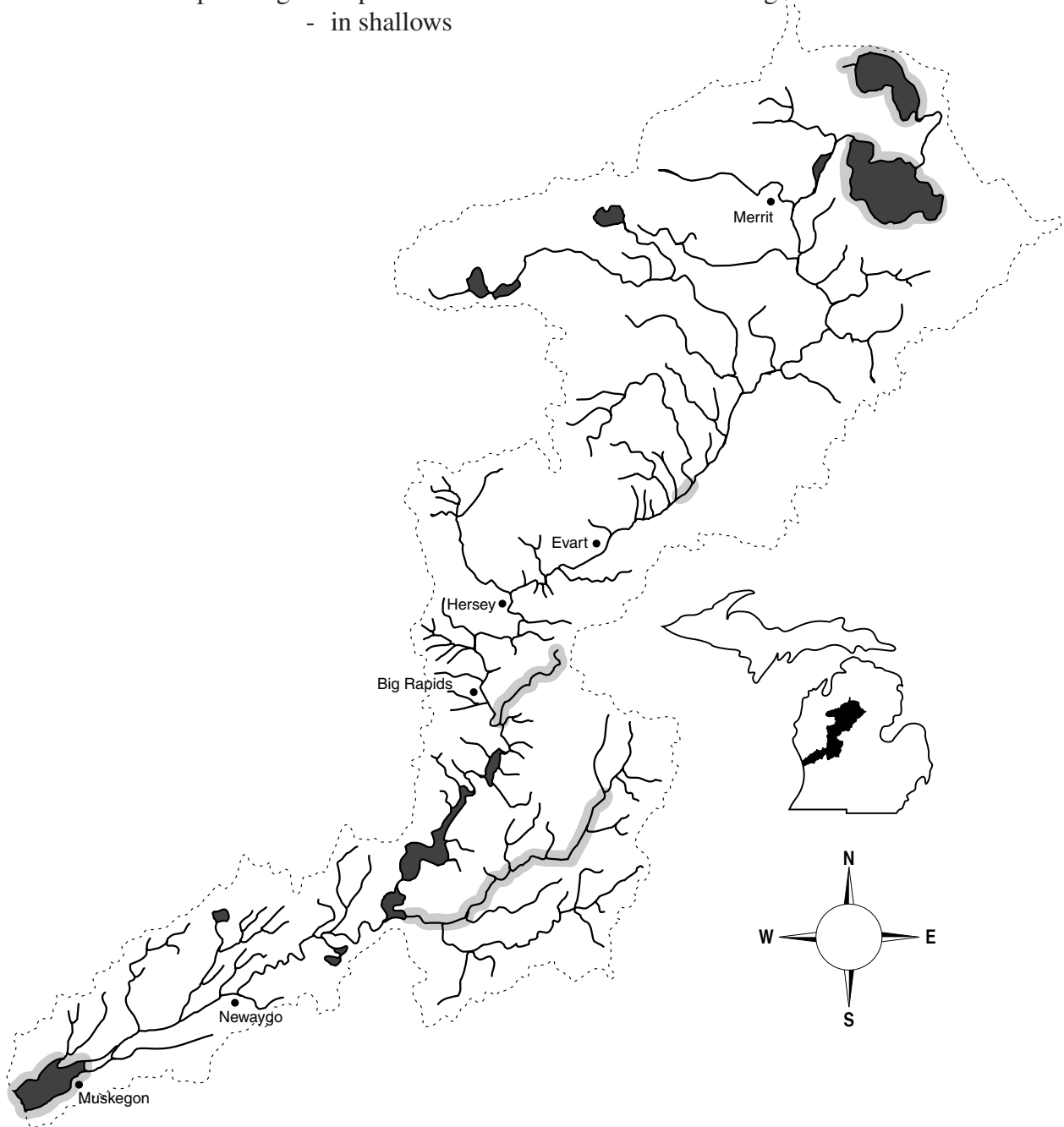


Iowa darter (*Etheostoma exile*)

Habitat:

- feeding
 - clear, slow moving streams and lakes
 - sandy to muddy substrates
 - intolerant of turbid water
 - lives in rooted aquatic vegetation

- spawning
 - in pond-like extensions of streams on organic matter or roots
 - in shallows



Least darter (*Etheostoma microperca*)

Habitat:

- feeding - moderate to warm temperature
- clear quiet low-gradient vegetated streams (wetlands, floodplains)
- soft substrate

- spawning - spawning occurs on stems of plants
- male guards a territory in a vegetated area.

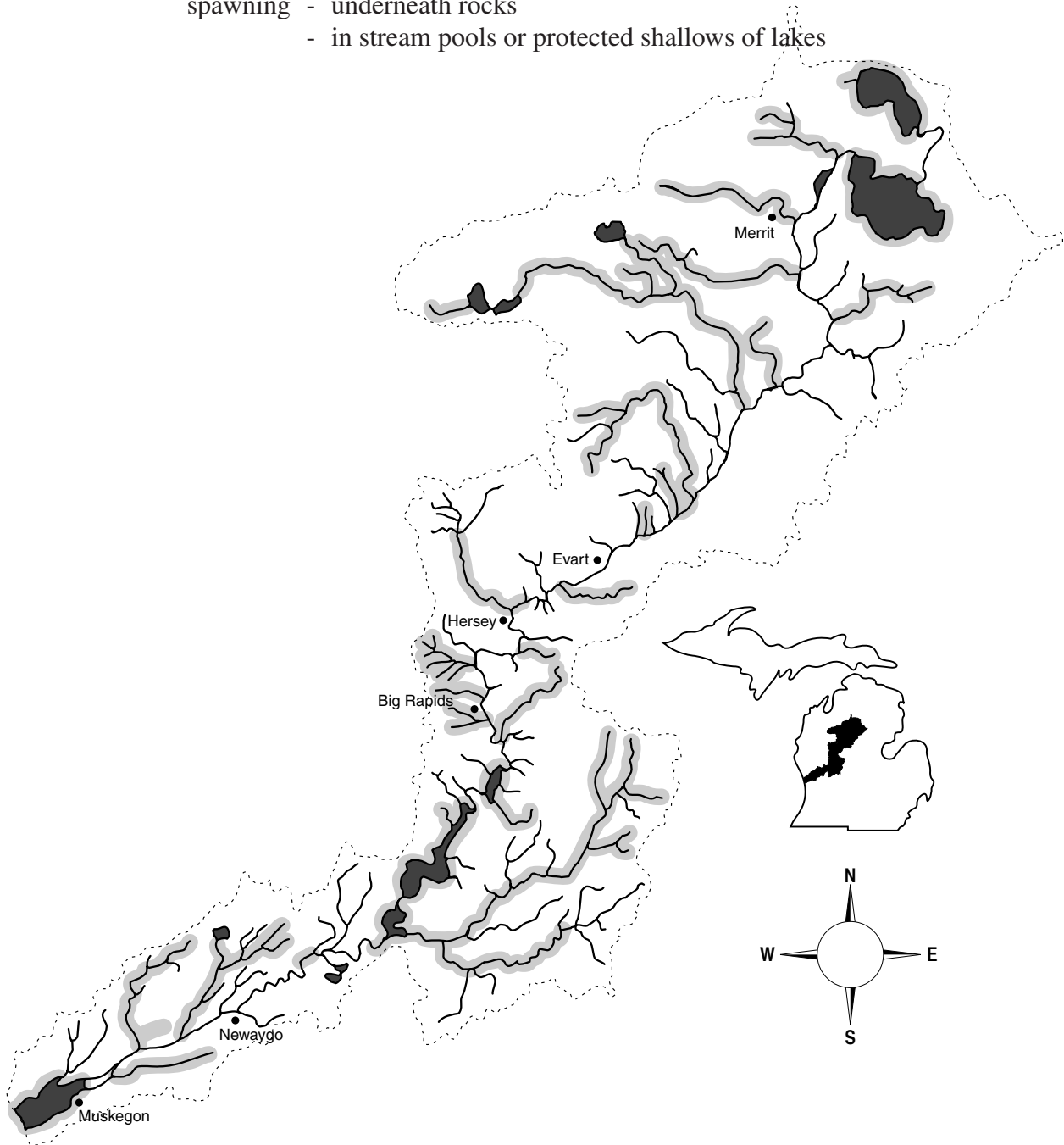


Johnny darter (*Etheostoma nigrum*)

Habitat:

- feeding - sand and silt substrate
- little to moderate current
- shallow areas of streams, rivers, lakes, and impoundments
- tolerant of many organic and inorganic pollutants and turbidity

- spawning - underneath rocks
- in stream pools or protected shallows of lakes

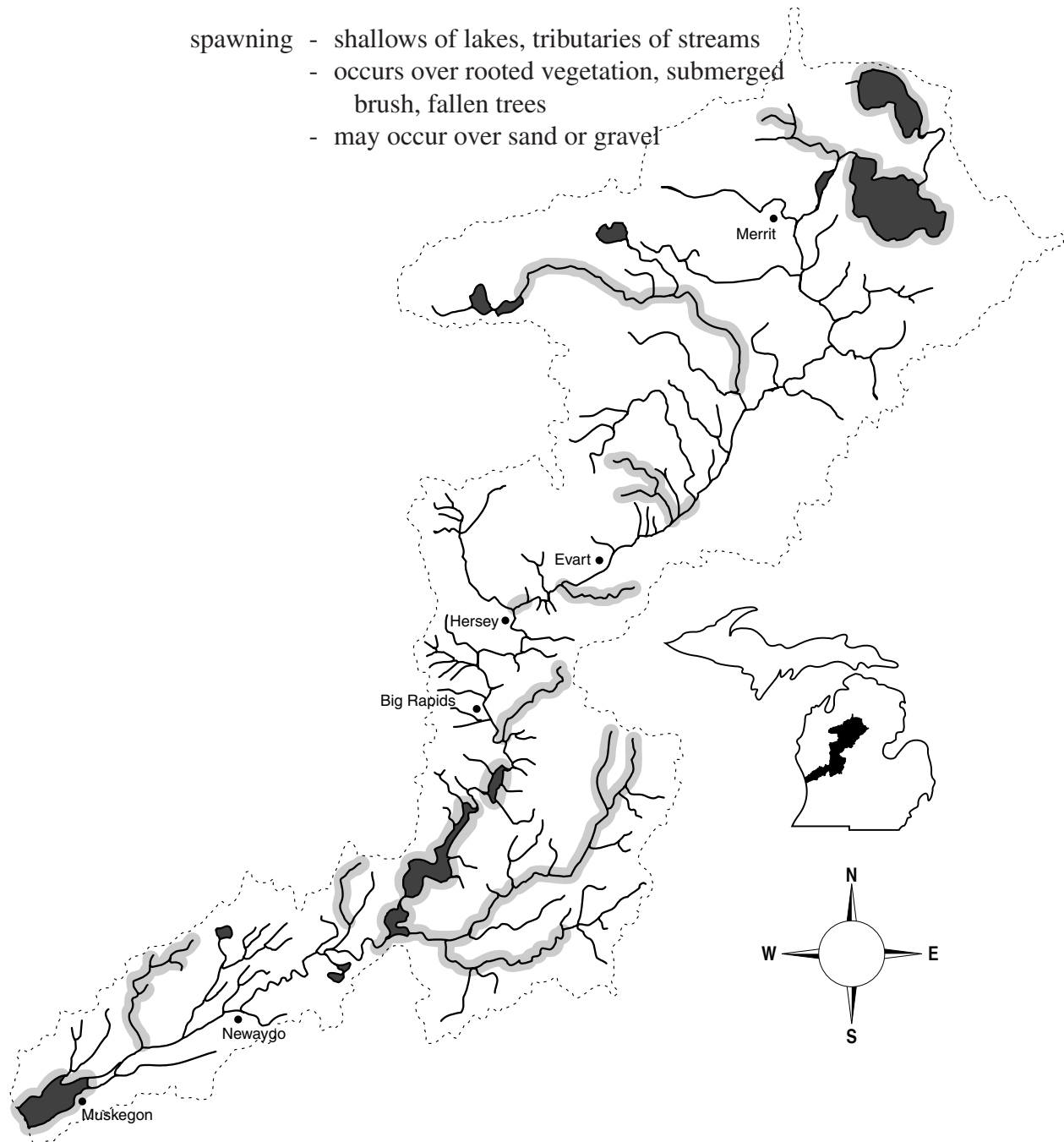


Yellow perch (*Perca flavescens*)

Habitat:

- feeding
 - clear lakes and impoundments; also Lake Michigan
 - low gradient rivers
 - abundance of rooted aquatics
 - muck, organic debris, sand, or gravel substrate
 - does not tolerate turbidity and siltation

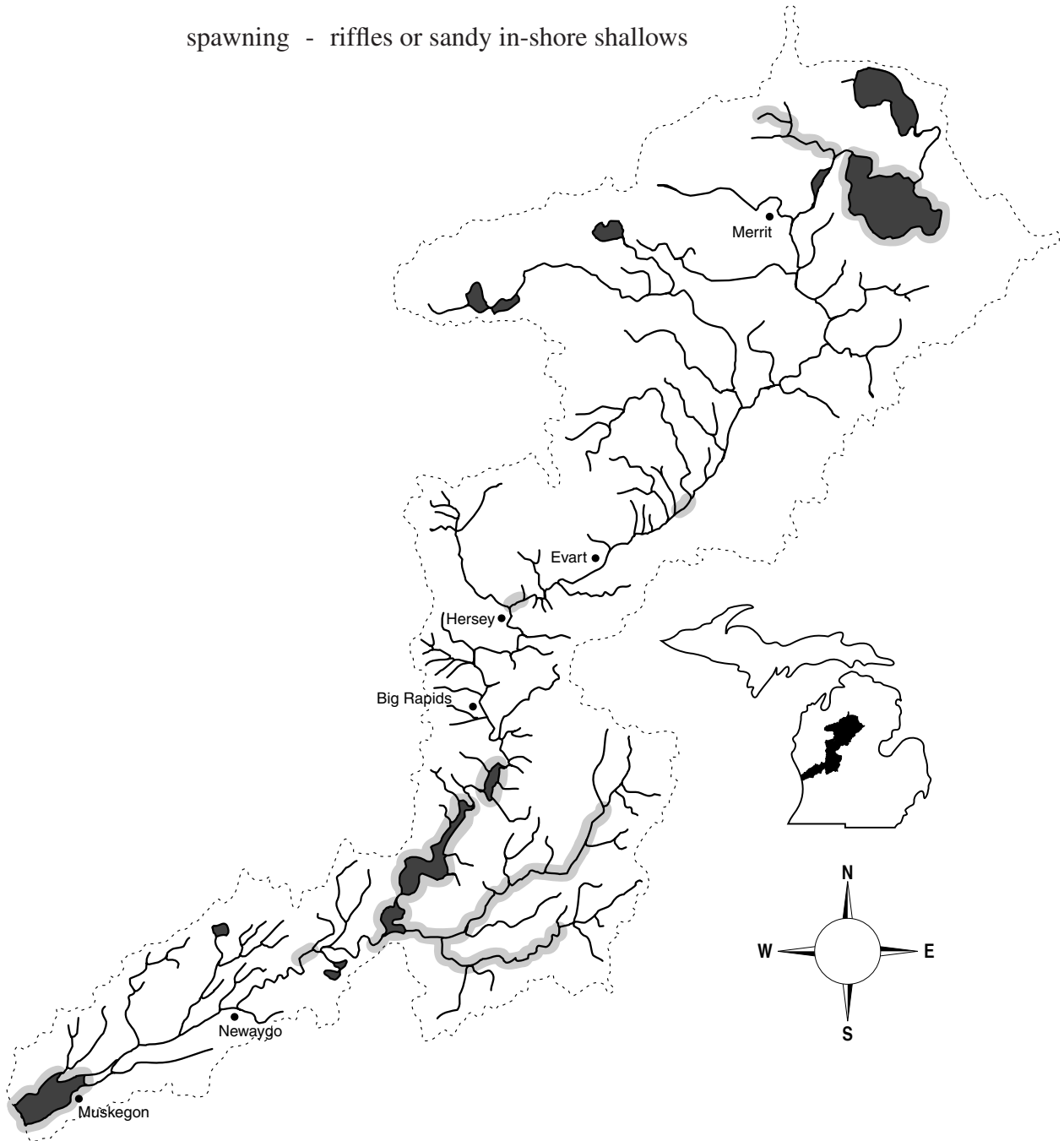
- spawning
 - shallows of lakes, tributaries of streams
 - occurs over rooted vegetation, submerged brush, fallen trees
 - may occur over sand or gravel



Logperch (*Percina caprodes*)

Habitat:

- feeding - gravel riffles, deeper slower sections of rivers
 - medium size streams; also lakes, impoundments, and Lake Michigan
 - sand, gravel, or rock substrate
 - avoids turbidity and silt
- spawning - riffles or sandy in-shore shallows

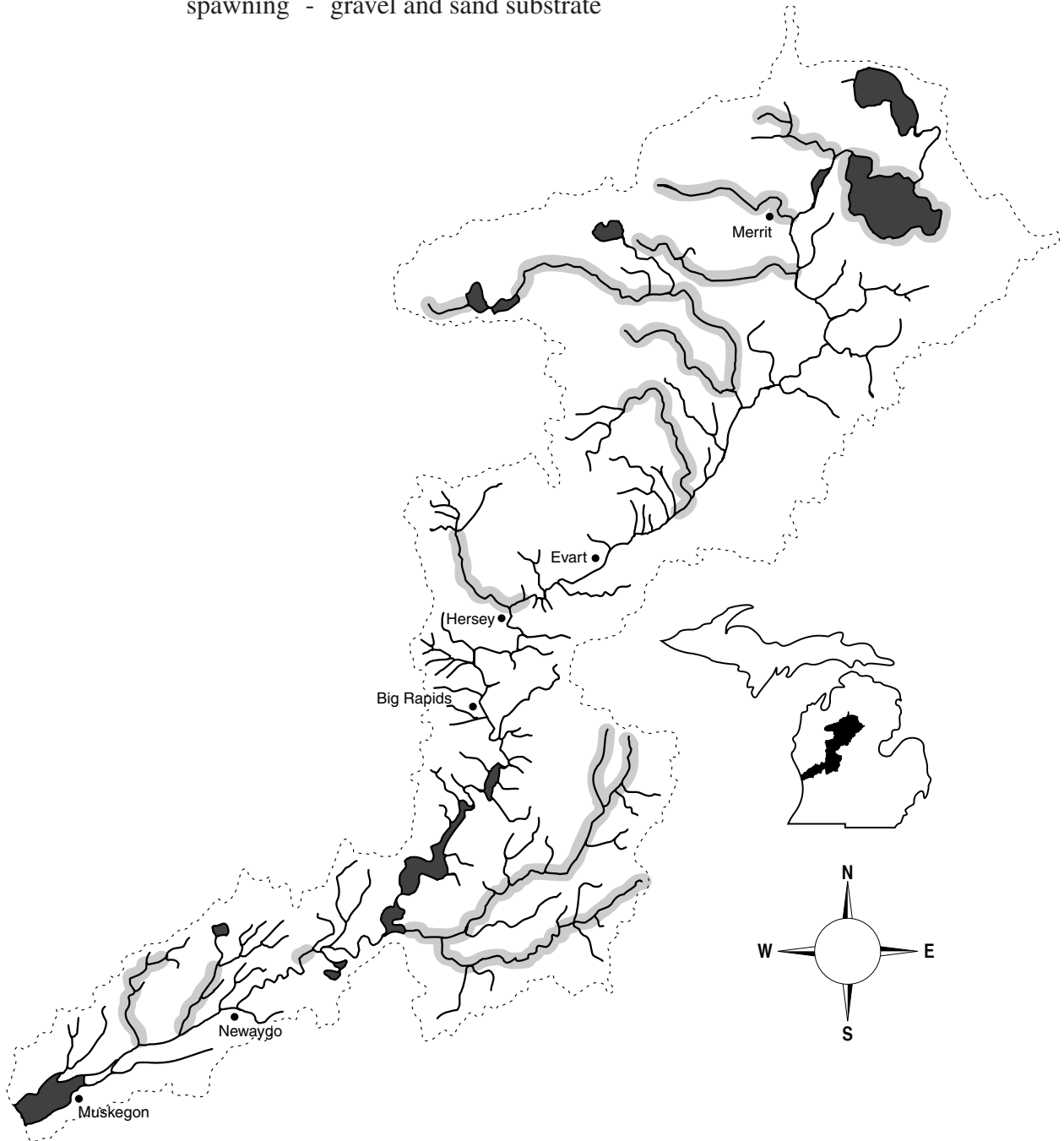


Blackside darter (*Percina maculata*)

Habitat:

- feeding - small to medium streams
- low to medium gradient
- gravel and sand substrate
- tolerate some turbidity

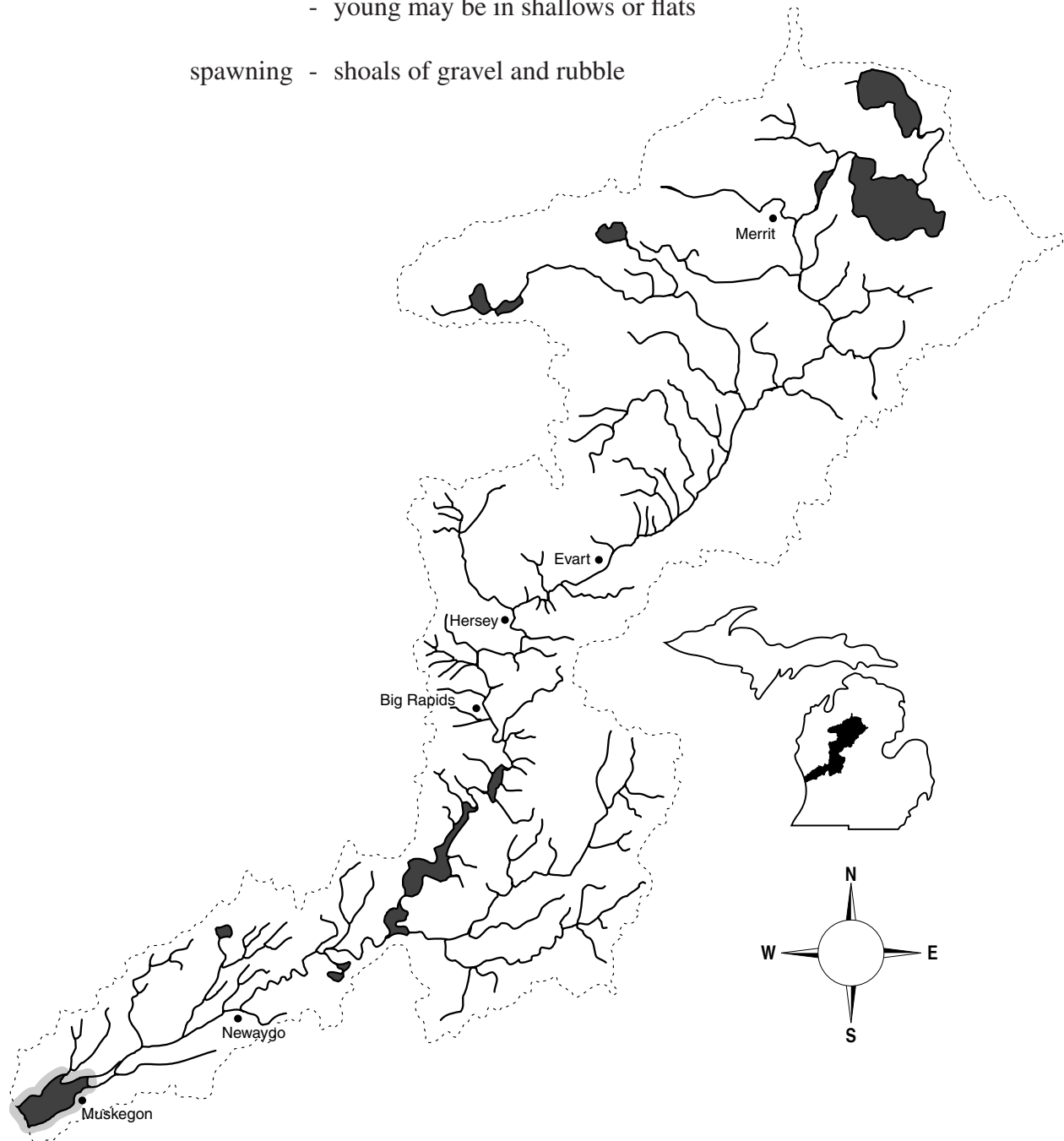
- spawning - gravel and sand substrate



Sauger (*Stizostedion canadense*) - threatened

Habitat:

- feeding - larger, deeper, low gradient rivers; turbid lakes and impoundments;
also Lake Michigan
 - not tolerant of high gradient
 - tolerant of silted substrate
 - more tolerant of turbid water than walleye
 - young may be in shallows or flats
- spawning - shoals of gravel and rubble



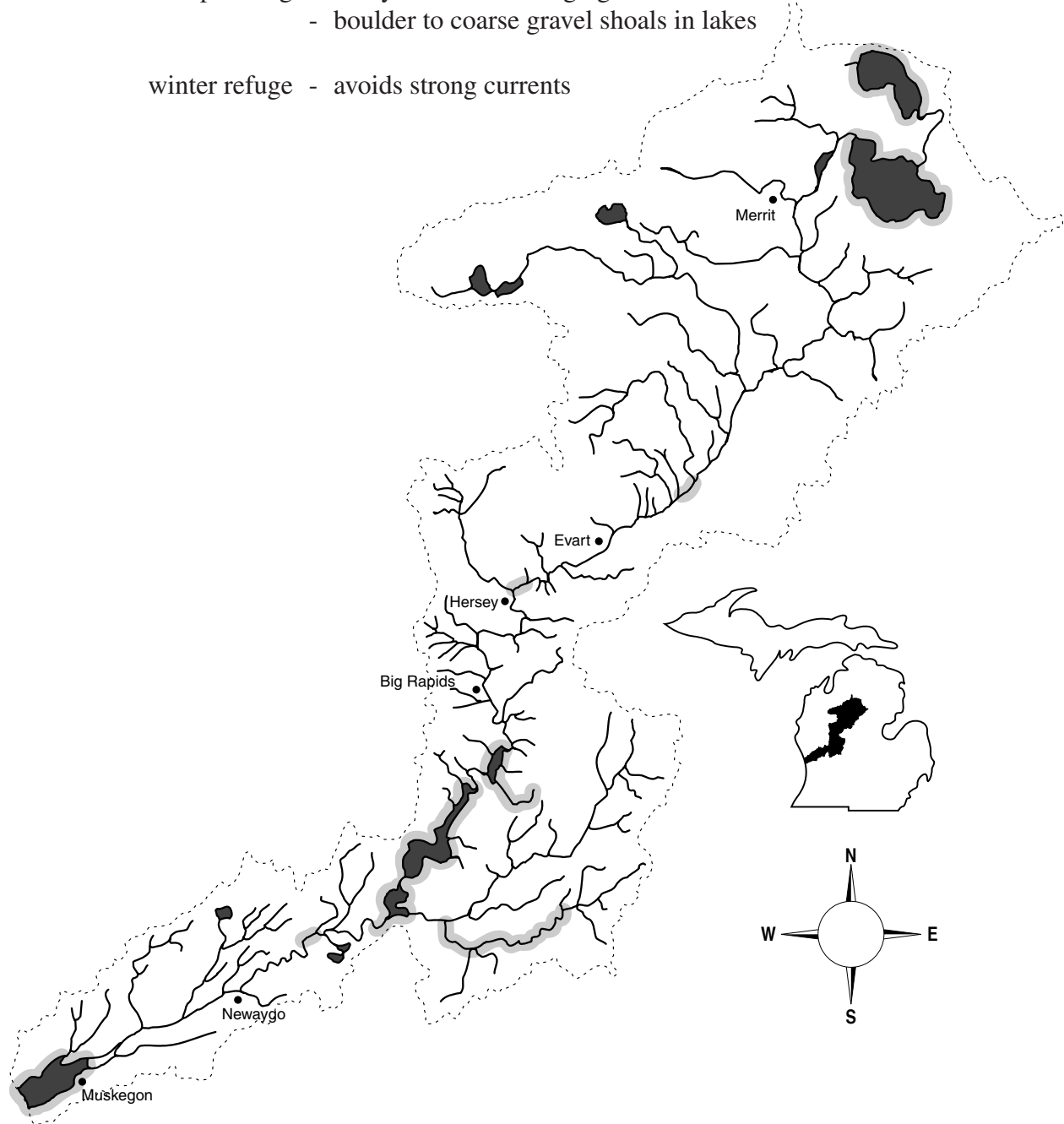
Walleye (*Stizostedion vitreum*)

Habitat:

- feeding - larger, deeper streams and in large, shallow, turbid lakes and impoundments; also Lake Michigan
 - gravel, bedrock, and firm substrates preferred
 - does not tolerate a lot of turbidity or low oxygen

- spawning - rocky substrates in high gradient water in rivers
 - boulder to coarse gravel shoals in lakes

- winter refuge - avoids strong currents



Freshwater drum (*Aplodinotus grunniens*)

Habitat:

- feeding - deeper pools of rivers
- in shallows
- prefers clear waters and clean substrates
- can adapt to high turbidity levels

- spawning - pelagically, in open water, over sand or mud substrate
- occurs in bays or lower portions of marshes

