DOWNLOAD PDF THE EUROPEAN ZEBRA MUSSEL, DREISSENA POLYMORPHA

Chapter 1 : Zebra Mussel - Stop Aquatic Hitchhikers

A long tradition of zebra mussel study exists in Europe and the former Soviet Union, where the zebra mussel has been present for years (see Mackie et al. for an annotated bibliography of European references).

Mytilus polymorpha Pallas, Short Description Sessile bivalve mollusc, forming dense colonies on various hard substrates in fresh and slightly brackish waters. It has brownish-yellowish triangular shells up to 50 mm with dark and light coloured "zebra" zigzag banding. It is a filter feeder on microscopic plankton organisms and organic particles. Reproduction Zebra mussels have separate sexes, usually with a ratio 1: Fertilisation takes place externally. A mature female may produce one million eggs per year. Resistant Stages seeds, spores etc. Surface standing waters, C2: Surface running waters, C3: Littoral zone of inland surface waterbodies, X1: Large estuaries and inland waters, hard and soft bottom habitats. The typical habitats colonised are estuaries, rivers and lakes, particularly where there are firm surfaces suitable for attachment. It tolerates brackish waters with salinity up to 7 ppt. Prefers moderately productive mesotrophic water bodies. Occurs from the lower shore to depths of 12m in brackish parts of sea and to 60m in lakes. It is able to tolerate low oxygen content in water for several days and to survive out of water under cool damp conditions for up to three weeks. Introduction Pathway The most likely introduction vector is shipping ballast water and hull fouling of vessels. Also could be transported with timber or river gravel and overland transport. Larval dispersal may occur. In it first appeared in Lake St. Clair and rapidly spread throughout the Great Lakes of North America. Trend Further range expansions are expected in temperate latitudes of the Northern Hemisphere. Distribution Map Main symbols used in maps known distribution area in CGRS grid squares; in countries; along coast Specific symbols occurring only in some species eradicated.

Chapter 2 : DAISIE - Species Factsheet

Zebra Mussel. Scientific name: Dreissena polymorpha (Pallas,) (ITIS). Common name: Zebra mussel. Spotlight: Bureau of Reclamation Launches Prize Competition Looking to Eradicate Invasive Quagga and Zebra Mussels (Dec 14,).

They hamper boating, swimming, fishing, hunting, hiking, and other recreation, and take an economic toll on commercial, agricultural, forestry, and aquacultural resources. Zebra mussels were introduced into the Great Lakes in or , and have been spreading throughout them since that time. They were most likely brought to North America as larvae in ballast water of ships that traveled from fresh-water Eurasian ports to the Great Lakes. Zebra mussels look like small clams with a yellowish or brownish D-shaped shell, usually with alternating dark- and light-colored stripes. They can be up to two inches long, but most are under an inch. Zebra mussels usually grow in clusters containing numerous individuals. Zebra Mussel Scientific names: Dreissena polymorpha Ecological threat: Zebra Mussels feed by drawing water into their bodies and filtering out most of the suspended microscopic plants, animals and debris for food. This process can lead to increased water clarity and a depleted food supply for other aquatic organisms, including fish. The higher light penetration fosters growth of rooted aquatic plants which, although creating more habitat for small fish, may inhibit the larger, predatory fish from finding their food. This thicker plant growth can also interfere with boaters, anglers and swimmers. Zebra mussel infestations may also promote the growth of blue-green algae, since they avoid consuming this type of algae but not others. Zebra mussels attach to the shells of native mussels in great masses, effectively smothering them. A survey by the Corps in the East Channel of the Mississippi River at Prairie du Chien revealed a substantial reduction in the diversity and density of native mussels due to Zebra Mussel infestations. Future efforts are being considered to relocate such native mussel beds to waters that are less likely to be impacted by zebra mussels. The recommendation for Zebra Mussels was based upon this literature review developed by the department. If you know of a location that is not listed, send us a report. Once zebra mussels are established in a water body, very little can be done to control them. It is therefore crucial to take all possible measures to prevent their introduction in the first place. Some of the preventative and physical control measures include physical removal, industrial vacuums, backflushing. Chemical applications include solutions of chlorine, bromine, potassium permanganate and even oxygen deprivation. An ozonation process is under investigation patented by Bollyky Associates Inc. This method only works in controlling veligers, and supposedly has little negative impacts on the ecosystem. Further research on effective industrial control measures that minimize negative impacts on ecosystem health is needed.

Chapter 3 : BioKIDS - Kids' Inquiry of Diverse Species, Dreissena polymorpha: INFORMATION

The zebra mussel (Dreissena polymorpha) is a small freshwater www.nxgvision.com species was originally native to the lakes of southern Russia and Ukraine. However, the zebra mussel has been accidentally introduced to numerous other areas, and has become an invasive species in many countries worldwide.

Received Mar 5; Accepted Dec 5. This article has been corrected. This article has been cited by other articles in PMC. The brackish lagoons of the Odra River Estuary ORE in the south-western Baltic Sea, represent an important area for the species during the non-breeding season in Europe. This mussel was present in the ORE already in the 19th century and continues to be superabundant. We estimate that Scaup alone consume an average of 5 tons of Zebra Mussels annually, which represents 5. Our results provide a clear picture of the strong dependence of the declining, migratory duck species on the non-native mussel, its primary food in the ORE. Our findings are particularly important as they can form the basis for the conservation action plan aimed at saving the north-western European populations of Scaup. Key breeding grounds are situated in the lower Pechora River basin [1]. The main wintering grounds are in the lagoons and bays of the south-western Baltic Sea [2], and in the south-eastern North Sea [3]. Outside the breeding period, the Scaup occupies two ecological niches. It lives both on seawaters, like other ducks of the tribes Somaterini and Mergini [4 , 5 , 6], and on freshwater bodies like typical Aythyini [7 , 8]. During migration and wintering, Scaup form mixed flocks with other sympatric species, frequently with Tufted Duck A. The Odra River Estuary hereafter ORE is one of two areas, where the European population of Scaup congregates in the largest numbers during the non-breeding season [2 , 3 , 15]; the reasons for its high abundance here have remained unclear, however. Its main food are benthic bivalves mainly mussels [5] obtained by diving Fig 1d. Like other ducks of the genus Aythya, Scaup forage mainly at night [6 , 16 , 17], but there are also studies documenting daytime feeding [8 , 18]. In wintering areas, Scaup flocks regularly move between night-time foraging areas and daytime roosts; these movements were first described by Liepe from Germany [16 , 17] and by Nilson [6 , 19] from Scania Sweden. Alternatively, birds may remain in the area without undertaking daily migrations [18]. The favored prey items in winter are marine or freshwater bivalves, whereas in spring these ducks regularly feed on fish eggs [4 , 5 , 8]. On the Dutch lakes IJsselmeer and Markermeer their basic food is the freshwater Zebra Mussel Dreissena polymorpha [8], an alien species originating from the Black and Caspian Sea basins [21]. In our work, we focused on the distribution and numbers of Scaup in the Polish part of the ORE, an area known for huge concentrations of the species [9 , 10 , 11 , 12 , 13 , 14 , 22 , 23 , 24 , 25]. During waterfowl censuses we regularly observed large flocks of Scaup in some areas of the ORE, while in others there were few or no birds at all Fig 1a, 1b, 1e and 1f. In some areas, we observed the characteristic shapes of Scaup flocksâ€”long lines of ducks a few hundred meters from the shore Fig 1b and 1e or irregularly-shaped, dense flocks a few kilometers from the shore Fig 1f. The ORE was colonized by Zebra Mussel in the midth century; nowadays it is still considered to be one of the sites with the largest aggregations of this freshwater mussel in central-western Europe [26]. We predicted that the abundance of Scaup flocks is positively related to the areas of Zebra Mussel aggregations on the water bodies bed. To test this prediction, we expressed the Zebra Mussel abundance by two measures related to abundance area of occurrence and biomass with extensive sampling in the ORE and then used bird census results to assess the strength of the relationship between Scaup abundance and Zebra Mussel area of occurrence and biomass. We also analyzed the digestive tract contents of dead birds caught in fishnets to confirm that the species does indeed feed on Zebra Mussel in the ORE.

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Chapter 4 : Zebra Mussel | Chesapeake Bay Program

The Zebra mussel (Dreissena polymorpha) is one of world's most successful invasive species. Originating from the Ponto-Caspian region, it spread all over Europe and crossed.

Genetics The haploid genome size of D. High levels of genetic variability have been reported for European populations with heterozygosity values at allozyme loci between 0. Similar high levels have also been reported for North American populations: There might be a risk of hybridization between D. There is evidence for species-specific sperm attractants suggesting that interspecific fertilization may be rare in nature Spidle et al. Females generally reproduce in their second year. Eggs are expelled by the females and fertilized outside the body by the males; this process usually occurs in the spring or summer, depending on water temperature. Over 40, eggs can be laid in a reproductive cycle and up to one million in a spawning season. After the eggs are fertilized, the larvae veligers emerge within 3 to 5 days and are free-swimming for up to a month. Dispersal of larvae is normally passive by being carried downstream with the flow. The larvae begin their juvenile stage by settling to the bottom where they crawl about on the bottom by means of a foot, searching for suitable substratum. They then attach themselves to it by means of a byssus, an organ outside the body near the foot consisting of many threads. Although the juveniles prefer a hard or rocky substrate, they have been known to attach to vegetation. As adults, they have a difficult time staying attached when water velocities exceed two meters per second. They are capable of filtering about one liter of water per day while feeding primarily on algae Starobogatov, ; Olenin et al. Physiology and Phenology Although D. They can tolerate starvation for extended periods, desiccation, extremes of high and low temperatures, and highly variable dissolved oxygen levels. The mussels appear capable of adapting to a variety of temperature regimes, being found from Sweden to Italy. They have been found in lakes with highly variable acidity and calcium content. Large numbers have been reported growing in the static conditions of lakes and reservoirs and in the swift currents of pipes and rivers. They can be found in nutrient poor oligotrophic and nutrient rich eutrophic lakes. While normally considered as freshwater species, D. They are capable of tolerating a certain degree of pollution, although they are absent from heavily polluted waters. When presented with acute, adverse conditions, the animal will close its shell and remain closed up to 2 weeks before reopening Claudi and Mackie, Higher filtration activity of D.

Chapter 5 : zebra mussel, Dreissena polymorpha Veneroida: Dreissenidae

PRIMARY RESEARCH PAPER The zebra mussel (Dreissena polymorpha) impacts European bitterling (Rhodeus amarus) load in a host freshwater mussel (Unio pictorum).

Three color varieties of the shell of the zebra mussel Close-up of a typical shell of a zebra mussel Zebra mussel and the closely related and ecologically similar quagga mussels are filter-feeding organisms. They remove particles from the water column. The zebra mussels process up to one liter of water per day, per mussel. Nonfood particles are combined with mucus and other matter and deposited on lake floors as pseudofeces. Since the zebra mussel has become established in Lake Erie, water clarity has increased from 6 inches to up to three feet in some areas. These plants, when decaying, wash up on shorelines, fouling beaches and cause water quality problems. This biomass becomes available to bottom-feeding species and to the fish that feed on them. Other mussel species frequently represent the most stable objects in silty substrates, and zebra mussels attach to, and often kill these mussels. They build colonies on native unionid clams, reducing their ability to move, feed, and breed, eventually leading to their deaths. This has led to the near extinction of the unionid clams in Lake St. Clair and the western basin of Lake Erie. Zebra mussels also can tolerate a wide range of environmental conditions and adults can even survive out of water for about 7 days. Drawing of zebra mussel, showing the byssus Predators[edit] Research on natural enemies, both in Europe and North America, has focused on predators, particularly birds 36 species and fish 15 and 38 species eating veligers and attached mussels. The vast majority of the organisms that are natural enemies in Europe are not present in North America. Ecologically similar species do exist, but these species are unlikely to be able to eliminate those mussels already established and will have a limited role in their control. An adult crayfish consumes around zebra mussels every day, or about mussels in a season. Predation rates are significantly reduced at lower water temperatures. Fish do not seem to limit the densities of zebra mussels in European lakes. This test was conducted in a lakefront harbor in the western province of Manitoba. They disrupt the ecosystems by monotypic colonization , and damage harbors and waterways, ships and boats, and water treatment and power plants. Water treatment plants are most affected because the water intakes bring the microscopic free-swimming larvae directly into the facilities. Zebra mussels also cling to pipes under the water and clog them. Grossinger reported it in Hungary in Kerney and Morton described the rapid colonization of Britain by the zebra mussel, first in Cambridgeshire in the s, London in , and in the Union Canal near Edinburgh in Canals that artificially link many European waterways facilitated their early dispersal. It is nonindigenous in the Czech Republic in the Elbe River in Bohemia since ; [20] in southern Moravia, it is probably native. The first appearance of the organism in northern Italy was in Lake Garda in ; [22] in central Italy, they appeared in Tuscany in Many water companies are reporting having problems with their water treatment plants with the mussels attaching themselves to pipeworks. Another possible, often neglected, mode of introduction is on anchors and chains, although this has not been proven. Since adult zebra mussels can survive out of water for several days or weeks if the temperature is low and humidity is high, chain lockers provide temporary refuge for clusters of adult mussels that could easily be released when transoceanic ships drop anchor in freshwater ports. They have become an invasive species in North America, and as such they are the target of federal policy to control them, for instance in the National Invasive Species Act Using models based on the genetic algorithm for rule-set production GARP , a group of researchers predicted that the southeastern United States is moderately to highly likely to be inhabited by zebra mussels and the Midwest unlikely to experience a zebra mussel invasion of water bodies. Today, the invasion continues. For instance, in , the Massachusetts Department of Conservation and Recreation confirmed that zebra mussels had been found in Laurel Lake in the Berkshires. This was the first confirmed sighting in the Red River Basin , which extends across the international border into the province of Manitoba. New contamination was found outside treated areas of Lake Winnipeg in and they have also been found in the Red River near the lake in Selkirk Park in This

resulted in reduced water supplies during a drought year , worsening water restrictions across the Dallas area. Trailered boat traffic is the most likely vector for invasion into Western North America. This spread is preventable if boaters thoroughly clean and dry their boats and associated equipment before transporting them to new bodies of water. Since no North American predator or combination of predators has been shown to significantly reduce zebra mussel numbers, such spread would most likely result in permanent establishment of zebra mussels in many North American waterways. A major decrease in the concentration of dissolved oxygen was observed in the Seneca River in central New York in the summer of This decrease was due to extremely high concentrations of zebra mussels in the watershed. Additionally, the Seneca River had significantly less chlorophyll in the water, which is used as a measure of phytoplankton biomass, due to the presence of zebra mussels. When in the water, they open their shells to admit detritus. Since their colonization of the Great Lakes, they have covered the undersides of docks, boats, and anchors. They have also spread into streams and rivers throughout the US. In some areas they completely cover the substrate , sometimes covering other freshwater mussels. They can grow so densely that they block pipelines, clogging water intakes of municipal water supplies and hydroelectric companies. Zebra mussels do not attach to cupronickel alloys, which can be used to coat intake and discharge grates, navigational buoys, boats, and motors where the species tends to congregate. However, because they are so efficient at filtering water, they tend to accumulate pollutants and toxins. For this reason, most experts recommend against consuming zebra mussels. Ormond Lock on the Arkansas River However, zebra mussels and other non-native species are credited with the increased population and size of smallmouth bass in Lake Erie [43] and yellow perch in Lake St. This cleansing also increases water visibility and filters out pollutants. Each quagga and zebra mussel filters about 1 US quart 0. Because zebra mussels damage water intakes and other infrastructure, methods such as adding oxidants, flocculants, heat, dewatering, mechanical removal, and pipe coatings are becoming increasingly common.

Chapter 6 : Zebra Mussel - Montana Field Guide

Estimated smoothing functions modeling Greater Scaup Aythya marila abundance in relation to the area of occurrence of Zebra Mussel Dreissena polymorpha (km 2, left-hand panel- 5A) and Zebra Mussel density (tons per 1 km 2, right-hand panel- 5B) from the best-supported model.

Native to the Caspian Sea region of Asia, zebra mussels reached the Great Lakes in the mids in the ballast water of a ship. Since their arrival, zebra mussels have spread rapidly throughout the Great Lakes and into several major river systems of the eastern United States, including the Ohio. Populations are now known from at least 23 states, primarily within the Great Lakes and Mississippi River watersheds. This species continues to spread and threaten many lakes and rivers across the United States. See a progression of the invasion of the mollusk in the United States. The shell of the quagga mussels is rounder and usually light tan to almost white, with black, cream, or white bands. Both species have byssal threads or ropes on the hinge edge of their shells that allow them to attach to solid objects. These threads are unique to zebra and quagga mussels and are not found on native mussels. Female zebra mussels can produce up to one million eggs per summer. Fertilized eggs develop into free-swimming larvae called veligers. These veligers are not visible to the naked eye and are about the width of a human hair. Once attached it takes approximately one year for the mussel to grow one inch and become sexually mature. On average, zebra mussels live years. Densities of zebra mussels can reach over , individuals per square meter. Zebra mussels usually grow in clusters and are generally found in shallow feet , algae-rich water. Their ability to attach to hard surfaces results from the tuft of fibers located at the hinge of their shell called byssal threads. These threads produce powerful glue that anchors the mussel in place. Any hard surface is a suitable place for a mussel to live and may include rock, metal, wood, vinyl, glass, rubber, fiberglass, or paper. Zebra mussels may even colonize living organisms such as plants, other mussels, and the bodies of slow moving animals like turtles. Back to top Why are zebra mussels harmful? Zebra mussels have had deleterious effects on waterbodies where they become established. Adult zebra mussels feed by filtering large amounts of plankton and detritus from the water. Zebra mussels eat phytoplankton, small zooplankton, large bacteria, and organic detritus by filtering the water and straining out the edible material. Phytoplankton and zooplankton form the base of the aquatic food web and many animals depend on them for survival. By removing this food from the water column, zebra mussels effectively starve the native populations of infested lakes and rivers. Each zebra mussel can filter one liter of water per day. In addition, zebra mussels accumulate contaminants within their tissues, increasing the exposure of these toxins to wildlife that consume mussels. Zebra mussel infestations also threaten native mussel populations by attaching to the shells of these species and smothering them. Many native mussel populations that share waters with zebra mussels have decreased to the point of being threatened or endangered. Zebra mussels cost taxpayers hundreds of millions of dollars a year. Zebra mussels clog water intake pipes and filters, reducing water pumping capabilities for power and water treatment plants. They can also damage boats by encrusting boat hulls; clogging water systems used in boat motors, air conditioners and heads; and causing navigation buoys to sink. Beaches may become unusable as a result of the sharp shells and pungent odor that are characteristic of bivalve invasions. Back to top What can be done to stop the spread of zebra mussels? Both adult zebra mussels and the larval form, known as veligers, can be transported into other bodies of water. Adult zebra mussels can attach to boats or other equipment and be transported to new waters. Adult zebra mussels are able to close their shell and may survive out of water for several days. Veligers are able to hitchhike in water held in the bilge, live wells, motors, or bait buckets, or they may cling to plant fragments, boats or trailers, or other equipment or recreational items that came into contact with water. They can survive for days in water trapped in a boat. To minimize the potential spread of zebra mussels, follow these simple steps: If unable to let it dry for at least 5 days, rinse equipment and watercraft with high pressure, hot water when possible and wipe with a towel before reuse. NEVER introduce fish, plants, crayfish, snails or clams from one body of water to another.

Chapter 7 : Dreissena polymorpha (zebra mussel)

Correlation between Zebra Mussel Dreissena polymorpha biomass and biomass of all other food taxa in the digestive tracts of 32 Greater Scaup Aythya marila from the Odra River Estuary during the non-breeding seasons in the years

Zebra mussel larvae have no special defense against predators, but they are so small that only small predators and filter-feeders eat them. The larvae are part of the zooplankton in the water, and pretty much any predator that eats zooplankton eats them. This includes many small fish including the young of large fish , other zooplankton such as copepods, freshwater Cnidaria like hydras , even freshwater sponges. A few fish species have specialized teeth and jaws that are strong enough to break the shells of mollusks, and some of them do eat zebra mussels. In Europe the roach , is a major predator of zebra mussels, along with bream , and silver bream. Round gobies and common carp , native to Eurasia, have been introduced to North America, and eat zebra mussels where they occur. The black carp is an east Asian species that has been introduced to Europe, and eats zebra mussels there. The pumpkinseed sunfish has been introduced to Europe from North America, and eats zebra mussels on both continents. Besides pumpkinseeds, the several other North American fish eat zebra mussels, including freshwater drums , redhorse suckers , river carpsuckers and smallmouth buffalos. Blue crabs Callinectes sapidus consumed many zebra mussels during a study in the Hudson River. Crayfish, including the northern clearwater crayfish, Orconectes propinquus , may prey on small zebra mussels. Geological Survey, What roles do they have in the ecosystem? Zebra mussels can be very important in freshwater ecosystems. If they are enough of them, they can filter an enormous amount of plankton out of the water. This changes the flow of energy in the foodweb -- the energy in the phytoplankton goes to the bottom, to the mussels and the animals that eat them, instead of swimming plankton predators like zooplankton and fish. Also, if zebra mussels clear the water, sunlight can penetrate deeper into the water, allowing more aquatic plants to grow. These plants provide food and hiding places for fish and invertebrates. Zebra mussels attach to the outside of North American freshwater mussels. They slow the larger mussel down, interfere with its growth, sometime jam the shell open, and prevent the large mussel from feeding and pumping water in and out of its shell. Where zebra mussels have moved into the Great Lakes basin, native mussels have been wiped out. Great Lakes Information Network, ; U. Geological Survey, Do they cause problems? The introduction of zebra mussels into many areas of the world has created major economic problems. The mussels grow on all kinds of man-made structures in the water, include water intake pipes for drinking water plants and power plants. So many grow there that they clog the pipes. Businesses and governments spend hundreds of millions of dollars every year to clear out the mussels and keep the pipes open. Mussels also grow on navigational buoys, sometimes sinking them, and on locks and dams, interfering with their operation. They grow on hulls of boats and ships, slowing them down and clogging engine intakes. The ecological impacts of zebra mussels are still happening, and not all the effects are known. They eat phytoplankton faster than zooplankton in the water does. This means zooplankton and the fish that live in the open water like walleye, salmon, and lake trout have less to eat. When zebra mussels have spread to inland lakes in North America, the amount of this toxic type of algae increases. See the references for more information on the many ecological effects of zebra mussels, especially in North America. How do they interact with us? Zebra Mussels were added to freshwater lakes in the Netherlands to help make the water more transparent they eat the phytoplankton that makes the waters cloudy. Other cities in other countries have done the same. Nalepa and Schloesser, ; Neumann and Jenner, Are they endangered? Zebra mussels are still common and abundant in their original range, and have spread far beyond it. They are not considered to be in any need of special conservation efforts.

Chapter 8 : Zebra mussel - Wikipedia

The Zebra Mussel, Dreissena Polymorpha: a Synthesis of European Experiences and a Preview for North America. Water Resources Branch, Ontario Ministry of the Environment. On.

Range Comments Global Range: Widespread in Europe; originally native to the Black and Caspian seas; accidently introduced into the Great Lakes in North America in the mids. It has since spread to the Mississippi, Ohio, and Susquehanna River systems. By , the following rivers had established populations of zebra mussels: By , the following states had reported records of zebra mussels within their borders or in water bodies adjacent to their borders: More recently, Connecticut has been added to the list of states where zebra mussels have been found. In , zebra mussels were found in a small isolated quarry in Virginia, a first for this state. During the summer of , zebra mussel larvae known as veligers were collected in the Missouri River, the stretch of the river shared by both Nebraska and South Dakota. A lake in western Massachusetts became infested in July, T. Adults were later confirmed in the state in Wilson Confirmation of adults is ongoing Schmidt and McLane Until , there were no known records for Montana and agencies are still trying to locate the adult population in the presumed inhabited lakes. If adult populations are located in these reservoirs, dispersal downstream into the Missouri River system could be devastating. Migration Adult zebra mussels are mostly sedentary and spend their lives near the area where they first settled as juveniles and attached their byssal threads. Most dispersal takes place through the veliger stage after fertilization where they will passively travel with wind direction or water currents. Habitat Zebra mussels attach to any stable substrate in the water column or benthos: Long-term stability of substrate affects population density and age distributions on those substrates. Given a choice of hard substrates, zebra mussels do not show a preference, indicating that veligers cannot discriminate between substrates with the exception of substrate rejection due to contaminants. Populations on plants also were dominated by mussels less than a year old, as compared with benthic populations. These populations of small individuals allow higher densities on plants. In areas where hard substrates are lacking, such as a mud or sand, zebra mussels cluster on any hard surface available. Research on Danish lakes shows that factors exist, however, that cause substrate to be unsuitable for both initial and long term colonization: These conditions affect both spatial patterns of pelagic veliger density and benthic adult dispersion. Population density of benthic adults has been observed to vary as widely as two orders of magnitude e. Tolerance limits of physical and chemical parameters are well known Sprung , Vinogradov et al. Food Habits Freshwater mussels, including zebra mussels, are filter-feeders, siphoning in floating particulate organic materials small plant or animal from the water column and straining out the particles and expel the strained water. Zebra mussels have gill filters small enough to strain out large bacteria from the water column Cotner et al. Ecology The life history of zebra mussels differs greatly from most endemic Great-Lakes region bivalves Pennak , Mackie and Schlosser Exotic dreissenids are dioecious, with fertilization occurring in the water column. Endemic bivalves are monoecious, dioecious or hermaphroditic, and some internally fertilized by filtering sperm from the water column. Under natural thermal regimes, zebra mussel oogenesis occurs in autumn, with eggs developing until release and fertilization in spring. In thermally polluted areas, reproduction can occur continually through the year. Females generally reproduce in their second year. Eggs are expelled by the females and fertilized outside the body by the males; this process usually occurs in the spring or summer, depending on water temperature. Over 40, eggs can be laid in a reproductive cycle and up to one million in a spawning season. Spawning may last longer in waters that are warm throughout the year. After the eggs are fertilized, the larvae veligers emerge within 3 to 5 days and are free-swimming for up to a month. Dispersal of larvae is normally passive by being carried downstream with the flow. The larvae begin their juvenile stage by settling to the bottom where they crawl about on the bottom by means of a foot, searching for suitable substratum. They then attach themselves to it by means of a byssus, an "organ" outside the body near the foot consisting of many threads. Although the juveniles prefer a hard or rocky substrate, they

have been known to attach to vegetation. As adults, they have a difficult time staying attached when water velocities exceed two meters per second. Zebra mussels are filter feeders having both inhalant and exhalant siphons. They are capable of filtering about one liter of water per day while feeding primarily on algae. Once the veliger undergoes morphological changes including development of the siphon, foot, organ systems and blood, it is known as a postveliger. Further subdivision of the larval stage has been delineated: The settling stage attaches to a substrate via protienaceous threads secreted from the byssal gland. Sensitivity to changes in temperature and oxygen are also greatest at this stage. Once attached, the life span of D. Maximum growth rates can reach 0. Adults are sexually mature at 8â€”9 mm in shell length i. Reproductive Characteristics Eggs are expelled by the females and fertilized outside the body by the males; this process usually occurs in the spring or summer, depending on water temperature. Management Zebra mussels can easily survive overland transport from the Midwest to Montana while attached to boat hulls or in live wells, engine cooling systems, or bait buckets. Live zebra mussels have been found at California agricultural stations on boats from the Midwest, and in Washington on boats destined for British Columbia. The zebra mussel is a prolific fouling organism with great potential to disrupt fish passage facilities and cause ecological and economic damage in the Pacific Northwest. Contact information for Aquatic Invasive Species personnel:

Chapter 9 : Zebra Mussels - Wisconsin DNR

Identification: The zebra mussel is a small shellfish named for the striped pattern of its shell. Color patterns can vary to the point of having only dark or light colored shells and no stripes.