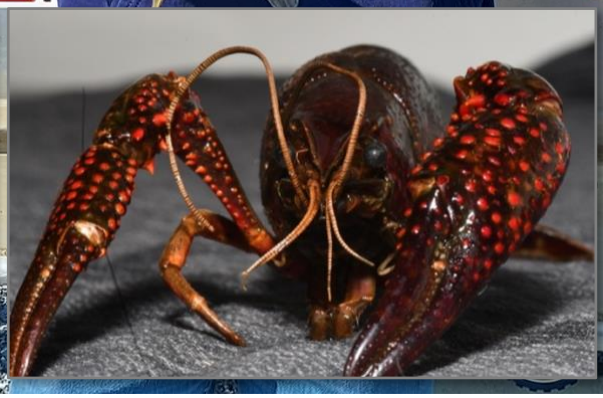
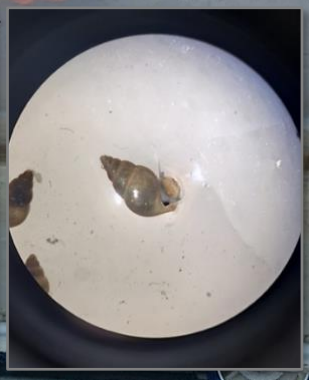
New Jersey
Aquatic Invasive Species
Management Plan





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This Aquatic Invasive Species Management Plan was prepared by the New Jersey Aquatic Invasive Species Working Group in partnership with a variety of New Jersey state Agencies and environmental stakeholders committed to invasive species management, with input from the public.

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The recommendations of the New Jersey Aquatic Invasive Species Working Group to Governor Phil Murphy.

State of New Jersey
Philip D. Murphy, Governor

NJ Department of Environmental Protection
Commissioner

NJ Department of Agriculture
Secretary

Acknowledgements

This Aquatic Invasive Species Management Plan (AISMP) was created by the New Jersey Aquatic Invasive Species Management Plan Core Team and prepared under the guidance developed by the Aquatic Nuisance Species Task Force (ANSTF) and US Fish and Wildlife Service (USFWS). The Aquatic Invasive Species Working Group (AISWG) included representatives from state agencies, academic institutions, and nongovernmental organizations. Additional agency representatives, as well as members of the public, provided valuable technical input and review. This plan could not have been written without the work of those who developed the New Jersey Strategic Management Plan for Invasive Species (under the guidance of Dr. Mike Van Clef). Funding for the development of this plan was provided by the Mid-Atlantic Panel on Aquatic Invasive Species (MAPAIS).

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Executive Summary

Recognizing the immediate and lasting threats posed by non-native, invasive species, the New Jersey Department of Environmental Protection (NJDEP) recently initiated discussions to revisit invasive species actions to date and explore short-term actionable items that could be implemented from the 2009 New Jersey Strategic Management Plan for Invasive Species. From these discussions, it was recommended to pursue the development of an Aquatic Invasive Species Management Plan. With at least 81 aquatic invasive species already reported within New Jersey, compounded by a lack of funding and dedicated resources, this Aquatic Invasive Species Management Plan is a necessary step in limiting potential negative impacts to New Jersey's water resources, natural communities, and species diversity.

New Jersey is a geographically and historically unique matrix of aquatic and coastal (brackish) ecosystems that are threatened by aquatic invasive species (AIS). New Jersey is home to over 18,000 miles of streams and rivers, over 1,900 lakes and reservoirs, more than 9,000 ponds, over 700,000 acres of freshwater wetlands, and an extensive network of underground aquifers. Along the state's 127-mile coastline, there are over 200,000 acres of tidal wetlands. The State is surrounded by water on three sides and relies on these water resources to support some of the busiest shipping ports in the United States, commercial aquaculture, commercial and recreational fishing, municipal and industrial water supplies, multiple hydroelectric facilities, irrigation, and a wealth of water-related recreational opportunities. Each of these water resource uses represents its own series of potential pathways for spread of AIS.

AIS impact recreational enjoyment, interfere with water supply systems and industrial facilities, and threaten the sustainment of healthy ecosystems. New Jersey has experienced nearly 400 years of intensive land use change, industrial development, and ecological disturbance, yet still harbors distinctive endemic species and globally rare species populations. Despite New Jersey's storied history in aquatics, it is one of only a few states that does not have an AIS Management Plan, nor does it have a dedicated funding source to address AIS. The state does have some regulations to help reduce the risk of new introductions and spread of AIS. Various species-specific, or region-specific AIS surveillance and management projects are underway. However, efforts are limited and often lack state-wide coordination or assessment. Neighboring states (New York and Pennsylvania) with Invasive Species Management Programs–supported by a dedicated funding base–as described by their respective AIS Management Plans, have reported improved outcomes for AIS response, mitigation, and restoration efforts.

For this plan, experts identified 184 species of AIS that have either already invaded New Jersey or are under observation, with further research required. Data suggest that AIS in New Jersey are likely underreported, and the extent to which many AIS have become established is incomplete. No defined coordinated response currently exists among the various state agencies and organizations presently working in aquatic resource management within New Jersey. Therefore, a comprehensive state-wide plan will assist in centralizing the strategy for reducing the potential for new introductions and managing existing AIS, where practical, to help

safeguard New Jersey's vital aquatic ecosystems. The development and implementation of the New Jersey Aquatic Invasive Species Management Plan (referred to herein as the NJAISMP) can be an effective tool to prevent, slow, manage, and/or mitigate the deleterious effects imposed by AIS. While the AISMP is a "management plan", it does not imply that all AIS should be actively "managed" or "controlled" in New Jersey. Based on the age and extent of certain AIS infestations in New Jersey, control or eradication may not be an appropriate response no matter the amount of coordination or funding available. Therefore, the AISMP will focus on how the State can identify new and emerging threats and focus limited resources on appropriate projects/areas.

The NJAISMP aims to identify technical, enforcement, and financial assistance required to reduce the environmental, public health, and safety risks associated with AIS in New Jersey. This NJAISMP provides background information on relevant species, outline how authorities, expert working groups, and environmental stakeholders can better coordinate, standardize education and outreach initiatives, improve regulatory oversight, and coordinate mechanisms to act on AIS [including 'Early Detection and Rapid Response' (EDRR)]. The AISMP is organized around five objectives:

- Oversight and Coordination
- Prevention
- Surveillance and Early Detection
- Response and Restoration
- Long-term Control and Evaluation.

The NJAISMP provides a framework to be used by the NJDEP as the lead agency in cooperation with a series of working groups and collaborative organizations. A working group of experts identified and prioritized eighty-two action items as key components of a comprehensive invasive species management program for the state of New Jersey. The proposed action items have been assigned a priority ranking (critical, high, moderate, low). Three "Critical" action items are those that require committed funds to implement, without which none of the additional action items would be possible. "High-priority" actions tackle the most immediate unaddressed AIS needs within the state and this NJAISMP proposes to implement them within the first year of plan adoption. "Medium-priority" actions are those that require investment or setup from "high-priority" actions to be accomplished and should be implemented within 2-4 years following plan adoption. "Low-priority" actions are still key components of a comprehensive plan and all action items identified should be completed prior to the first 5-Year evaluation of the Plan. Additional resources and capacity will be required to grow this new program over time.

The Implementation Table summarizes the NJAISMP's funding from all sources. This AISMP recommends NJDEP dedicate two FTE's over the course of the next five years. New Jersey anticipates applying for funding annually from the U.S. Fish & Wildlife Service (USFWS) State

Grant Program to support implementation of the NJAISMP. At the time of writing this plan, states with approved plants received approximately $90,000 per year.

The NJAISMP will utilize adaptive management to collect and review data about how objectives need to be modified or updated with new technologies. Annual reports will be compiled by the NJAISMP Working Group to evaluate progress and update/modify action items as needed.

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Acronyms

AFS	American Fisheries Society
AIS	Aquatic Invasive Species
AISMP	Aquatic Invasive Species Management Plan
ANS	Aquatic Nuisance Species
ANSTF	Aquatic Nuisance Species Task Force
APHIS	Animal Plant Health Inspection Service
DRIPP	Delaware River Invasive Plant Partnership
FoHVOS-NJISST	Friends of Hopewell Valley Open Space New Jersey Invasive Species Strike Team
IPM	Integrated Pest Management
ISAC	Invasive Species Advisory Committee
ISPZ	Invasive Species Protection Zone
ITIS	Integrated Taxonomic Information System
MAPAIS	Mid-Atlantic Panel on Aquatic Invasive Species
NAISMA	North American Invasive Species Management Association
NALMS	North American Lake Management Society
NANPCA	Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990
NEANS	Northeast Aquatic Nuisance Species Panel
NEAPMS	Northeast Aquatic Plant Management Society
NERRS	National Estuarine Research Reserve System
NJAISMP	New Jersey Aquatic Invasive Species Management Plan
NJCOLA	New Jersey Coalition of Lake Associations
NJDA	New Jersey Department of Agriculture
NJDEP	New Jersey Department of Environmental Protection
NJDOH	New Jersey Department of Health
NJDEPFW	New Jersey Department of Environmental Protection Fish & Wildlife
NJISC	New Jersey Invasive Species Council
NJSMPIS	New Jersey Strategic Management Plan for Invasive Species - 2009
NJWAP	New Jersey Wildlife Action Plan - 2018
NJWSA	New Jersey Water Supply Authority
NOAA	National Oceanic and Atmospheric Administration
NYNJTC	New York-New Jersey Trail Conference
TNC	The Nature Conservancy
TU	Trout Unlimited
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USDA-NISIC	USDA National Invasive Species Information Center
USEPA	United States Environmental Protection Agency
USFWS	United States Fish & Wildlife Service
USGS	United States Geological Survey

Glossary

Accidental introduction: An introduction of non-native species that occurs as the result of activities other than the purposeful or intentional introduction of the species involved, such as the transport of nonindigenous species in ballast water or in water used to transport fish, mollusks, or crustaceans for aquaculture or other purposes.

Adaptive management: Refinement of an approach (and sometimes objectives) to an environmental implementation plan that is modified based on the observed outcome of initial results.

Aquaculture: The farming of freshwater or saltwater organisms including mollusks, crustaceans, and aquatic plants.

Aquatic ecosystem: Waters of the United States, including wetlands, that serve as habitat for interrelated and interacting communities and populations of plants and animals.

Aquatic gardening: Aesthetic gardening in an artificial or natural waterbody with aquatic species.

Aquatic invasive species: Also called aquatic nuisance species, a non-native species that threatens the diversity or abundance of native species or the ecological stability of infested waters, and/or commercial, agricultural, aquacultural or recreational activities dependent on such waters.

Aquatic species: All animals and plants, including pathogens and parasites of these organisms, that are totally dependent on aquatic ecosystems for at least a portion of their life cycle.

Ballast: An often water-filled device used on ships and submersibles to control buoyancy and stability.

Ballast water: Any water and associated sediments used to manipulate the trim and stability of a vessel.

Benthic (benthos): The ecological region located at the deepest level of a body of water; this includes the area around the interface between the sediment surface and water column.

Biocontrol: The use of living organisms, such as predators, parasites and pathogens, to control pest animals (e.g., insects), weeds or diseases.

Biofouling: The undesirable accumulation of colonizing microorganisms, plants, algae, and animals on submerged structures and water vessels, such as dock pilings and ships' hulls.

Biological integrity: A relative index to gauge the quality of an ecosystem (e.g., how "pristine" it is) and its function relative to the potential or original state (reference condition) of an ecosystem before human alterations were imposed.

Coldwater fish: Fish species that prefer and inhabit colder waters; examples are salmonid species such as trout and salmon.

Control: Employment of various methods (e.g., physical, cultural, chemical, or biological) with the goal of reducing the impact of a pest, such as an AIS. These methods may result in increasing the rate of mortality of a pest or reducing the rate of damage of a pest.

Crustacean: A large group of mostly aquatic arthropods that includes various species such as crab, lobster, crayfish, shrimp, krill, and barnacle.

Dangerous Species: A species that is non-native to an ecosystem and whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health.

Possession and/or release of live potentially dangerous fish species is prohibited in New Jersey and if these species are encountered while angling, they must be destroyed.
Dreissenid: A family of small, often invasive, freshwater mussels in the phylum Mollusca.
eDNA: Environmental DNA is the genetic material shed by organisms into the environment which can be used to detect the presence of various organisms, including invasive species.
Eradicate: For the purpose of this Plan, eradication is the complete elimination of an invasive species from a specific waterbody or project area within New Jersey.
Established: An introduced organism with a permanent population(s) (i.e., one that has the ability to reproduce and is not likely to be eliminated by humans or natural causes).
Extirpation: Complete elimination of a localized population of an aquatic invasive species.
Facultative: A species that can use an aquatic habitat for part of its life cycle but does not depend on these habitats for all phases to survive (e.g., can utilize both aquatic and upland areas).
Freshwater wetland: Area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation.
Indigenous: An organism that is native or naturally evolved to a specific region in which it naturally occurs.
Integrated Pest Management: A sustainable approach to managing pests by using all appropriate technology and management practices in a way that minimizes health, environmental and economic risks.
Intentional introduction: All or part of the process by which a nonindigenous species is purposefully introduced into a new area.
Introduction: The intentional or unintentional escape, release, dissemination, or placement of a species into a novel ecosystem because of human activity or intervention.
Invasive species: Non-native plant and animal species that have been intentionally or accidentally introduced into habitats and geographical areas outside of their natural geographical range and that have the ability to reproduce and spread, thereby threatening native biological diversity and/or the integrity of natural ecosystems.
Mitigate: Actions taken to prevent or reduce the risk of an AIS infestation from occurring.
Monitoring: Activities related to the assessment of the distribution and/or abundance of AIS.
Native species: A species within its natural range or natural zone of dispersal (i.e., within the range it would or could occupy without direct or indirect introduction and/or care by humans).
Nearshore: The littoral zone including the intertidal zone extending from the high-water mark.
Non-native or Nonindigenous species: Any species of plant or animal that does not occur naturally in the waters of the State.
Noxious weed: Any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, natural resources of the United States, public health, or the environment.
Nuisance species: For this plan, the term is synonymous with invasive species.
Pathogen: A microbe or other organism that causes disease.

Pathway: Mode by which a species establishes and continues to exist in a new environment; often synonymous with vector, dispersal mechanism, and mode. Natural and human connections that allow movement of species or their reproductive propagules from place to place.
Phenological: Traits relating to phenology or the study of periodic events in biological life cycles and how these are influenced by seasonal and interannual variations in climate, as well as habitat factors.
Rapid response: A series of actions conducted as soon as possible after the introduction of an invasive species occurs, usually aimed at eradication, containment, or control.
Riparian: Situated or dwelling on the bank of a river or other water body.
Taxa: Groups used to classify organisms (e.g., kingdom, phylum, class, order, family, genus, and species). Taxa is the plural form of taxon.
Unintentional Introduction: See "accidental introduction".
Vector: The physical means or agent by which a species is transported (e.g., boat hulls, live wells, fishing gear); often synonymous with pathway, dispersal mechanism, and mode.
Warm water fish: Fish species that prefer and inhabit warmer waters; examples include smallmouth bass, crappie, and other sunfish (Centrarchidae).
Watershed: A land area that channels rainfall and snowmelt to creeks, streams, and rivers, and eventually to outflow points such as reservoirs, bays, and the ocean.

Indigenous Peoples Land Acknowledgement

This AISMP recognizes and respects Indigenous Peoples as the traditional stewards of New Jersey's lands and waters, and the enduring relationship that exists between Indigenous Peoples and their traditional and contemporary territories in New Jersey. The Nanticoke Lenni-Lenape, Powhatan Renape Nation, Ramapough Lenape Indian Nation, and Inter-Tribal People of New Jersey have the longest history of seeing species change over time on the lands and within the waters of New Jersey. Invasive species management strategies within New Jersey strive to protect the integrity of native ecosystems thus enabling the ecosystem services they provide. This AISMP recognizes the importance of Indigenous knowledge, perspective, and interpretation of native ecosystems and ecosystem services and endeavors to apply all where necessary to preserve historical and ecological integrity.

Introduction

Invasive species are defined as organisms that are "1) non-native to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic, environmental, or harm to human health" (NJSMPIS 2009). Aquatic invasive species (AIS), as defined by the US Department of Agriculture National Invasive Species Information Center (USDA NISIC), are "non-native plants, animals, and other organisms that live primarily in water (aquatic habitats) rather than on land (terrestrial habitats)". Whether a non-native species is considered "invasive" is based on several factors. Many species, when introduced to a new habitat, are unlikely to survive because they are not adapted to the environmental conditions. Biological invasion of a waterbody requires both dispersal and establishment (Havel et al., 2015).

Furthermore, invasive species do not simply integrate into new environments, but instead disrupt the balance by outcompeting native species.

Unchecked, AIS can exert an enormous strain on a waterbody, potentially altering the native flora and fauna communities as well as the normal biological processes of that resource. Species that establish and reproduce rapidly outside of their native range, such as AIS, may threaten the diversity or abundance of native species through competition for resources, predation, parasitism, hybridization with native populations, introduction of pathogens, or physical or chemical alteration of the invaded habitat. AIS may negatively affect human health and/or the economy through their impacts on natural ecosystems, water delivery infrastructure (e.g., canals), flood protection systems, and recreational opportunities.

The "Invasion Curve" is commonly used to describe a phased-based approach to invasive species introduction and is shown in Figure 1: Invasion Curve. The introduction arrow illustrates a non-native species being introduced to an ecosystem. The possibility of eradication involves detection, rapid response, and public awareness to prevent further spread. Eradication or containment may no longer be possible when an invasive species is detected too late or effective management cannot be implemented in time. The Invasion Curve illustrates that prevention is the most effective and least costly method of combating invasive species. As a non-native species becomes more established over time, the effort, and associated costs of addressing it escalate exponentially.

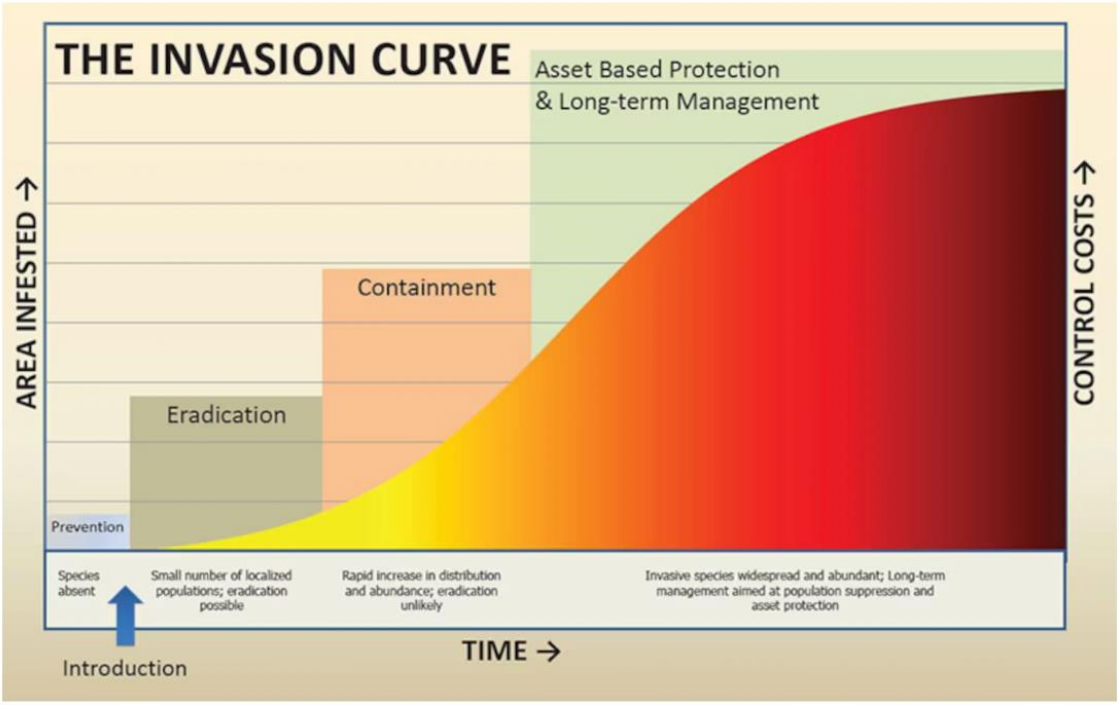

FIGURE 1 : IMAGE CREDIT: USDA FOREST SERVICE 2005 INVASIVE PLANT ENVIRONMENTAL IMPACT STATEMENT.

Purpose

The purpose of this NJAISMP is to provide the framework to coalesce existing initiatives, identify partner agencies that can leverage resources and expertise, and centralize the collection of data on the distribution and occurrence of AIS. The NJAISMP will identify potential funding sources for prevention and management of AIS within New Jersey. It will also compile existing tools for water resource managers, provide an implementation framework, and create special committees and working groups. The NJAISMP will complement elements of the existing New Jersey Strategic Management Plan for Invasive Species (Van Clef, 2009), serving to achieve aquatic-specific goals, objectives, and actions that foster a more robust Invasive Species Program for the State of New Jersey.

The highest priority actions are:

- Hire an AIS Coordinator for the State of New Jersey (1.0 FTE) that will lead the New Jersey Aquatic Invasive Species Program to complete the deliverables outlined in this AISMP,
- Establish iMapInvasives for state-wide use as the central repository AIS database and reporting tool for New Jersey,
- Hire a Database Manager for the State of New Jersey (1.0 FTE) that will identify the appropriate species list for the state, incorporate bulk uploads of existing data, and train users,
- Identify and secure stable funding resources necessary to implement priority management actions, including establishing a grant program for eligible partners seeking to do localized or regional targeted AIS projects; and
- Develop educational tools and other outreach materials that can be shared with the public on AIS.

Scope

New Jersey is surrounded by water on three sides: the Delaware River to the west, Delaware Bay to the South, and the Hudson River, Upper New York Bay, Kill van Kull, Lower New York Bay, and Atlantic Ocean all to the east. The New Jersey Department of Environmental Protection (NJDEP) designates over 3,864 stream-miles and 10,219 acres of lakes and reservoirs classified as “Category One” waters, which are waterbodies defined in N.J.A.C. 7:9B-1.4 as those “protected from any measurable changes in water quality because of their exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, or exceptional fisheries resources”.

Prior to European settlement, the lands and waters of what is now New Jersey were inhabited by the Nanticoke Lenni-Lenape, Powhatan Renape Nation, Ramapough Lenape Indian Nation, and Inter-Tribal People of New Jersey. Members of these indigenous groups remain in New Jersey and are acknowledged as ongoing stewards. New Jersey has historically been divided into many different regions. The New Jersey Geological and Water Survey has given the state distinctive landforms that are divided into five regions known as “Physiographic Provinces”: Ridge and Valley, Highlands, Piedmont, Inner Coastal Plain and Outer Coastal Plain (FIGURE 2:

Physiographic Provinces of New Jersey). NJDEP has identified six “Watershed Regions” of New Jersey including Northwest, Northeast, Raritan, Atlantic Coast, Lower Delaware, and Ocean. NJDEP has also established three “Water Compliance and Enforcement Regions” of New Jersey being Northern, Central, and Southern. Research of and discussion about the various regions within New Jersey has been informative to identifying potential AIS pathways, creation of Invasive Species Protection Zones (ISPZs), and ecological risk assessment/prioritization within this AISMP.

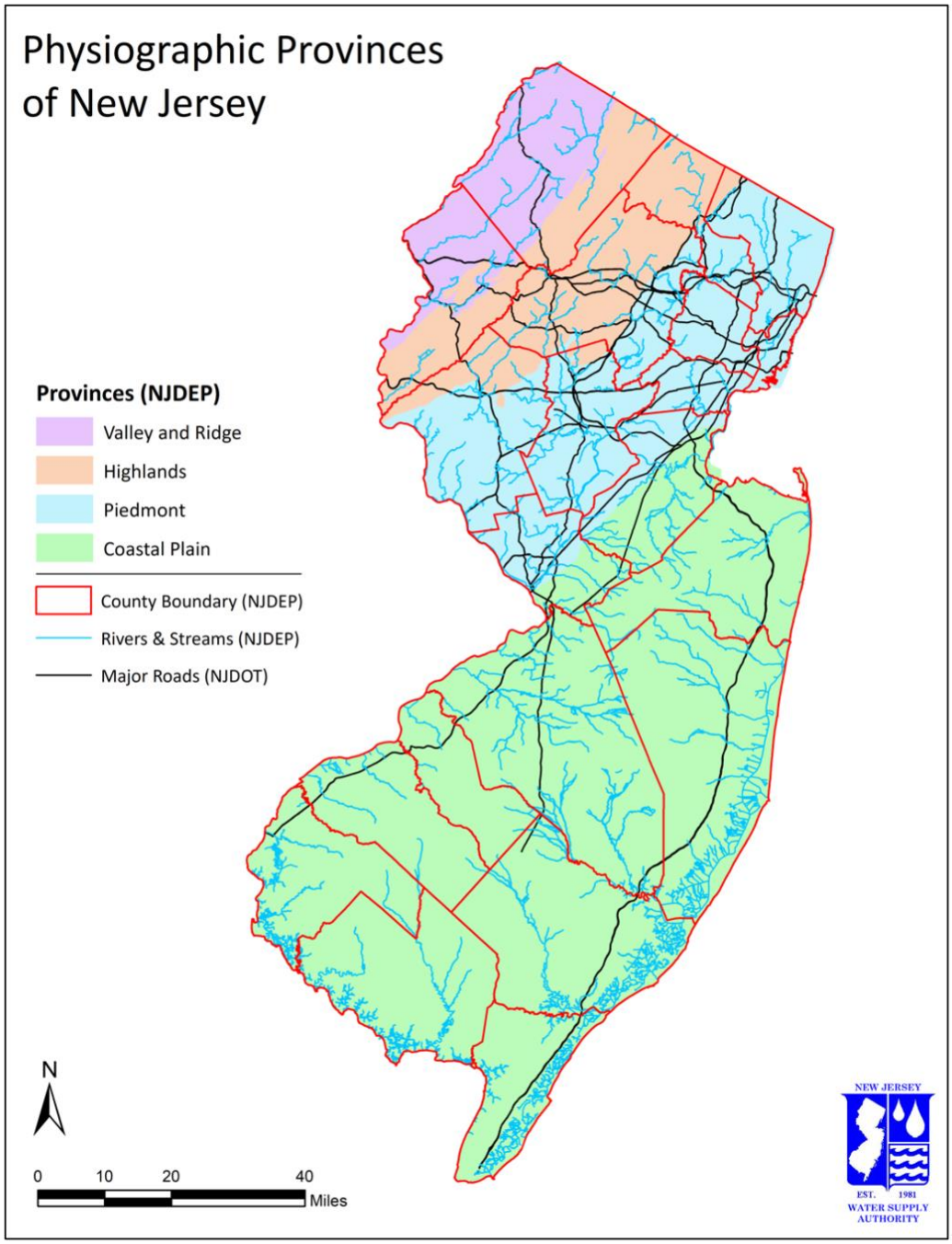

FIGURE 2 : PROVINCES OF NEW JERSEY MAP. CREDIT: NEW JERSEY WATER SUPPLY AUTHORITY.

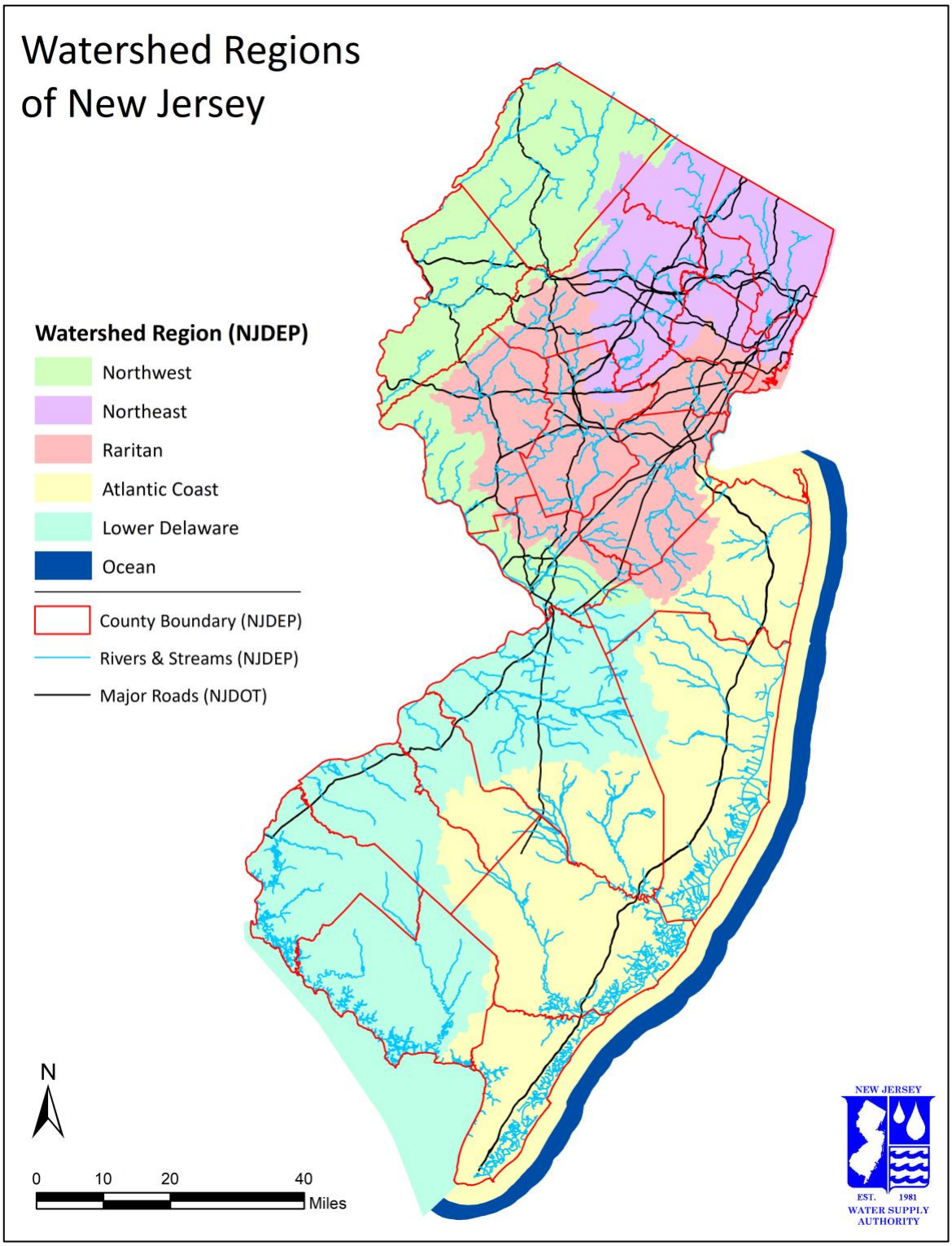

FIGURE 3 : WATERSHED REGIONS OF NEW JERSEY MAP. CREDIT: NEW JERSEY WATER SUPPLY AUTHORITY.

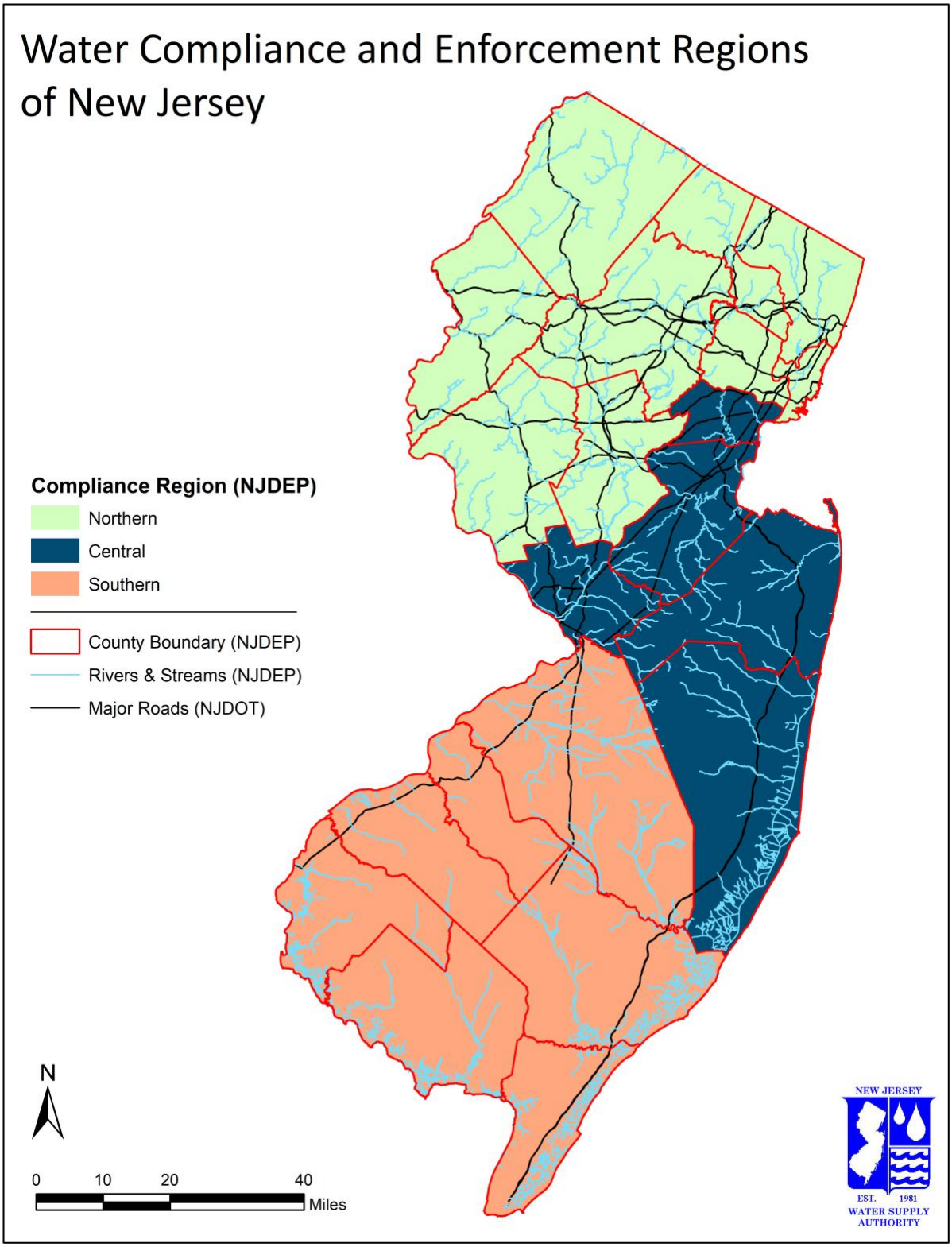

FIGURE 4 : WATERSHED COMPLIANCE AND ENFORCEMENT REGIONS OF NEW JERSEY MAP. CREDIT: NEW JERSEY WATER SUPPLY AUTHORITY.

The scope of this AISMP includes a variety of taxa that are truly aquatic (i.e., that inhabit and are dependent on water for at least one life stage) as well as those species that have wetland indicator status ratings of “obligate” and “facultative wetland” by the National Wetland Plant List (Lichvar, 2016). This AISMP considers freshwater, brackish, and marine species that inhabit riparian, nearshore, and open water environments, including benthic, submersed, emergent, and floating species. The criteria discussed by the working group to include/exclude various species can be found here:

- various herbaceous plants were included, while woody plants and vines were selectively excluded,
- if spread pathways could be identified as aquatic then species were included; whereas, if the spread pathway was not covered in this AISMP the species were excluded,
- if management options require aquatic-approved pesticide products or involve permitting within the aquatics realm the species were included; whereas, if the management methods could be conducted from land/utilizing terrestrial pesticide products/mowing/cutting practices the species were excluded,
- if the survey method for the species requires boats, nets, weed rakes, etc., then the species were included; whereas, if the survey method is conducted primarily visually from land the species were excluded; and
- if there are examples of the species as an aquatic invader within proximity to NJ the species were included; whereas, if the infestations are primarily associated with construction disturbance, contaminated fill, etc., then the species were excluded.

Plan Development Process and Participation

This AISMP was developed in 2023 with the participation of a working group composed of members from federal and state agencies, environmental groups, researchers, and industry representatives. It was structured according to requirements within the ANSTF guidance documentation. A draft of this AISMP was released by NJDEP via posting on NJDEP webpage, NJDEP press release, and working group networking to the public for a 60-day public comment period which began on Friday, December 8, 2023, and ended on Tuesday, February 6, 2024. A record of public comment is included in Appendix I. As per ANSTF guidance, ANS management plans (or AIS management plans, used synonymously with and referred to as the latter for the purpose of this plan) were intended to undergo a process of periodic review and evaluation culminating in living, mature plans that ideally span five years of management projections with the caveat that emerging issues would require plan amendments on an as-needed basis.

Problem Definition

The presence of AIS often goes unreported until nuisance densities or a critical threshold have been reached. The exceedance of these thresholds can manifest in several different ways, often to the detriment of the living resources inhabiting or to the users of the affected waters. Examples include nuisance aquatic plants disrupting transport within water supplies, sharp seed pods or mussel shells clogging public boat launches, or an unrecognized fish species caught by anglers. The total number of aquatic invasive species records for the State of New Jersey is currently unknown. It is likely, however, that species are significantly underreported, as reports are split among multiple databases maintained by various federal and local agencies and organizations and a significant number of AIS populations became established before formal AIS record keeping in digital databases. Aside from intrastate reports, we can also extrapolate data based on mapping of AIS reports from bordering states that have comprehensive state-managed invasive species programs. Several AIS are presumed to already be present within New Jersey, however, detections require specialized survey methods or allocated staff capacity. Examples include chytrid pathogen of frogs (*Batrachochytrium dendrobatidis*), zebra mussels (*Dreissena polymorpha*), and salvinia (*Salvinia minima*).

Without surveillance and management, many species have the potential to harm native ecosystems, impact drinking water sources, and threaten human health. The confirmed reports within New Jersey include AIS listed as “injurious wildlife” under CFR Title 50 Part 16 of the Lacey Act, “noxious weeds” under 7USC 2801-2814 of the Noxious Weed Act, and/or included on the Plant Protection and Quarantine Pest List (CFR Title 7 Parts 300-399), and those mapped in online database platforms such as EDDMaps and iNaturalist. Increased coordination is needed among New Jersey’s water resource managers and research experts along with those from neighboring states to ensure seamless information sharing among the many agencies, programs, and jurisdictions involved in AIS prevention within the state. For both terrestrial and aquatic systems, undisturbed ecosystems with high species diversity and exceptional biological integrity are often more resistant to invasion. Likewise, habitats with limiting ecological conditions are often inhabited by highly specialized native species that have evolved to withstand these conditions over time. Conversely, highly disturbed and developed systems, as well as fertile areas dominated by generalist species tend to be the most susceptible to invasive species. Because New Jersey currently lacks a state-wide AIS database, there is also a lack of data about which species should receive prioritization for surveillance and management efforts. AIS management projects in New Jersey currently vary in size and cost depending on jurisdiction, species, funding sources, and water user.

Impacts

AIS threaten New Jersey’s native species diversity and will undoubtedly impact the integrity of the state’s waters, whether these waterbodies are ecologically sensitive, recreational destinations, refugia for recreationally and commercially important species, or a critical part of

the state's water supply. Threatened and endangered species and unique habitats are particularly vulnerable to establishment by AIS. Ecological impacts include degradation of habitat, direct competition for resources, and transfer of disease or parasites to native species from those introduced. The introduction of even commonly encountered aquarium fish species can pose a threat to established fish populations, resulting in increased competition, stunting, transfer of disease, or parasites resulting in a decline in the overall fishery. Loss of ecosystem services as habitats degrade can be incremental and difficult to quantify in real time. Threats to public health include disruption to water supply systems, contamination with microorganisms or pathogens, taste and odor concerns, and occurrence of AIS that may injure humans directly (such as clinging jellyfish). Economic impacts include degradation of recreational fisheries and related tourism, declines in real-estate value, and the required maintenance/temporary shutdowns incurred by New Jersey power and manufacturing industries. For many non-native aquatic species, invasion potential has not yet been established and further research is required to understand the extent of impact if introduced.

Pathways

To understand which species may have the greatest social, cultural, and economic impacts—we must understand pathways of introduction. The following have been identified as the main introduction pathways and vectors for AIS in New Jersey. This list contains both intentional and unintentional introduction pathways and a summary of the risks each pathway poses on various ecological and socio-economic factors. Some potential pathways/vectors are highly regulated in New Jersey while other pathways remain unregulated or may have volunteer-driven precautions associated with AIS prevention. Potential mitigation strategies for each pathway and vector are described in Appendix A: Pathway Mitigation Measures Table.

Maritime Commerce

With 127 miles of coastline and proximity to several major ports, New Jersey is at risk of unwanted introduction of AIS from on board shipping vessels. This risk comes from both interstate and international shipping and most significantly impacts the immediate coast and nearshore habitats. Transoceanic shipping may introduce AIS to nearshore areas, which may then be transported inland by other vectors. The two main vectors associated with maritime commerce are ballast water and ship biofouling.

- Ballast water is carried by ships to provide stability and trim. However, this water and suspended sediment can harbor a variety of aquatic organisms including larval animals, plant fragments, and pathogens. Vessel loading and discharge of ballast water is likely responsible for several global AIS introductions including zebra mussels (*Dreissena polymorpha*), quagga mussels (*Dreissna bugensis*) and spiny water fleas (*Bythotrephes cederstoemi*). Zebra mussels compete for space and food resources with native mussels and can outcompete both native mussels and larval fish for phytoplankton/zooplankton (Wilson, 2003). Zebra mussels prefer hard substrate to anchor and may damage boats, docks, and water intake pipes or other infrastructure. Zebra mussels cause $300-$500 million annually in damages to power plants, water systems, and industrial water

intakes in the Great Lakes Region (Great Lakes Commission, 2012) and there is concern of introduction into New Jersey. Commercial vessels using New Jersey ports as well as those accessing ports in bordering coastal states both pose a threat to AIS introduction through ballast water.

- Biofouling is the accumulation of microorganisms, plants, algae, or small animals where it is not wanted on underwater surfaces. Biofouling can occur in marine, brackish and freshwater environments. Ship biofouling, particularly on ship's hulls and anchors, can negatively affect a ship's operation by increasing friction and decreasing speed, and costing the shipping industry worldwide millions of dollars per year (Chakroborty, 2023). Ship biofouling is a main vector for the introduction of AIS as ships move from port to port. Apart from ships, surfaces such as submarines, water inlet devices, pipework, grates, submerged electric cables, buoys, and docks can also be colonized by living organisms. Biofouling can accelerate corrosion, cause mechanical blockages, reduce heat transfer efficiency, and cause deterioration of materials.

Recreation

AIS can spread unintentionally between waterbodies (or to new areas within larger waterbodies) as hitchhikers on watercraft, recreational gear, or equipment. Several species of aquatic plants for example can regenerate from small plant fragments or tiny reproductive structures (such as tubers or turions) caught on boat trailers or props.

- Boating introduces the possibility of transport from both motorized and non-motorized watercraft. Motorized watercraft (e.g., boats, jet skis), can harbor AIS along the hull, motor prop, and within water holding compartments including ballast tanks, live wells, and bilge areas.
- Boat trailers are common attachment points for AIS including framework, axles, rollers, bunks, mud guards, and tail boards.
- Non-motorized watercraft such as canoes, kayaks, and paddleboards can also harbor AIS.
- Equipment and gear such as paddles and personal flotation devices can harbor AIS.
- Float planes can also potentially transport AIS from infested waterbodies via struts or water rudders.
- Transport of floating/stationary docks and lifts between waterbodies can also introduce AIS.
- Anglers using live-wells/bait-wells on their watercraft can transport AIS. Any angler using live bait in bait buckets may introduce AIS such as the baitfish themselves (if non-native) or microorganisms and/or pathogens in the bait bucket water.
- Fishing gear can transport AIS, for example use of soft-bottom (such as felt) boot waders and fishing nets can harbor hitchhikers. Even fishing line and lures can harbor spiny water flea (*Bythotrephes longimanus*) and fishhook waterflea (*Cercopagis pengoi*).

- Recreational activities that involve boating/watercraft including waterfowl hunting and fishing create the opportunity to unintentionally transport AIS. Waterfowl hunters often utilize motorized watercraft to reach hunting grounds and may also transport plant material used to create hunting blinds.
- Equipment used for snorkeling or self-contained underwater breathing apparatus (SCUBA) could potentially transport AIS from infested waterbodies.

Trade

Various vectors exist for AIS introduction through the animal and plant production and cultivation processes and subsequent movement of organisms in trade. Consumer preference of certain physical characteristics (e.g., survivability and fecundity) may artificially select for invasive qualities of plants and animals being cultivated in trade. Cultivation that includes hybridization can hinder professionals from correctly identifying species which have escaped or are intentionally introduced to the environment. Vectors of organisms in trade include aquarium or pet dumping, water gardening, aquaculture, live seafood markets, and commercial biological supply.

- The spread of various AIS can be linked to commercial trade including national retail aquarium and pet store chains, privately-owned retail, and hobby sale/trade of plants and animals by individuals. A recent example of this was contamination of "moss ball" aquarium products by invasive zebra mussels, which led to a nationwide recall and federal investigation, as well as disposal and decontamination protocols issued by various state and federal agencies (U.S. Fish & Wildlife Service, 2021). Aquarium plants and animals that are unwanted after purchase are often released by customers into local waterbodies (rather than returning them to the store, finding an appropriate captive home, or humanely euthanizing them). Many intentionally released animals are likely to die upon introduction as they are not adapted to the local environment. However, under certain conditions the animals that are dumped or hitchhikers within the tank (such as plants, animals, or microorganisms) can survive and harm native species.
- Water gardening is a popular hobby which may introduce non-native vegetation, animals, or microorganisms to backyard ponds where they can be accidentally introduced to nearby waterways through flooding or escape. Introduced plant stock may even be contaminated with AIS such as snails, microorganisms, and pathogens.
- Aquaculture in New Jersey focuses primarily on growth of bivalve shellfish, mainly hard clams and oysters but also includes finfish such as trout, baitfish, koi, and aquatic plants. Aquaculture within New Jersey is guided by the New Jersey Department of Agriculture's Office of Aquaculture Coordination; however, the agency does not issue permits. Permitting is issued by NJDEP or NJDOH. The few hatcheries within New Jersey or nearby coastal waters that produce juvenile shellfish (seed) are highly regulated. AIS contamination of these facilities (in the form of larval organisms or pathogens) is highly unlikely due to regulatory measures including seawater filtration. Importation of

aquaculture stock is the most probable vector of AIS transmission in New Jersey. Although many responsible vendors will have their stock reviewed and approved by the New Jersey Department of Agriculture (NJDA), others acquire materials from internet sources which are not regulated. Unregulated seed sources could not only widely spread AIS but also threaten the economic stability of aquaculture farmers and the local restaurants that rely on production.

- Live seafood markets can be a potential vector for AIS as live freshwater and saltwater fish and invertebrates are frequently sold for human consumption and could be inappropriately released. In addition, hitchhikers such as microorganisms and pathogens arrive with the seafood and are then unknowingly released. Species that may be harmful to the environment may be sold without proper regulation on importation.
- Species produced for commercial biological supply can themselves be AIS that are subsequently released by customers (e.g., goldfish released by elementary school classes to local ponds) or may be contaminated with microorganisms or pathogens. Rearing facilities may become contaminated with AIS that are then spread to the environment.

Fish Stocking

Fish stocking could potentially introduce non-native and invasive fish species, as well as parasites, pathogens, and diseases. Fish stocking within New Jersey can be broken into six categories: recreational, baitfish, biological control agents, fish salvages, cultural, and release of pets, or a combination of multiple reasons. For the protection of the state's freshwater fisheries resources a fish stocking permit from NJDEP Fish & Wildlife is required prior to introducing any fish, including their fry or eggs, into any waters, regardless of ownership. Links to NJDEP's fish stocking permit applications and a list of New Jersey "approved commercial fish hatcheries" can be found in Appendix G: Reference Links. Therefore, any release of fish without a valid fish stocking permit issued by NJDEP Fish & Wildlife is illegal.

- **Recreational:** The intentional introduction of sportfish species to new waterbodies to increase recreational opportunities for anglers has historically been a pathway for AIS, whether from the fish species themselves or from diseases/parasites they carry. To reduce the risk of the introduction of disease and/or parasites to New Jersey waters fish must be purchased from an "approved hatchery source" that must be cleared as negative for a series of diseases and subsequently certified/approved by NJDEP Fish & Wildlife. A fish stocking permit assures against the release of invasive fish species, minimizes the risk of disease or parasite introduction, assures fish are stocked at proper sizes and rates, and that the stocking is consistent with established management goals for specific waters if identified. Table A: Stocked Freshwater Sportfish Species of New Jersey are those that may be approved for stocking by NJDEP Fish & Wildlife. Additional sportfish species are present in New Jersey but do not currently have active hatchery stocking programs.

Table A: STOCKED FRESHWATER SPORTFISH SPECIES OF NEW JERSEY

Scientific Name	Common Name
Pomoxis nigromaculatus	Black Crappie
Pomoxis annularis	White Crappie
Lepomis macrochirus	Bluegill
Lepomis gibbosus	Pumpkinseed
Micropterus salmoides	Largemouth Bass
Micropterus dolomieu	Smallmouth Bass
Esox masquinongy	Muskellunge
Esox lucius	Northern Pike
Esox masquinongy x E. lucius	Tiger Muskellunge
Ictalurus punctuatus	Channel Catfish
Morone saxatalis x M. chrysops	Hybrid Striped Bass
Sander vitreus	Walleye
Perca flavescens	Yellow Perch
Salmo salar	Atlantic (Landlocked) Salmon
Salmo trutta	Brown Trout
Onchorhynchus mykiss	Rainbow Trout
Salvelinus fontinalis	Brook Trout
S. trutta x Salvelinus fontinalis	Tiger Trout

- **Baitfish and Natural Bait:** In New Jersey, the term baitfish is used to describe a variety of small fishes that can be legally collected and used as bait while fishing. While healthy baitfish populations provide forage for a variety of piscivorous fish species within a waterbody, the introduction of live baitfish represents a significant AIS pathway worldwide, both as a species and as a vector for pathogens and parasites. Current NJDEP Fish & Wildlife regulations limit the species that are allowed to be captured and used as bait. It is illegal to sell any freshwater fish species under the NJ Fish Code (except under commercial permits issued by NJDEP Fish & Wildlife). Table B: Freshwater Baitfish Species of New Jersey lists those species legally defined as baitfish within the State of New Jersey. Baitfish are not to be confused with “fish bait”. Fish bait or “natural bait” is defined in the NJ Fish Code as any bait that in its live, preserved, or original form would be consumed by fish. Purchase of live natural bait mostly unregulated within New Jersey, as various species of live minnows, crayfish, worms, and other invertebrates are frequently sold in sporting good stores / bait and tackle shops. As regulated in the Fish Code, natural baits are not permitted in waters designated “catch and release only”, “Year-Round and Seasonal Trout Conservation Areas”, “Native Brook Trout Streams”, or “Wild Trout Streams”. Natural bait is currently permitted in other waters and represents an additional introduction pathway for AIS.

Table B: FRESHWATER BAITFISH SPECIES OF NEW JERSEY

Scientific Name	Common Name
Anguilla rostrata	American Eel
*Alosa pseudoharengus**	Alewife (landlocked)*
Dorosoma cepedianum	Gizzard Shad
Notemigonus crysoleucas	Golden Shiner
Pimephales promelas	Fathead Minnow
Semotilus atromaculatus	Creek Chub
Semotilus corporalis	Fallfish
Noturus gyrinus	Tadpole Madtom
Noturus insignis	Margined Madtom
Fundulus diaphanus	Banded Killifish
Fundulus heteroclitus	Mummichog
*Landlocked Alewife only, the possession, take, attempt to take, sale or purchase of Alewife or Blueback Herring from any freshwater stream or river is prohibited.	

- **Biological control agents:** Fish species popular to stocking for biological control purposes include triploid Grass Carp (*Ctenopharyngdon idella*) used to control aquatic vegetation and a variety of mosquito-eating fish such as Mosquitofish (*Gambusia* spp.) to control mosquitoes. The stocking of any type of carp is prohibited except for triploid (sterile) Grass Carp by permit. Stocking permits for sterile Grass Carp (triploid) are approved by NJDEP Fish & Wildlife, as a biological form of aquatic weed control, under strict guidelines to minimize escape of this exotic species from the treated impoundment. The Office of Mosquito Control Coordination (OMCC) can be thought of as the working arm of the State Mosquito Control Commission (SMCC). The Office is staffed full time to run SMCC supported programs and advise the Commission on statewide mosquito control and research activities. OMCC staff serve as liaisons between federal, state, county and private agencies, where mosquito control concerns exist. Mosquito-eating species such as sunfish, Gambusia, and Fathead Minnows are raised at the NJDEP Fish & Wildlife's Hackettstown Fish Hatchery for distribution by County Mosquito Programs. Parameters limit the use of mosquito-eating fish to contained environments such as water troughs, unkempt swimming pools, and roadside ditches.
- **Fish salvages:** Fish salvages are frequently required when lake conditions are no longer suitable to support the existing fish community. This may be in connection with a planned or unplanned (dam failure) water lowering. This could be the result of a dam failure or repair, or a dredging project. A fish salvage may be required as a condition of the water lowering permit issued by NJDEP Fish & Wildlife. All sportfish species are required to be collected and relocated by a lake management consultant. The

relocation of these fish requires a scientific collecting and stocking permit issued by NJDEP Fish & Wildlife. All "potentially dangerous species" must not be relocated and must be humanely euthanized and disposed of properly. Common carp (*Cyprinus carpio*), though not regulated as a potentially dangerous species, may not be relocated as indicated by regulatory statute. Fish salvages are considered a potential vector for the introduction of AIS and a thorough inspection of all fish collected is necessary to prevent transport.

- **Cultural:** Intentional release of live animals is a common practice in some cultures. While terrestrial examples may be more well-known (ex. release of doves or butterflies for various celebrations) aquatic species releases have also been documented. For example, the release of Swamp Eels in North America has been linked to the live-food trade and prayer-release rituals performed as a cultural practice (Nico, et al. 2019).
- **Release of Pets:** Unfortunately, some pet owners release fish and wildlife species into the open environment when they are no longer wanted or outgrow an aquarium. Although pet owners often feel as though they are doing something good for the individual animal, they are potentially causing harm to the animal as the habitat might not me suitable or causing harm to the environment by releasing an invasive species or disease into the wild. Release of aquarium pets that have outgrown their tanks like Goldfish and red-eared slider turtles has often been viewed as more humane than euthanizing animals. However, pet owners are often unaware of the many impacts that can occur from their unwanted pets (and the plants and diseases potentially harbored in their tanks). The release of any fish from private aquariums, food markets, or the transfer of fish from one waterbody to another, is expressly forbidden in New Jersey and poses series threats (transfer of disease, parasites, or introduction of invasive species) to the state's fishery resources (N.J. Admin. Code § Section 7:25-6.26 (a)). The introduction of even commonly encountered aquarium fish species can pose a threat to established fish populations, resulting in increased competition, stunting, transfer of disease, or parasites resulting in a decline in the overall fishery.

Wildlife

Wildlife may be responsible for transporting AIS over short distances to new waterbodies. Several invasive aquatic plants can reproduce from small plant fragments, tiny vegetative reproductive structures (tubers or turions), or from seeds, which could all potentially be carried by waterfowl or other wildlife. The barbed seeds of water chestnut (*Trapa natans*) could cling to the feathers of waterfowl such as ducks and geese, or mammals such as muskrats. Zoochory is the passing of seeds or spores by animals. Certain seeds even require digestive action by animals to break dormancy to trigger germination. Mollusks, such as the silty pond mussel (*Sinanodonta woodiana*), can be transported in the larval stage (glochidia) attached to the gills of imported Asian carp, as evidenced by the only confirmed *S. woodiana* occurrence in the United States discovered in New Jersey. Additionally, muskrats and beaver may feed on seeds and rhizomes as well as move vegetation throughout waterbodies while feeding and building

structures which could potentially assist AIS in range expansion within a newly invaded body of water. Fish and waterfowl may be responsible for movement of invasive snails [e.g., right-handed mudsnail (*Potamopyrgus antipodarum*)] and parasites along or among waterbodies.

Waterbody Connectivity

The Delaware River watershed connects New York, New Jersey, Pennsylvania, and Delaware. Interconnectivity among states allows movement of boats and equipment subject to often uncoordinated regulations. Once introduced, AIS can potentially invade entire river corridors and connecting tributaries. Canals create man-made hydrologic connectivity between watersheds that would be otherwise disconnected, facilitating AIS spread. The 60-mile-long Delaware and Raritan Canal (D&R Canal) is currently utilized as water supply infrastructure within New Jersey. An AIS case study involving the noxious weed hydrilla (*Hydrilla verticillata*) within the D&R Canal is described in the New Jersey-specific Management Project Profiles found in Appendix L. The 14-mile-long Chesapeake and Delaware Canal (C&D Canal), utilized by commercial vessels and recreational watercraft alike, connects the Chesapeake Bay to the Delaware River. Movement of the invasive northern snakehead (*Channa argus*) has been documented through the C&D Canal (Delaware Department of Natural Resources and Environmental Control, 2023).

Categorization of Species

Because not all non-native species may become invasive, this AISMP provides the rationale about which non-native species have pathways to New Jersey, have documented survival capacity within New Jersey, and invasion potential established (and for which research is required). The NJAISMP Working Group compiled a list of non-native aquatic species and their threat levels which is not meant to be complete, and instead represents a living document that will continue to be updated by a working group of experts utilizing the methodology described below and any new information that may become available. The list of relevant species was compiled using existing AIS datasets and utilized expert knowledge which will allow fish and wildlife managers and water resource managers to identify, rank, and prioritize response based on distribution and threat. Data sources included aquatic species:

- listed as “injurious wildlife” under CFR Title 50 Part 16 of the Lacey Act,
- listed as “noxious weeds” under 7USC 2801-2814 of the Noxious Weed Act,
- included on the Plant Protection and Quarantine Pest List (CFR Title 7 Parts 300-399),
- listed on the New Jersey Invasive Species Strike Team (NJISST) invasive species dataset (New Jersey Invasive Species Strike Team, 2023) provided by the Friends of Hopewell Valley Open Space (FoHVOS),
- included in the iMapInvasives database, provided by the New York New Jersey Trail Conference (NYNJTC) Pilot Project,
- included on the United States Geological Survey – Nuisance Aquatic Species database within the New Jersey border (United States Geological Survey, 2023),

- included on the NJ Fish & Wildlife "Non-native and Invasive Fish Species found in Freshwaters of New Jersey" list,
- identified as "potentially dangerous fish" within the NJ Fish Code (N.J.A.C. 7:25-6.2),
- identified by New Jersey Natural Heritage Program botanist David Snyder,
- included on the 2022 Invasive Species List provided by the Long Island Invasive Species Management Area (LIISMA),
- included on the 2022 Invasive Species List provided by the Lower Hudson Partnership for Regional Invasive Species Management,
- included on the 2022 Species List provided by the Long Island-Metro AIS Task Force; and
- included on the 2022 Invasive Species list provided by the Commonwealth of Pennsylvania Invasive Species Program.

The "New Jersey Aquatic Invasive Species List" includes various data for each entry including current distribution, invasiveness, life cycle/phenology, socioeconomic impact risk, and Integrated Taxonomic Information System (ITIS) number. Species can be sorted into the following broad category definitions:

- "Watch" – AIS currently present outside eastern North America but has a known introduction pathway to New Jersey,
- "Buffer" – AIS within Eastern North America and New Jersey invasion potential is established,
- "Encroaching" – AIS found within 100 miles of New Jersey border/border waters,
- "Emerging" – AIS that occurs in low presence within New Jersey, management goal of eradication,
- "Established" – AIS that occurs in moderate presence within New Jersey, management goal of containment,
- "Widespread" – AIS that occurs in abundance within New Jersey, management goal of local control,
- "Research Required" – aquatic species with unknown survival capacity or invasiveness within New Jersey, monitoring is required; and
- "Untiered" – aquatic species including naturalized, native nuisance, and non-native game species as well as intentionally introduced (i.e., stocked) species without management goals.

The "New Jersey Non-native Aquatic Species List" is not meant to be static or complete. Instead, it is presented as a dynamic document that will be continuously updated and adapted as new data is made available through reporting, regional expert verification, research, and the advancement of new survey tools. The "New Jersey Non-native Aquatic Species List" can be found in Appendix B.

Species Categorization Working Group

This AISMP established a Species Categorization Working Group made up of local experts, water resource managers, researchers, those conducting surveys, and NJISST Technical Advisory Committee aquatic experts (Action 1.2.2). The Species Categorization Working Group's responsibilities include updating the "New Jersey Non-native Aquatic Species List" at least annually with any new distribution data, impacts, and/or phenological information as it becomes available.

While this extensive "New Jersey Non-native Aquatic Species List" can be helpful to professional AIS program staff and water resource managers within New Jersey, it is not necessarily designed for at-a-glance understanding. Instead, the NJAISMP core team ranked a subset, based on current distribution within New Jersey, to create a list of "AIS Ranking Very Highly in New Jersey."

- It includes native-range, life cycle/phenology, potential impacts to introduced range, and ITIS number.
- The content is available to be utilized for public webpages, outreach material development, or social media content by various agencies/partners.

For AIS Ranking Very Highly within New Jersey, a "New Jersey Aquatic Invaders Watch List" was created and included as Appendix C.

- AIS Included in Appendix C: AIS Ranking Very Highly Within New Jersey are the "top 20" or "least wanted" AIS ranked by the Species Categorization Working Group that should be highlighted for the public to be aware of due to invasion potential, risk to ecosystems and human health, and chance that they can be readily identified by the public.
- AIS included in Appendix D: New Jersey Aquatic Invaders Watch List are those ranked by the Species Categorization Working Group from the AIS Species List "watch", "buffer", or "encroaching" categories defined above, that would be significant early-detect species, and may require specialized surveys or technology such as eDNA to detect.
- The Species Categorization Working Group will be responsible for maintaining both the AIS Ranking Very Highly In New Jersey list and the New Jersey Aquatic Invaders Watch List at least annually, or as new data become available and NJDEP will be responsible for providing a webpage where the public can learn about each (Action 1.2.5).

The previously described species categorization system for aligns with similar systems in bordering states. That is beneficial because it can aid neighboring AIS programs in streamlining data transfer regarding invasion potential, detection location, abundance, and distribution.

Goal

The main goal of the NJAISMP is to reduce the potential for further introduction and spread of AIS within New Jersey as well as mitigate, control, and, if plausible, eradicate existing AIS infestations. The NJAISMP aims to situate NJDEP as the state-agency that should be responsible for coordinating and streamlining AIS efforts within the state, as well as providing regulatory

oversight and enforcing compliance. The NJAISMP aims to identify technical, enforcement, and financial assistance required to eliminate or reduce the environmental, public health, and safety risks associated with AIS in New Jersey. The AISMP provides background information on relevant species, outlines how authorities, expert working groups, and environmental stakeholders can better coordinate, standardizes education and outreach initiatives, improves regulatory oversight, and coordinates mechanisms in place to act on AIS [including 'Early Detection and Rapid Response' (EDRR)].

Objectives

Five main objectives were identified within the NJAISMP to achieve the main goal stated above:

1.) prevention,
2.) establishing oversight and coordination,
3.) surveillance and detection,
4.) response and restoration, and
5.) long-term control and evaluation.

A series of strategies are outlined for each objective and action items have also been designed to accomplish each strategy are cited herein.

Existing Authorities and Programs

The following is a list of the existing state agencies, programs, and authorities, councils and committees, federal programs, non-government organizations, academic institutions, and cooperating organizations that are already involved in efforts to address AIS issues within New Jersey.

State Agencies & Programs

New Jersey Department of Environmental Protection (NJDEP) – It will be the responsibility of NJDEP as the lead agency to review this list and identify gaps in authority associated with various pathways and vectors or implementation of management strategies, develop the multi-year budget necessary to support the NJ AIS coordinator position, and to partner with neighboring states to prevent AIS introduction and spread. Several programs serving within the NJDEP are involved with managing the state's fish and wildlife resources or provide technical assistance and expertise to support these efforts:

> **NJDEP Fish & Wildlife** – New Jersey Fish & Wildlife's mission is to protect and manage the State's wildlife resources to maximize their long-term biological, recreational, and economic values for all New Jerseyans. The program's goals include maintaining stable and healthy fish and wildlife populations, educating the public on the values and needs of these resources, and maximizing the recreational and commercial use of these resources. New Jersey Fish & Wildlife has the authority to enforce rules that regulate the release and trade of fish and wildlife species, including managing species on state owned lands, and is anticipated as being the Lead Organization for implementation of the AISMP, which only becomes possible with dedicated funding.

NJDEP Fish & Wildlife Bureau of Freshwater Fisheries (BFF) - Within NJDEP Fish & Wildlife, the Bureau of Freshwater Fisheries is responsible for the propagation, protection and management of the State's freshwater fisheries resources as well as promoting its recreational use. To meet management goals and assure the long-term protection of the state's aquatic resources, fisheries biologists conduct fishery surveys on the state's freshwater lakes and streams, propose surface water classifications and provide technical input on a multitude of land use, watershed, and habitat-based issues. BFF evaluates and recommends revisions to the New Jersey Fish Code every 2-4 years. The New Jersey Fish Code governs when, by what means, at which locations, in what numbers, and at what sizes, fish, and certain turtles and frogs may be pursued, caught, killed, or possessed in fresh waters of the state. This includes designation of "potentially dangerous" species (including AIS) and regulations on stocking on non-native species. In addition, it regulates the use of bait on specific waters.

NJDEP Fish & Wildlife Endangered and Nongame Species Program (ENSP) – The ENSP was formed in 1973 to ensure that the State of New Jersey manages all endangered and nongame forms of wildlife to ensure their continued participation in the ecosystem. That mission was the charge of the Endangered and Nongame Species Conservation Act (N.J.S.A. 23:2A), which the legislature passed that same year. This program can advise on areas where AIS may pose increased risk to sensitive aquatic habitats.

NJDEP Fish & Wildlife Bureau of Land Management (BLM) – The Bureau of Land Management is responsible for maintaining New Jersey Fish & Wildlife's Wildlife Management Area System of more than 360,000 acres in 122 areas and includes approximately 1,100 miles of roads (19 paved and 1,081 unpaved). These areas are maintained and managed for a diversity of wildlife species through forest/field manipulation and habitat improvement, as well as for public access. The bureau is also responsible for stocking fish and game birds, maintenance of buildings and grounds, development of visitor facilities, and construction of parking areas and boat ramps. The bureau is involved in the preservation of open space through the Green Acres Land Acquisition Program.

NJDEP Fish & Wildlife Marine Fisheries Administration (MFA) – The MFA, made up of the Bureaus of Marine Fisheries and Marine Habitat and Shellfisheries, plays an important role in managing and conserving New Jersey's marine fish and shellfish resources on an intra-state and inter-state level. The Administration along with each of its bureaus, serve to support habitat protection, monitor populations of these resources, and to seek to provide access to commercial and recreational fisheries for current and future generations. In addition, the MFA has authority to regulate the management and harvest of marine species and to issue permits for shellfish aquaculture.

NJDEP Fish & Wildlife Bureau of Information and Education (BIE) - The Bureau of Information and Education coordinates a number of programs that help thousands of people each year enjoy the outdoors. The bureau also develops and distributes fish and wildlife information in the form of publications, news releases, media announcements and this Website. Together, these educational programs and outreach efforts promote the protection, management and wise and enjoyable use of our fish, wildlife, and other natural resources. The efforts are equally focused on fostering stewardship that will ensure future generations will be able to enjoy these resources.

NJDEP Fish & Wildlife Bureau of Law Enforcement (BLE) – Within NJDEP Fish & Wildlife, The Bureau of Law Enforcement is a professional law enforcement agency dedicated to the wise use of the state's natural resources. Conservation Police Officers (CPOs) enforce wildlife laws and regulations, and educate and inform the public regarding the rules, laws, procedures, and management practices involving the recreational and commercial uses of fish and wildlife. As sworn law enforcement officers, Conservation Police Officers have the authority to enforce all the laws of the state and the federal government enacted for the protection and management of natural resources and other related environmental enforcement activities. Amongst many other duties, CPOs enforce AIS regulations prohibiting the possession of live Potentially Dangerous Species, including invasive fishes.

NJDEP State Parks, Forests & Historic Sites – NJDEP Park, Forests & Historic Sites is responsible for providing safe, public access to 10 swimming areas, 34 boating and 40 fishing opportunities and aquatic invasive species is an ever-present concern. The department works closely with other NJDEP agencies, local governments, NJ Water Supply Authority and nonprofit organizations in educational outreach, surveys and management (including weed harvesting and aquatic herbicide applications). These combined efforts represent more than $600,000 a year in spending in attempts to maintain the waterways for public use.

NJDEP Office of Natural Lands Management (ONLM) – The ONLM administers a group of interrelated land management and planning programs and is committed to the conservation of biodiversity through excellent stewardship and the enhancement of passive recreational opportunities for the benefit of present and future generations. ONLM also monitors rare plants and unique ecological habitats and performs restoration work on Natural Lands which often involves the removal of invasive species.

New Jersey Forest Service (NJFS) – The NJFS is the steward of all forests and trees across the state. Through sustainable science-based management and conservation practices, the New Jersey Forest Service promotes the resilience of New Jersey's forests and their interdependent natural systems. The Forest Service, among other activities, conducts management in state forests to maintain the health and ecological integrity of

these ecosystems, which often includes management and restoration work to control or mitigate the impacts of invasive species. These actions can include management of invasive species in terrestrial habitats (including private land forests via Woodland and Forest Stewardship Plans) as well as management and control of AIS in waterbodies on state lands.

NJDEP Bureau of Coastal and Land Use Compliance & Enforcement (CLUE) – The CLUE, under the division of Watershed and Land Management, is responsible for enforcing the regulatory programs established under six separate state environmental protection statutes: the Waterfront and Harbor Facilities Act; the (Coastal) Wetlands Act of 1970; the Coastal Area Facilities Review Act; the Flood Hazard Area Control Act; the Freshwater Wetlands Protection Act; and the Highlands Water Protection and Planning Act. All these statutes provide authority for the New Jersey Department of Environmental Protection to regulate development (including clearing of vegetation and filling) within environmentally sensitive areas such as beaches, dunes, wetlands and floodplains.

NJDEP Bureau of Freshwater & Biological Monitoring - Under the Division of Water Resources Management, is responsible for numerous multi-year monitoring programs mandated by the Clean Water Act, some of which have served as prototypes for the nation. Water quality monitoring projects emphasize watershed monitoring and frequently combine biological/chemical/physical monitoring to assess the success of State and Federal Clean Water Programs. The sampling stations include surface water as well as groundwater monitoring. Notably, the Biological Monitoring program samples for and identifies macroinvertebrates (Ambient Macroinvertebrate Network – AMNET) and fish (Fish Index of Biotic Integrity – IBI), which includes recording of AIS present when encountered in this extensive monitoring network.

NJDEP Division of Science and Research – The function of the Division of Science and Research (DSR) is to help ensure that the NJDEP's decision-making is based upon the best possible scientific and technical information. The role of DSR is to provide the department with, and access to, expertise and information that supports its technical and policy needs. In this capacity, the division also performs research to meet the DEP's information and problem-solving needs, identifies emerging issues, and integrates a multi-disciplinary perspective to resolving these issues. The Division of Science and Research is not a regulatory authority, however for the purpose of the AISMP, DSR is serving as the lead facilitator in the Plan's development and is a core team member. has been involved in tracking and assessing clinging jellyfish populations in the state and has spent approximately $135,000 for this effort. DSR has also worked with Rutgers University and the Musconetcong Watershed Association to collect eDNA for a left-handed mudsnail detection study, in the amount of $50,000. Additionally, the Division has been involved in efforts to investigate options and revive implementable actions

provided in the New Jersey Strategic Management Plan for Invasive Species (2009).

New Jersey Water Supply Authority (NJWSA) – The NJWSA Watershed Protection Program is involved in AIS management, education and outreach, and coordination. NJWSA staff serve as a NJ state representative on the MAPAIS and as a member of the NJAISMP Core Team. NJWSA has been involved in the management of AIS, specifically hydrilla and water chestnut, in the context of water supply operations. NJWSA has also provided training and financial support for three boat steward programs at Spruce Run Reservoir, Manasquan Reservoir, and Round Valley Reservoir. Between 2016-2022, NJWSA has spent more than $2.5 million on AIS management and educational efforts.

New Jersey Department of Agriculture (NJDA) Office of Aquaculture Coordination – Aquaculture within New Jersey is guided by the NJDA's Office of Aquaculture Coordination (with permitting issued by NJDEP or NJDOH). The Office of Aquatic Coordination provides permitting guidance and assistance, technical assistance to new growers or those looking into experimental and/or new techniques, and marketing assistance. Appendix G: Reference Links contains aquaculture guides and recommended management practices created by the Office of Aquaculture Coordination.

Other Agencies, Councils, Committees & Institutions

New Jersey Sea Grant Consortium (NJSGC) – NJSGC's Extension Program is compiling educational materials and resources on AIS in New Jersey to be distributed to different user groups and stakeholders throughout the state in order to protect valuable aquatic resources.

New Jersey Department of Transportation (NJDOT) – NJDOT maintains information regarding the Call Before You Haul Program on their SUPERLOAD online permitting website.

Friends of Hopewell Valley Open Space (FoHVOS) – The Friends of Hopewell Valley Open Space is an accredited non-profit land trust that is dedicated to working with communities to preserve land, protect natural resources, and promote conservation. FoHVOS founded the NJ Invasive Species Strike Team (NJISST), which works to prevent the spread of invasive species in the state through coordination and cooperation with a variety of stakeholders. The NJISST employs several methods to achieve these objectives which include mapping, data analysis and reporting, education and outreach, training, and EDRR. The NJISST maintains an invasive species list for New Jersey that was used as a template for the species list developed for this AISMP.

Lake Hopatcong Foundation (LHF) – The LHF is a registered nonprofit dedicated to protecting the lake environment and enhancing the lake experience by bringing together public and private resources to encourage a culture of sustainability and stewardship on and around New Jersey's largest lake, for this and future generations. The LHF works to foster a vibrant and healthy Lake Hopatcong and its surrounding community through a variety of programs and initiatives in the following areas: environment, education, community, and advocacy. Our environmental efforts focus on improving water quality and preventing the spread of aquatic

invasive species. Projects aimed at preventing and mitigating Harmful Algal Blooms (HABs) as well as our Water Scouts programs, which prevent and stop the spread of highly invasive species, like water chestnut, are examples of this work.

Musconetcong Watershed Association (MWA) – The MWA is an independent non-profit organization dedicated to protecting and improving the quality of the 42-mile-long Musconetcong River and its 157.6 square mile watershed, including natural and cultural areas. MWA conducts a variety of education programs for students, teachers, municipalities, and nonprofit/service groups. MWA has established a robust network of volunteers to collect water quality data and is currently monitoring for AIS within the watershed.

New Jersey Conservation Foundation (NJCF) – A private, not-for-profit, accredited land trust that owns and operates more than 140,000 acres of natural areas and farmland in New Jersey. NJCF property was the first report of silty pond mussel in the United States.

Rutgers University – Rutgers University faculty, staff, and students conduct applied research on the causes and consequences of AIS establishment within the state and region. Rutgers has leveraged large national databases to document and explore the dynamics of the pathways by which AIS enter the US, and to what extent different theses dynamics translate into higher numbers of AIS in freshwater, marine, and terrestrial ecosystems. Rutgers also houses an environmental DNA (eDNA) lab, which is actively involved in AIS eDNA assay development and deployment of eDNA surveys in support of early detection and rapid response programs. This effort includes developing eDNA assays for Silty Pond Mussel for use within New Jersey watersheds, and statistically evaluating the survey effort required to determine Silty Pond Mussels' geographical range extent and success of eradication programs. Rutgers has provided $40,000 annually toward AIS management within New Jersey watersheds via in-kind contributions of eDNA materials and tools, use of molecular lab resources, and staff time (consultation, survey planning, training partner organizations in eDNA surveys, molecular diagnostics). The Rutgers University Marine Field Station (RUMFS) conducts long-term weekly ichthyoplankton surveys, semi-weekly fish trapping surveys, and various long-term trawling surveys.

Montclair State University (MSU) – MSU is a New Jersey state university that offers more than 300 programs across 10 colleges and schools at all degree levels. The Department of Biology includes a diversely disciplined faculty with national and international renown and conducts research on campus in many different facilities such as the Microscopy and Microanalysis Research Laboratory, the Institute for Sustainability Studies, and the New Jersey Center for Water Science and Technology. Several researchers have applied their focus to invasive species in terrestrial and aquatic - marine systems. As a result, much study has been dedicated solely to aquatic and marine invasive species. Examples of research include studies investigating the distribution, life histories, proliferation and genetic profiles of invasive jellyfish and other species in marine ecosystems, tracking and characterization of exotic pathogens in aquatic

systems and wildlife, investigation of the impacts of invasive plants on water supply, as well as investigations on invasive species management strategies in aquatic systems.

Raritan Headwaters Association (RHA) – RHA is a non-profit conservation organization working to protect and restore water quality in the 470 square-mile North and South Branch Raritan Watershed Region (WMA8), a region covering 38 municipalities in New Jersey's Hunterdon, Somerset, and Morris counties. Since 1959, RHA's long-standing stream monitoring program involves documenting the biological, chemical, and visual habitat of our streams and providing the data to NJDEP to utilize for regulatory uses according to Tier 3.3 data quality alignment. Because of our ranking, our data are used by NJDEP for their 303(d) list, which implements limits on discharges for specific pollutants, and for stream designation as Category 1, affording greater protections on buffers and upstream wastewater discharges. In addition, the data can be used for local and regional efforts to inform decision-making, such as locating and prioritizing potential restoration projects. RHA also works on policy to protect water resources, education programs for children, families and local leaders, and land preservation and stewardship. RHA holds 9 preserves in the Upper Raritan and is an accredited land trust.

The Watershed Institute – The Watershed Institute is a non-profit environmental advocacy organization that stewards a 950-acre reserve in Hopewell Township, Mercer County. The Watershed Institute actively monitors and removes invasive species, including aquatic invasive species such as water chestnut, from its reserve. The Watershed Institute serves more than 10,000 children, teens and adults through more than 300 education programs and events each year for schools, community groups, and the general public. Their programs aim to increase environmental literacy, build awareness of environmental issues, inspire empathy for the natural world, and promote environmental stewardship.

Federal Land Management Agencies/Programs

Aquatic Nuisance Species Task Force (ANSTF) – Voluntary actions to promote nationwide AIS prevention include ANSTF's national campaigns: Stop Aquatic Hitchhikers™ including the "Clean, Drain, Dry" messaging".

Jacques Cousteau National Estuarine Research Reserve (JC NERR) – One of 30 National Estuarine Research Reserves that monitors current conditions and species observations. JC NERR monitors ambient conditions via its System Wide Monitoring Program, maintains species lists, and documents invasive species through monitoring programs (including piloting an eDNA project with the intent to develop a permanent system-wide effort) in the Mullica River/Great Bay/Little Egg Harbor Complex.

United States Army Corps of Engineers (USACE) – USACE provides expertise on genetic testing and data sharing for various AIS across State boundaries. Additionally, the USACE Engineer Research and Development Center (ERDC) Environmental Laboratory (EL) Aquatic Ecology and Invasive Species Branch also conducts research into AIS control for various species including efficacy of various aquatic herbicides on water chestnut (*Trapa natans*).

United States Fish and Wildlife Service (USFWS) – Co-chair of the ANSTF with the National Oceanic and Atmospheric Administration (NOAA) which conducts AIS prevention as authorized under the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (NANPCA). USFWS manages a network of public lands and waters called the National Wildlife Refuge System, which administers recreational access permits and conducts monitoring and management activities. AIS pathways that threaten the refuge system include hitchhikers from human visitors and migratory birds as vectors. The USFWS Office of Law Enforcement conducts inspections at ports and national wildlife refuges. The New Jersey Ecological Services Field Office provides technical assistance to private landowners and conducts project permit reviews.

U.S. National Park Service (NPS) – The NPS oversees the Delaware Water Gap and Sandy Hook/Gateway National Recreation Areas and the National Pinelands Reserve, as well as manages access permits, signage, boat ramps, beaches, and monitoring efforts. The NPS also manages five designated "National Wild & Scenic Rivers" (WSR) with the assistance of local River Management Councils to administer "River Management Plans", some of which include protections of AIS. Some offer boat permit access, own boat ramps, and conduct water quality monitoring. WSR's in New Jersey include:

- Middle Delaware WSR in Delaware Water Gap National Recreation Area – oversees boat ramps and permit access system,
- Great Egg Harbor WSR – local management via the Great Egg Harbor River Wild & Scenic River Management Council,
- Lower Delaware WSR – local management via the Lower Delaware Wild & Scenic River Management Council,
- Maurice WSR – local management via Citizens United for the Maurice River; and
- Musconetcong WSR – local management via the Musconetcong River Management Council.

U.S. Department of Agriculture – Animal and Plant Health Inspection Service (USDA-APHIS) – The USDA created APHIS to protect domestic agricultural resources. Pertaining to AIS, APHIS is responsible for preventing the spread of certain foreign weeds into and through the U.S. Therefore, APHIS regulates interstate transport of several AIS deemed "noxious weeds" under the Federal Noxious Weed Act. APHIS Investigative and Enforcement Services conduct port inspections. Under the USDA, the Natural Resources Conservation Service (NRCS) conducts private land management initiatives including providing grant funding for watershed protection and rehabilitation.

U.S. Geological Survey (USGS) – USGS maintains the Nonindigenous Aquatic Species Database as an informational resource on spatial accounts of introduced aquatic species (United States Geological Survey, 2023).

National Oceanic and Atmospheric Administration (NOAA) – The NOAA is co-chair of the ANSTF with USFWS. NOAA administers the National Sea Grant programs (within New Jersey:

the New Jersey Sea Grant Consortium) which provides funding for research, training, and education relating to marine issues and coastal sustainability.

National Marine Fisheries Service (NMFS) – As part of the U.S. Department of Commerce, the NMFS regulates import of shellfish to prevent AIS hitchhikers.

U.S. Coast Guard (USCG) – USCG implements the rules and standards for ballast water exchange as assigned by NANPCA. These rules and standards are updated over time in coordination with the International Maritime Organization's Ballast Water Management Convention (International Maritime Organization, 2004) and USEPA Vessel General Permit (United States Department of Environmental Protection, 2013).

U.S. Department of Defense (DOD) – DOD owns and operates several facilities within the state, including working waterfronts like the Naval Weapons Station Earl and Coast Guard Stations-Training Center Cape May, as well as the Fort Monmouth Army Base and the Naval Air Engineering Station Lakehurst Navy Base.

U.S. Department of Energy (DOE) – Under the DOE, the Federal Energy Regulatory Commission (FERC) administers permitting and oversight for thermal discharges for cooling water that can alter temperatures and habitats that may support invasive species (e.g. Oyster Creek Power Generating Station).

Regional Partnerships

Mid-Atlantic Panel on Aquatic Invasive Species (MAPAIS) – This group is a regional panel of the ANSTF, comprised of state, federal, and academic representatives within the Mid-Atlantic Region (NY, NJ, PA, DE, MD, WV, VA, NC, SC, DC) with the goal to prevent the introduction and spread of AIS through research, management, and education and outreach. MAPAIS provides resources and funding for AIS projects that support its mission.

North American Lake Management Society (NALMS) – NALMS is an international non-profit organization whose mission is to forge partnerships among community scientists and professionals to foster the management and protection of lakes and reservoirs.

New Jersey Coalition of Lake Associations (NJCOLA) – NJCOLA is the regional affiliate of NALMS within New Jersey whose mission is to develop partnerships among lake associations, professionals, regulatory agencies, local municipalities, and county organizations to serve as a resource on lake matters.

Northeast Aquatic Plant Management Society (NEAPMS) – This professional society represents private sector aquatic plant management specialists, academic, government, and non-governmental organizations to advance aquatic plant science, management, and research in the Northeast. The society hosts an annual conference in January, webinars throughout the

year, and has hosted a 3-day Plant Camp for aquatic plant identification training.

Interstate Coordination

New Jersey will coordinate AIS management activities with neighboring states. New Jersey is active with the Mid-Atlantic Panel on AIS (MAPAIS) with three representatives (NJDEP, NJWSA, and Rutgers University), and has networked with state representatives from adjacent and nearby states throughout the Mid-Atlantic and Northeast. New York and Pennsylvania both have approved state AIS plans, and at the time of publication, Delaware's state plan is in development. Interstate coordination is critical for the state of New Jersey that shares water borders along the Delaware River and Bay, Arthur Kill, Kill Van Kull, the Raritan Bay, Walkill River, and Hudson River. Inter-state waters require uniform signage and messaging across political boundaries and coordination by relevant authorities to manage access points – particularly sites along the Delaware River and Hudson River/Hudson Bay.

Delaware River Basin Commission (DRBC) – A regional body composed of Delaware, New Jersey, Pennsylvania, and New York, signed into law in 1961 that creates water-resource programs through federal, state, and private grants. The DRBC authors periodic "State of Basin" Reports that include sections on Living Resources including AIS.

Delaware River Port Authority – Regional transportation agency that serves as steward of four bridges that cross the Delaware River between Pennsylvania and New Jersey. Stakeholders regarding ballast water, port inspections, etc.

Port Authority of New York and New Jersey (PANYNJ) – An interstate compact, authorized by the United States Congress, which oversees regional transportation infrastructure, including bridges, tunnels, airports, and seaports within the geographical jurisdiction of the Port of New York and New Jersey. PANYNJ includes stakeholders regarding port inspections, ballast water, and biofouling.

Call Before You Haul – To prevent the spread of aquatic invasive species, the Pacific States Marine Fisheries Commission, Bonneville Power Administration, U.S. Fish and Wildlife Service, Western Regional Panel on Aquatic Nuisance Species, and others are making information available to boat haulers, auctioneers, marinas, manufacturers, and brokers to make it easy to comply with state, provincial and federal laws, prevent costly delays in transporting or selling boats, and help reduce the spread of aquatic invasive species. The NJ Department of Transportation participates in this initiative and has made "Call Before You Haul" information available on their website. The webpage link can be found in Appendix G: Reference Links.

Intrastate Coordination

It is the goal of this AISMP to coordinate with other existing New Jersey invasive species plans:

- New Jersey Wildlife Action Plan: This AISMP is in line with the New Jersey Wildlife Action Plan (NJ WAP 2018) goals. The NJWAP states that "invasive species (both native and exotic terrestrial and aquatic animals, plants, invertebrates, and exotic pathogens) cause

significant impacts and permanent loss of terrestrial and aquatic ecosystems. The cost of restoring habitat destroyed by invasive species can be prohibitive and requires persistent and long-term dedicated management. Without swift and significant intervention, losses of natural communities and wildlife may be permanent" (New Jersey Division of Fish & Wildlife, 2018).

- New Jersey Strategic Management Plan for Invasive Species (NJSMPIS): This AISMP was designed to dovetail with the NJSMPIS 2009 and provides particular guidance and strategies to avoid the introduction/spread of AIS through recreational activities in line with the invasive species prevention goals outlined in Section 3.B.2 of the NJSMPIS: "Recreational Activities". Similarly, the AISMP will strive to limit pathways to introduction of AIS in marine systems as outlined in Section 3.B.4 of the NJSMPIS: "Marine Invasive Species" (Van Clef, 2009).
- New Jersey Forest Action Plan: The Forest Stewardship Program (FSP) offers technical and financial assistance to private landowners, which includes help with developing management plans to address forest and wildlife health, invasive species control and maintenance of water quality (New Jersey Forest Service, 2020). The AISMP will provide additional guidance and resources that landowners can use to ensure habitat quality and prevention particularly for aquatic invasive species establishment.

Existing Legislation to Prevent AIS in New Jersey

The AISMP Core Team assessed existing state and federal legislation and regulations that aim to prevent the introduction or spread of AIS within New Jersey. Only a few pertain to AIS, but the existing regulations constitute a vital baseline of prevention measures. New Jersey statutes prohibit the possession or release of live, "potentially dangerous" animals including fish, which are defined as "species that are non-native to an ecosystem and whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health." The following state and federal legislation and regulations were identified relating to AIS in New Jersey:

State

N.J. Admin. Code § Section 7:25-4.2(a)bans possession 7:25-4.2(b) and bans release of any non-game species or exotic species of mammal, bird, reptile, or amphibian while N.J. Admin. Code § Section 7:25-4.8 bans potentially dangerous species as pets or for hobby purpose along with pet shops and animal dealers after 1/17/95 (permits can be issued for scientific holding, zoological, etc.). Relevant to AIS, species included on this list are limited to some types of serpents and crocodiles. N.J. Admin. Code § Section 8:23-2.1 bans possession of undersized or diseased turtles.

N.J. Admin. Code § Section 7:25-6.10 deals with baitfish collection and subsequent use. It sets limitations on baitfish collection (up to 35 per day of select species listed in Table A: Freshwater Baitfish Species in New Jersey). N.J. Admin. Code § Section 7:25-6.10(g) allows collection "in numbers greater than the daily limit for the purpose of sale under special permit issued by the Division in its discretion."

N.J. Admin Code. § Section 7:25-6.1(g) states "The possession and/or release of live potentially dangerous fish species, identified in N.J.A.C. 7:25-6.2, is strictly prohibited. Potentially dangerous fish species encountered while angling shall be destroyed. There are no season, minimum size or creel limits on these species."
N.J. Admin. Code § Section 7:25-6.26 (a) states "No person may release any live indigenous or exotic fish, or their eggs, into the aquatic environment without a permit. For the Purpose of this subchapter, indigenous and exotic fish shall include all fish species, their subspecies, and hybrids."

N.J. Admin. Code § Section 7:25-6.26 (e) states "An application for a fish stocking permit shall be approved if the Director determines that the introduction of the fish species, the number of fish proposed to be introduced, and the source of the fish proposed to be introduced will not create a potential risk to the freshwater resources of the State, and the proposed fish stocking is consistent with Division management plans and established stocking programs"

N.J. Admin. Code § Section 7:25-6.26 (g) states "Except for triploid grass carp for weed control purposes, the stocking of carp, including koi or goldfish, is prohibited. Any carp, including koi and goldfish and potentially dangerous fish collected as a result of a permitted lowering must be destroyed." Criteria for approval to stock triploid Grass Carp are further outlined.

N.J. Admin. Code § Section 7:25-6.26(k) requires "Except for fish taken from one waterbody and reintroduced to another waterbody pursuant to N.J.A.C. 7:25-6.25, the source of all fish to be introduced to the waters of the State must be from an approved fish culture facility." N.J.A.C. 7:25-6.25 refers to fish being salvaged from a waterbody when a relocation is necessary due to planned or emergency situations that put their survival at risk.

Potentially dangerous fish species are defined in N.J. Admin. Code § Section 7:25-6.2. It specifically identifies the following fish species as potentially dangerous and prohibits their live possession or stocking:

- Bighead Carp (*Hypophthalmichthys nobilis*)
- Black Bass, not including Largemouth and Smallmouth Bass (*Micropterus sp*.)
- Blue Catfish (*Ictalurus furcatus*)
- Brook Stickleback (*Culaea inconstans*)
- Flathead Catfish (*Pylodictis olivaris*)
- Grass Carp (diploid) (*Ctenopharyngodon idella***)**
- Green Sunfish (*Lepomis cyanellus*)
- Round Goby (*Neogobius melanostomus*)
- Silver Carp (*Hypophthalmichthys molitrix*)
- Snakeheads (*Channa* spp.)
- Swamp Eel (*Monopterus albus*)
- Warmouth (*Lepomis gulosus*)
- Weatherfish (*Misgurnus anguillicaudatus)*

Natural Areas Systems Rules regarding invasive species include N.J. Admin. Code § Section 7:5A:1.9 Interim management practices e(15), which states that "Control of invasive species by biological, mechanical, or chemical methods may be performed upon approval of an invasive species control plan by the Commissioner" and (e)17, which states that "The introduction of invasive species is prohibited."

Federal

USFWS: The USFWS was authorized under the NANPCA, as amended by the National Invasive Species Act of 1996 (NISA), to administer the Aquatic Nuisance Species Task Force (ANSTF) (U.S. Fish & Wildlife Service, 1994). The ANSTF provides grant funding and guidance for development of state/interstate ANS management plans including this AISMP. The USFWS, through the Lacey Act, also provides the process for which species deemed injurious can be evaluated and potentially added to lists. The USFWS manages the National Wildlife Refuge System, of which there are 5 in New Jersey including: Cape May, Edwin B. Forsythe, Great Swamp, Supawna Meadows, and Wallkill River. In addition to regulatory authority, the USFWS Aquatic Invasive Species Program has produced national AIS awareness campaigns including both "Stop Aquatic HitchhikersTM" (focused on AIS prevention in recreational pathways) and "HabitattitudeTM" (focused on AIS prevention in aquarium and water gardening pathways).

Under a provision of the Lacey Act (18 U.S.C. 42), any importation of injurious wildlife into the United States or its territories or possessions must be authorized under a permit issued by the U.S. Fish and Wildlife Service. In addition, for any injurious specimens listed in the code of federal regulations (50 CFR 16), transport between the continental United States, the District of Columbia, Hawaii, the Commonwealth of Puerto Rico, or any territory or possession of the United States by any means whatsoever must be authorized by the Service.

The 2008 Farm Bill amended the Lacey Act (16 U.S.C. §§ 3371-3378) and extended its protections to a broad range of plants and plant products, making it unlawful to import into the United States any plant or plant product that was illegally harvested. It also makes it unlawful to import certain products without a declaration.

The U.S. Coast Guard (USCG) implements the rules and standards for ballast water exchange as assigned by NANPCA. These rules and standards are updated over time in coordination with the International Maritime Organization's Ballast Water Management Convention for the Control and Management of Ship's Ballast Water and Sediments (International Maritime Organization, 2004; U.S. Fish & Wildlife Service, 1994) (which entered into force globally in 2017) and USEPA Vessel General Permit (United States Department of Environmental Protection, 2013). The Vessel Incidental Discharge Act (2018) requires USEPA to develop national standards of performance for incidental discharges (similar to the discharges in the Vessel General Permit). The USCG will then be required to develop corresponding implementation, compliance, and enforcement regulations for those standards. As referenced previously, ballast water is a primary vector for the introduction of AIS across the globe.

Gaps in Existing Legislation

While New Jersey Code bans possession and release of non-game or exotic species in New Jersey, the species regulated are limited to animals. A procedure should be developed for AIS experts to recommend additions to this language that would include species from all taxa and be based on a risk assessment ranking. Non-native species could be labeled as prohibited/regulated/unregulated. The procedure should include a timeframe for reassessing species, particularly as new information/technology becomes available. Additional rules and regulations may be of benefit to prevent, or control spread of AIS and ensure multiple pathways and vectors are effectively managed. For example, regulations that require recreationists using public launches to take "reasonable precautions" to prevent the spread of AIS has been successfully enacted in New York State. The NJAIS coordinator (with support from partners) should be tasked with defining "reasonable precautions" and developing decontamination guidance that is appropriate for various New Jersey waterbodies. It will be the responsibility of NJDEP and the Species Categorization Working Group (led by the NJAIS coordinator) to review the existing state statutes and develop a framework for recommending additions to these lists (Action 3.1.2). It would be the responsibility of NJDEP as the recommended lead agency and the NJAIS coordinators to review lists and identify legislative/regulatory impediments to AIS prevention (Action 3.1.3).

Objectives, Strategies, Actions & Cost Estimates

Objective 1: Oversight and Coordination

In New Jersey, NJDEP should be responsible for overseeing the management and control of AIS. Currently, the state does not have dedicated programs or staff tasked specifically with invasive species prevention or management. However, once this AISMP is approved, implementation of the NJAISMP will occur through NJDEP (contingent upon funding) in cooperation and coordination with NJDA and other agencies/entities where appropriate.

Strategy 1.1 Establish Lead Organization for AIS Coordination in New Jersey

1.1.1	Create AIS Coordinator Position within NJDEP
1.1.2	Develop multi-year budget necessary for state program
1.1.3	Identify gaps in authority based on Existing Authorities and Programs
1.1.4	Partner with neighboring states to prevent AIS introduction and spread

Based on several state-agency-level AIS Program models from around the United States, creation of a NJAIS Coordinator position is vital to successfully implement an AIS Program. NJDEP will request funding following approval of the AISMP and the NJAIS Coordinator is recommended to serve under NJDEP Fish & Wildlife. Funding the NJAIS coordinator position is vital to the implementation of this AISMP. Responsibilities of the NJAIS coordinator will include serving as the point of contact for all AIS reports in the state, coordinating all working group activity and deliverables, including updating the various species lists discussed in Objective 2,

creating and implementing the AIS Rapid Response Plan for New Jersey described in Objective 4 of this AISMP, developing an annual work plan and budget based on the strategies and actions identified within this AISMP, leveraging partner efforts, and implementing and managing the state-wide database for AIS reporting.

Strategy 1.2 Create and Maintain a State-wide database for AIS Reporting

1.2.1	Establish iMapInvasives as the state-wide standard for AIS reporting and database in New Jersey.
1.2.2	Establish database manager for State of New Jersey.
1.2.3	Participate in standing meetings held by data managers from neighboring states each month to standardize data (including "NatureServe" and ANS task force data managers.
1.2.4	Forge partnerships with community science programs in an effort to contribute AIS data to iMapInvasives via various projects and events (i.e. Regional AIS Landing Blitz)
1.2.5	Bulk upload all validated reports for New Jersey from other sources (NJISST, NYNJTC, USGS NAS, NY/PA iMap) into iMapInvasives
1.2.6	Upload data sets (confidentially if needed) from AIS survey and management projects being conducted at the state or municipal to iMapInvasives. Make this practice standard in all new contract language.

This AISMP establishes the need for a state-wide database for reporting invasive species detections to be maintained by NJDEP. Various tools are currently utilized by groups within New Jersey including:

- datasets collected by water resource managers on public and private waterbodies,
- datasets collected by researchers associated with public and private universities,
- EDDMapS Dashboard populated by NJISST; and
- an iMapInvasives pilot project for New Jersey, created by NYNJTC.

However, reporting for these efforts needs to be streamlined along with data from neighboring states, under the guidance of the NJAIS coordinator to obtain an accurate understanding of AIS distribution within New Jersey.

iMapInvasives

iMapInvasives is an online, global information system (GIS)-based data system used to assist community scientists and natural resource professionals working to protect natural resources from the threat of invasive species. It is used to manage and share invasive species data (including extent of infestation, search efforts, and treatment outcomes) through a publicly-accessible online platform. iMapInvasives is managed at the state jurisdictional level, requiring an administrator position (database manager) who works to identify an appropriate species list for the state, incorporate bulk uploads of existing data, and train users. Establishing iMapInvasives as the state-wide standard in New Jersey would allow for the seamless sharing of

data across the political boundaries that AIS do not recognize – reflecting accurate real-world conditions. An existing pilot program (formed under NYNJTC) has already devoted significant staff time and financial resources toward creating the baseline data layers required (i.e., species list, etc.) to form and operate a database specifically for the State of New Jersey. More than $600,000 in programming has gone into the current iMapInvasives interface, and any state that signs on and pays an annual membership fee is able to tap into that existing functionality. iMapInvasives is hosted by NatureServe and an annual server fee is required for participating states, which is $7,500 at the time of writing this report.

A variety of features/tools are available within iMapInvasives that would benefit enhancing the aquatic invasive species program within New Jersey including:

- the ability to grow the database operations over time (i.e., ability to fledge program with as little as one 0.5 FTE data manager position in Year 1 of the program) (Action 4.1.2)
- existing data sets from other sources (including presence, absence, and/or area surveyed) can be easily bulk uploaded into iMapInvasives by data manager from trusted sources (i.e., universities, water resources managers, etc.),
- both occurrence and treatment records can be uploaded into iMapInvasives publicly or confidentially (meaning property owners retain privacy and confidential records are only viewable by data managers and designated agency professionals),
- records can show managed areas and map how infestations are growing or shrinking over time,
- iMapInvasives can be utilized for terrestrial and aquatic invasive species, allowing this AISMP to dovetail with the existing New Jersey Strategic Management Plan for Invasive Species (Van Clef, 2009),
- robust survey data (records can be uploaded as points, polygons, or lines to show area surveyed and is inclusive of varying survey protocols for different taxa),
- community-science programs can be easily created to target specific watersheds,
- data existing community science platforms (iNaturalist) can be crosswalked into iMapInvasives,
- iMapInvasives reports can include “approaching region” criteria which consider range expansion and climate change projections,
- iMapInvasives has created a “Lakes and Ponds Prioritization tool” that can greatly assist even small teams to determine infestation risk using data and focuses limited resources on highest survey/management priorities,
- iMapInvasives is free to users through browser or mobile app,
- iMapInvasives can be accessed through desktop computers, smartphones, or tablets,
- iMapInvasives can be used through an internet browser with internet connectivity, or using the iMap mobile App when out of connectivity range,

- email alerts for new records of key species can be easily built into iMapInvasives (i.e., for New Jersey Watch List species); and
- iMapInvasives data can be easily exported to GIS as well as uploaded to USGS Nonindigenous Aquatic Species Database (USGS NAS).

Objective 2: Prevention

Prevention is the most effective and least costly method of combating invasive species. This plan aims to limit new introductions and further spread of AIS by funding and staffing a comprehensive AIS Program that can:

- assess the risks that intentional and unintentional pathways pose on various ecological and socio-economic factors,
- increase the use of both regulatory and non-regulatory measures to prevent the introduction and spread of AIS in New Jersey; and
- provide expert-level assessment of species across all taxa and all stages of invasion to rank appropriate response.

Strategy 2.1 Identify and Manage Introduction Pathways

2.1.1	Evaluate ecological and socio-economic risks associated with pathways identified in this AISMP.
2.1.2	Create "Pathway Mitigation Measures Table" to identify pathways, vectors, and potential mitigation strategies to prevent AIS and provide guidance to regulators/agencies on action steps/protocols (draft provided in Appendix A)
2.1.3	Identify any gaps in current regulatory or volunteer-driven pathway mitigation strategies and propose new regulations/protocols if needed.
2.1.4	Create educational campaign where all users of public boat launches should take "reasonable" precautions to prevent the introduction/spread of AIS and coordinate with action items under Strategy 3D to ensure training, signage, and decontamination is prioritized within the state.
2.1.5	Create system to label species as prohibited/regulated/unregulated and provide procedure to review additions. Propose additions as needed through legislation.

Strategy 2.2 Maintain an AIS Species Lists & Species Profiles for New Jersey

2.2.1	Establish Species Categorization Work Group
2.2.2	Compile species list as living document and categorize species based on distribution and risk (a draft can be found in Appendix B)
2.2.3	Coordinate annual ranking of AIS by Species Categorization Working Group using data available and expert knowledge
2.2.4	Maintain species profiles on NJDEP website for species listed in Appendix B
2.2.5	Evaluate list of excluded AIS deemed harmful, injurious, or noxious and expand as needed for New Jersey
2.2.6	Periodically refine list of most important "watch species" as new data becomes available

2.2.7	Participate in existing AIS meeting with bordering states/tasks forces/panels to share species data

Strategy 2.3 Develop an AIS Ecological Risk Assessment/Prioritization

In most cases, the ecological and socioeconomic problems derived from AIS infestations can be very difficult to quantify. The AISMP Core Team prepared a draft AIS Risk Assessment Tool which can be found in Appendix F. This tool is designed to rate AIS that occur or may occur within New Jersey and to determine their potential to become serious pests considering the following factors:

- invasiveness in areas geographically and climactically similar to New Jersey,
- current proximity to or distribution within New Jersey,
- abiotic and biotic factors that affect establishment/spread,
- reproductive traits,
- potential of spread by human and non-human vectors,
- potential ecological and economic impacts,
- potential impacts to human health,
- potential impacts to Environmental Justice Areas; and
- control efficacy.

This tool may be utilized to inform decision-making (i.e., prioritize use of limited funds for EDRR or as justification for which species should be listed on a state-wide regulated species list). The tool should be used by the NJAIS coordinator in collaboration with the Prioritization Working Group established under this AISMP.

2.3.1	Establish the Prioritization Working Group with individuals serving on the Species Categorization Working Group as well as state/federal regulators such as USDA-APHIS, port authorities, NJDEP Fish & Wildlife, NJ Department of Agriculture, and AIS coordinators from neighboring States.
2.3.2	Utilize existing assessment and prioritization tools to model risk for various species within NJ.
2.3.3	Create and utilize procedure to review additions to New Jersey's State list of Prohibited/Regulated AIS (using risk assessments and distribution status).

Strategy 2.4 Create State-wide AIS Education & Outreach Program

Education and outreach initiatives should be led by the NJAIS Coordinator with support from the Education and Outreach Working Group established under this AISMP to create an awareness campaign that features appropriately tailored messages for various audiences, user groups, and pathways.

2.4.1	Establish an AIS Education and Outreach Working Group including environmental education staff from various NJDEP divisions (Science & Research, Water Supply Authority, NJ State Park Service, NJ Fish & Wildlife, etc.), as well as staff/representatives from NJ Sea Grant, Rutgers Cooperative Extension, Rutgers Environmental Stewards, Indigenous Peoples, Riverkeepers, and Watershed Associations.
2.4.2	Disseminate "Clean, drain, dry" protocols for New Jersey boaters/anglers and information page with self-certification section for and distribute to all Marine Services Bureau Boating Safety Course Locations.
2.4.3	Design and provide templates for AIS launch signage and disposal station construction to local and county municipal groups.
2.4.4	Create and disseminate self-certification pledges with protocols for various user groups (e.g., boater safety course, fishing tournament permit applicants, waterfowl hunter permit applicants).
2.4.5	Create and distribute guidance on ways to properly dispose of unwanted aquarium pets/plants to retail locations.
2.4.6	Create database of existing resources to appropriate user groups (e.g., GoBoatingNJ.org for boaters).
2.4.7	Create documentation and signage reflecting Indigenous names for waterbodies, species present, and historical water uses of various sites.

Strategy 2.5: Develop Watercraft Inspection Steward Program/Decontamination Stations Program

Watercraft inspection programs serve the dual purpose of AIS education as well as preventing a major pathway for AIS introduction. Several other states utilize voluntary or mandatory watercraft inspection programs. A combination of mandatory and volunteer watercraft inspection programs can be used to maximize the effectiveness of AIS prevention efforts while minimizing inconvenience for boaters. Mandatory inspection programs can be focused at high-use and high-risk waterbodies, such as those that are close in proximity to infested waters or are popular with boaters from other states. Voluntary inspection programs can be used at lower-risk waterbodies or during times of low boat traffic. A network of volunteer or paid stewards would be required to inspect watercraft, trailers, and equipment for AIS as they enter and/or leave a waterbody. Stewards also provide education on AIS issues and prevention techniques and gather information about boater usage patterns. New Jersey currently has three waterbodies with part-time seasonal voluntary watercraft inspection programs: Manasquan Reservoir, Spruce Run Reservoir, and Round Valley Reservoir. All these stewards are funded and trained by NJWSA staff in partnership with other organizations including

Monmouth County Park Commission, NJ State Park Service, and NJDEP Fish & Wildlife, respectively.

2.5.1	Develop state-wide Watercraft Inspection Program for New Jersey
2.5.2	Develop a Watercraft Inspection Stewards Handbook (including inspection protocols), training materials, and statewide digital application (app).
2.5.3	Ensure that guidelines are consistent and practical for the State of New Jersey (by incorporating working group/public feedback).
2.5.4	Develop a list of freshwater and marine launches that should have decontamination stations and/or disposal stations installed.
2.5.5	Provide design guidance and designate funding for installation of decontamination/disposal stations and instructional signage.
2.5.6	Create a self-certification process for launching/retrieving at launches with no steward on duty (including decontamination procedures for watercraft/equipment).
2.5.7	Develop AIS informational signage for installation at launches.
2.5.8	Implement data collection and reporting systems to track the results of the watercraft inspection program.

Strategy 2.6 Create Necessary Training Programs for AIS Prevention

2.6.1	The NJAIS Coordinator, with support from the Education and Outreach Working Group, should identify and develop materials for training opportunities to educate municipal water resource managers that may encounter AIS.
2.6.2	Create and provide “AIS Identification” training (focus on Species List categories “Encroaching” and “Emerging” in New Jersey).
2.6.3	Create and provide “Reporting to iMapInvasives” training for professionals and the public.
2.6.4	Create and provide “Watercraft Inspection Steward Protocol” training for launch attendants.
2.6.5	Create and provide “Watercraft Decontamination Protocols” training for sites with decontamination stations.
2.6.6	Provide Best Management Practices for AIS Management on Public Lands for State, County, and Local Park and Wildlife Management Area Managers (Case study presentations)
2.6.7	Provide Recommended Management Practices for Aquatic Farms – Agricultural Management Practices (AMPS) Aquatic Organism Health Management Plan (Rutgers Cooperative Extension).
2.6.8	Provide Level 2 Inspector and Decontamination Training by the Pacific States Marine Fisheries Commission for marina employees.

Objective 3: Surveillance & Early Detection

This AISMP proposes to establish a comprehensive surveillance program to detect the presence of AIS in the state's waterbodies. This includes identifying and prioritizing key protection zones

(see Strategy 3.3), regular survey, sampling, testing of water samples, and visual inspections of waterbodies and shorelines. Regular surveillance of the state's waterbodies helps to quickly identify new introductions and track the spread of established species. Several AIS surveillance efforts are currently ongoing in New Jersey by various federal and state agencies, research groups and universities, and community science programs. Reporting for these efforts needs to be streamlined under the NJAIS coordinator so that data generated can inform state-wide objectives.

The Prioritization Working Group will be responsible for developing a list of New Jersey waterbodies, ranking those waterbodies based on risk assessment criteria, and identifying which waterbodies do not currently have surveillance coverage. The Prioritization Working Group will work with the NJAIS coordinator and various partner organizations to implement appropriate survey protocols for selected sites. A surveillance strategy will be developed, designed on a recurring basis throughout the state's water resources, and proposed for implementation by NJDEP and a variety of partner organizations. New Jersey should utilize existing tools from neighbors such as New York's "Waterbody Prioritization Framework" and iMapInvasives' "Ponds and Lakes Prioritization Tool" to develop a model for assessing risk to waterbodies and assigning appropriate survey schedule for the state.

Strategy 3.1 Establish Comprehensive Surveillance Program

3.1.1	The NJAIS Coordinator along with the Prioritization Working Group will enlist a selection of AIS experts across various taxa to be on call to identify EDRR species and validate presence records.
3.1.2	Foster partnerships with industries and universities to promote applied research and technology for survey and early detection efforts
3.1.3	The Prioritization Working Group's use of Appendix F: AIS Risk Assessment Tool to model risk for various species within New Jersey.
3.1.4	Implementing an "early detection" system for regular monitoring and surveying of waterbodies for AIS, created by the Prioritization Working Group.
3.1.5	Providing uniform procedures for reporting and verifying new AIS detections within the state.

Strategy 3.2 Incorporating Novel Research & Survey Methods

3.2.1	Implement new tools and novel research methods as they become available to organize AIS distribution and treatment records (including adding sources such as eDNA detections, Artificial Intelligence, etc.).

Strategy 3.3 Establishment of Invasive Species Protection Zones

The establishment of "Invasive Species Protection Zones" will function to ensure that the goal of aquatic invasive species prevention and response within New Jersey is conducted with the goal of protecting native plants and/or wildlife.

3.3.1	Establish an Invasive Species Protection Zone (IPSZ) Working Group made up of agency and other staff (including land managers) that work with federally or state-listed rare, threatened, and/or endangered species as well as ecologically significant natural communities. Key representatives for the working group would include representatives from: NJ Natural Heritage Program, Natural Areas Council, Pinelands Commission, Highlands Council, USFWS National Wildlife Refuges, NJFWS Ecological Services Field Offices, Nanticoke Lenni-Lenape, Powhatan Renape Nation, Ramapough Lenape Indian Nation, and Inter-Tribal People of New Jersey, and others.
3.3.2	Designate list of "Invasive Species Protection Zones" ISPZs by identifying biodiversity-rich sites with sensitive/protected aquatic species.
3.3.3	Explore USFWS Recovery Challenge Grants (linked in Appendix G: Reference Links) as a potential funding source for development of ISPZs.
3.3.4	Rank list of ISPZs as priority for state-funded surveillance, EDRR, and restoration initiatives.

Potential criteria for ISPZs are recommended as follows:

- Areas demonstrating high species biodiversity, presence of significant habitat, or high species richness,
- Ecological presence of rare, threatened, or endangered species
- Invasive cover limited to less than 5% of waterbody
- Ecological connectivity between protected areas
- Additional points for waterbody size
- Ongoing management by partner organizations

It will be the responsibility of the Invasive Species Protection Zone Working Group to establish the specific zones. "Brook Trout Conservation Zones" serve as an example of an ISPZ that the working group could consider. "Brook Trout Conservation Zones" are defined in the NJ Fish Code (7:25-6.2). Specifically, these are defined as "all waters within the northwest region of the state delineated by Interstate 287 to the east, Route 202 to the south, the New York/New Jersey border to the North, and extending to, but not including the Delaware River to the west".

Objective 4: Response & Restoration

While it is possible that response efforts to introduction of certain AIS will be uniform no matter where the introduction occurs within the state, many response scenarios will have to be tailored to the political jurisdiction, environmental setting, and ecosystem complexity of the infestation. This AISMP recognizes there may not be a viable or cost-effective response action

for every AIS introduction. However, the strategies and actions outlined in this section aim to ready the State to address the most immediate and pressing problems and concerns regarding AIS in New Jersey.

Strategy 4.1 Develop a Rapid Response Plan

The New Jersey AIS Rapid Response Plan will include relevant components such as:

- relevant agency/partner notification
    - determine whether authority exists to take action
- assessment (determining the extent of the infestation)
- establishment of action thresholds
    - determine whether a viable, cost-effective action exists for the specific species for that setting/scenario
- containment and/or control
    - define appropriate implementation measures (e.g., physically removing the invasive species or contaminated material, using chemical treatments, creating barriers to prevent the spread of the species or quarantining of affected waterbodies).
- research and monitoring
    - the NJDEP may conduct additional research and monitoring to better understand the biology and ecology of the AIS, and to develop long-term management strategies; and
- public awareness and education
    - the rapid response plan also includes a component focused on educating the public about the dangers of AIS and the steps that individuals can take to prevent their spread.

Response strategies will vary significantly based on a variety of factors including species, location, ecological setting, and water uses. Selected management methods must be effective, practical, economical, and environmentally sound.

4.1.1	Establish a Rapid Response Working Group
4.1.2	Develop and implement a New Jersey AIS Rapid Response Plan to serve as an inter-agency decision support tool designed to aid regulatory agencies in conducting a coordinated and structured response to new AIS infestations within the state.
4.1.3	Create and implement an “Incident Command System” chart detailing current organizational structure and authority to establish a communication strategy and implementation workflow that outlines the steps to determine the appropriate management response (e.g., control/eradication).
4.1.4	Designate funding for rapid response projects for high priority species.
4.1.5	Identify what type of training support personnel should receive and what equipment needs exist so that rapid response operations can be quickly mobilized.

4.1.6	Train relevant agency staff and water resource managers to use the protocol to ensure coordinated state-wide response efforts.
4.1.7	Develop BMP list containing rapid scientific assessment tools, management response, and adaptive management case studies for species identified in Species List. Include templates for management option decision-making process including eradication, control, no-action, education
4.1.8	Compile case study examples from species identified in Appendix B: New Jersey Aquatic Invasive Species List and Appendix E: Ecological Risk Assessment Tool to be used in Rapid Response Plan.
4.1.9	Assess what legislative/regulatory barriers could impede rapid response action and whether blanket state-wide permits (including emergency authorization of pesticide use) should be issued for specific control techniques for particular species or for particular settings (e.g., ISPZs) to speed up timeline.
4.1.10	Meet with neighboring states and relevant federal agencies to dovetail the Rapid Response Plan with existing IS/AIS Rapid Response in New York and Pennsylvania, including existing mutual aid.
4.1.11	The New Jersey AIS Rapid Response Plan will be based on adaptive management – where impacts are assessed, management is applied, variables and results are properly documented, and changes made to strategies as treatment outcomes are assessed and options weighed.

Strategy 4.2 Implement Restoration Projects

4.2.1	Ensure state-permitted AIS control projects work to limit impacts to sensitive ecosystems by providing restoration BMPs to permittees.
4.2.2	Compile and share a repository of regional restoration case studies.
5.2.3	Compile metrics and provide water resource managers with tools/guidance to measure success of restoration projects.
5.2.4	Secure funding to create capacity for Indigenous participation in native plant and animal restoration projects.

Objective 5: Long-term Control & Evaluation

Strategy 5.1 Establish & Maintain Funding Sources for Spread Prevention, Control, and Eradication

To achieve the goals and objectives described in this AISMP, the State of New Jersey will need to establish and maintain funding sources. Overall, there are a number of different funding sources that the State of New Jersey could explore to support the AISMP, including:

- federal (i.e., USFWS, USGS),
- state and local government,
- task force (i.e., MAPAIS),
- private and philanthropic,

- academic,
- professional (i.e., Boat U.S. Foundation); and
- user fees.

It will be important for the state to pursue multiple funding sources to ensure that the AISMP is adequately funded and able to effectively address the risks and impacts of AIS in the state. The most critical actions to secure funding for attaining these goals and objectives are to support the NJ AIS coordinator position and to support a state-wide database for reporting invasive species detections.

Federal Funding: As there are federal grants and funding available from federal agencies such as the Environmental Protection Agency, the U.S. Fish and Wildlife Service (USFWS), the National Oceanic and Atmospheric Administration, or AmeriCorps. ANSTF-approved state aquatic nuisance (invasive) species plans are eligible to apply annually for the USFWS State and Interstate Aquatic Nuisance Species Management Plan Grant Program (Action 6.1.2). This funding is designated under the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 for the implementation of ANSTF-approved plans, and, at the time of writing this plan, requires a minimum of a 25% cost share match. With respect to design, direction and coordination of aquatic invasive species management activities, this funding could also be used to support an AIS coordinator position within the state.

State Funding: The State of New Jersey could allocate funds from the state budget through an annual appropriation to support AIS management and prevention efforts. An annual appropriation from the state budget will ensure consistent funding for invasive species spread prevention, control, and eradication statewide. The following were identified as potential sources of state-level funding:

- **Creation of an Aquatic Invasive Species Fund:** Several states have designated AIS Funds to finance annual work plans or provide reserve for rapid response projects. New Jersey should explore creation of an Aquatic Invasive Species Fund administered by NJDEP.
- **User Fees:** The State of New Jersey could consider allocating a portion of motorboat registration fees to apply to AIS management and prevention efforts. The State may also consider implementing user fees, such as a fee for fishing licenses or bait sales, to generate revenue. In addition to user fees, a portion of penalty fines for violating invasive species laws or a percentage of all non-native plant/animal sales from aquarium shops and nurseries could be directed towards an AIS Fund for future work.
- **New Jersey Department of Environmental Protection Grants and Loans Program:** NJDEP administers funding opportunities including grants, loans, and financial programs to address a variety of community environmental, social, and economic improvement concerns. The following may be relevant to AIS in New Jersey and are linked in Appendix G: Reference Links:

- Endangered Species – Conserve Wildlife Matching Grant: To be used to fund staff time/iMapInvasives database creation/mapping by the Invasive Species Protection Zone Working Group to designate ISPZ's within New Jersey.
- Green Acres Local Assistance Grants & Loans: To fund boat stewards, installation of AIS prevention signage, decontamination stations, disposal stations.
- Natural Climate Solutions Grants: To fund restoration projects that will restore/enhance wetlands/marshes/seagrass beds as carbon sinks.

Private and Philanthropic Funding: There is funding from private foundations, corporations, and philanthropic organizations that are committed to protecting aquatic resources and preventing the spread of AIS. Various potential private and philanthropic funding sources are described below and linked in Appendix G: Reference Links.

- National Estuaries Program (NEP) Coastal Watersheds Grant Program: Priorities for grant funding include: Proliferation or invasion of species that limit recreational uses, threaten wastewater systems, or cause other ecosystem damage.
- New Jersey Water Resources Research Institute: Funding opportunities include the Graduate Student Grants-in-Aid program to fund graduate student work on AIS related projects and the Junior Faculty-Initiated Projects to fund associate/assistant professors on AIS related projects.

5.1.1	Explore allocation of funds from the state budget through an annual appropriation for invasive species plan implementation and priority projects.
5.1.2	Once NJAISMP is ANSTF-approved, apply annually for the USFWS State and Interstate Aquatic Nuisance Species Management Plan Grant Program to design, direct and coordinate AIS management activities. This funding could also be used to support an AIS coordinator position within the state.
5.1.3	Prepare and submit Annual Report to USFWS State and Interstate Aquatic Nuisance Species Management Plan Grant Program (if USFWS funds are received an utilized)
5.1.4	Ensure that tools can be updated for climate change scenarios

Strategy 5.2 Program Evaluation

To assess the effectiveness of implementing the AISMP and to ascertain its impacts on AIS prevention and control in New Jersey, a broad-based evaluation strategy will be needed. Employing several methods, including both proven and innovative, will ensure that success is quantifiable and data gaps or additional considerations are identified. This will require some degree of ground truthing, however lessons learned can be shared with state and partner water resource managers to improve outcomes. It is also important to recognize that research may be required to better understand and identify more appropriate protocols for AIS management, where the life history, ecological requirements, etc. of certain species is poorly understood. An additional yet crucial component of the AISMP's evaluation will be annual and periodic review.

This will be accomplished through submittal of an annual report to the USFWS State and Interstate Aquatic Nuisance Species Management Plan Grant Program, and through internal review and with the state's partners. Planning for future challenges and stressors related to global anthropogenic impacts must also be considered. Thus, the plan must ensure that AIS management tools can be updated for climate change scenarios.

The following measures are proposed for evaluation of the AISMP's efficacy in preventing new AIS introductions, limiting their spread via targeted management actions and through outreach and education, and securing the means to support these efforts:

- **Allocate funds and record the number of projects initiated** or grants awarded as a result of plan implementation.
    - Rationale – Amount of funding awarded for AIS prevention, EDRR and control serves as a useful benchmark for measuring resources applied to these efforts; increase in the number, size, and scope of projects-funded also provide an indicator as to how and where these funds are being applied. Ranking projects by cost will determine which efforts provide the greatest return on funding invested toward preventing and combating AIS invasions.
- **Updates to the NJDEP Strategy and Action Implementation Table (Appendix F) to include achieved or partially achieved objectives/actions.**
    - Rationale – Updating the AISMP Appendix F: Strategy and Action Implementation Table provides evidence of new achievements or partial successful actions as a result of the AISMP's implemented strategies, serving as process milestones. They can also serve as inspiration for new goals to be set. Achievements could include quantifying the number of species-specific EDRR protocols developed, the number of research projects initiated to study AIS, new methods, dedicated staff added, acres/hectares managed, etc.
- **Identification of new potential threats**
    - Rationale – AIS are a constant threat to the state and its resources. The AISMP will strive to promote vigilance, encourage surveillance, and provide public outreach regarding reporting protocols for AIS observed. Research, monitoring, and communication with neighboring states and partners will also provide critical information on vectors for introduction to New Jersey.
- **Identification of new methods or cases of adaptive management to detect, monitor, and rapidly respond to AIS detections.**
    - Rationale – The number of AIS affecting New Jersey and the region, including the potential vectors for translocation continue to increase. Thus, new, and innovative methods for EDRR and control are warranted. New technologies (i.e., eDNA) that can be adapted or specifically purposed for AIS efforts, coupled with traditional methods can provide a more robust and successful arsenal of tools available to AIS managers.

- **Linking the iMapInvasives' reporting feature to the NJDEP Invasive Species website to report AIS sightings and quantify number of records provided.**
    - Rationale – Public awareness and the ability to report sightings to state, regional, and non-profit water resource managers is invaluable, given the geographic scope of the state and the amount of available habitat that AIS can invade. Allowing the public to access the iMapInvasives' easy-to-use reporting tools will greatly enhance New Jersey's current surveillance efforts. Reports will be confirmed regularly and allow the appropriate AIS managers to develop plans and respond quickly.
- **Quantification of AIS reports from the public via IS reporting through the iMapInvasives' mobile app.**
    - Rationale – Tools such as the iMapsInvasives mobile applications can provide for rapid detection capabilities and invaluable information on AIS. These tools can also provide datasets that can be used by land managers and researchers alike to better understand trends in, for example, invasive history of AIS, habitat/area preferences, abundance, and/or direction of spread.
- **Provide annual reporting to ANSTF and other stakeholders which would include data gaps, resource needs, and lessons learned.**
    - Rationale – Reporting is a requirement of all state and regional AIS (or ANS) management plans, and for valid reasons. Providing updates to the ANSTF and New Jersey's stakeholders allows for transparency and fosters important relationships with those that value and conduct AIS-related work. It also allows for gleaning feedback on how methods can be improved or may be lacking.
- **Quantification of behavioral change based on AISMP-proposed AIS outreach initiatives/products.**
    - Rationale – Education and outreach are crucial for getting the message out to the public on the negative ecological and socioeconomic impacts caused by AIS establishment. However, in many cases, preventing the spread of AIS will require behavioral changes by water resource users. Quantification of boaters that have changed their behavior to prevent AIS will inform outcomes. Quantifying interactions with boat stewards and decontaminations are valuable to assess outcomes.
- **Identification of new outreach, opportunities, and AIS-related actions.**
    - Rationale – Identifying proven and new strategies for reaching users of the state's waterbodies and providing guidance for decontamination, identification of AIS, and reporting will favorably serve all and the state's resources in the long-term.
- **Learn from other states and regional partners on their experiences.**
  Neighboring states and multi-state cooperatives have reported improved outcomes for AIS prevention and control by incorporating AIS Plans. Examples include:

- The Great Lakes Restoration Initiative (GLRI) reporting that since the GLRI began, federal agencies and their partners have taken actions to control invasive species on over 216,000 terrestrial and aquatic acres, including over 38,000 acres in FY 2020–FY 2021. Additionally, these efforts have protected and restored over 479,000 acres (including over 37,000 acres in FY 2020–FY 2021) of coastal wetland, nearshore, and other habitats. GLRI federal agencies and their partners have further reduced the risk of invasive species entering the Great Lakes watershed by funding 66 projects in FY 2020–FY 2021 that help block the pathways of introduction (Great Lakes Restoration Initiative, 2023).
- The New York State Department of Environmental Conservation (NYSDEC)'s top priority of their statewide AIS management plan is to expand the coverage of boat stewardship programs across New York State and in 2020, NYSDEC's statewide watercraft inspection stewards educated more than 500,000 water recreationists, inspected almost 350,000 watercraft at more than 200 locations, and intercepted more than 19,000 findings of aquatic invasive species (New York State Department of Environmental Conservation, 2023). As of 2022, NYSDEC has installed 59 AIS "Designated Inspection Stations" in New York State in accordance with the statewide AIS Management Plan (New York Invasive Species Council, 2010).
- The Commonwealth of Pennsylvania's comprehensive invasive species management plan is updated every five years by executive order. A Pennsylvania Aquatic Invasive Species Rapid Response Plan and Pennsylvania Watercraft Inspection Handbook, were created, and "AIS Control Plans" were developed for 11 AIS. Because funding was established for a designated PA Invasive Species Coordinator to serve as data manager for a statewide invasive species database more than 15,559 AIS records have been reported to iMapInvasives since the Plan was implemented (Jewitt, personal communication, 2023).
- The Connecticut Aquatic Nuisance Species Management Plan has been in effect since 2006. Since then, the state has successfully partnered with federal and academic partners to control invasive species, such as Hydrilla and Phragmites, as both impact waterways and surrounding habitat. In 2020, the state began to require boat owners to purchase a $5 invasive species stamp to operate a boat, and out-of-state boaters had to pay $25. A recent revision of this bill, effective October 1, 2024, creates a $7 AIS stamp for individuals and a $20 AIS decal for vessels, with a limited exception for marine dealers, engine manufacturers, and surveyors. The previous funds (along with a federal match) were used by the state to hire an aquatic invasive species program coordinator and two seasonal Connecticut River stewards.
- Minnesota has experienced significant success as a result of outreach aimed at alerting boaters to AIS and actions to prevent them from spreading, an effort

that started over 20 years ago. Programs like “Stop Aquatic Hitchhikers” and “Clean, Drain, Dry and Dispose” have become well-known among boaters, anglers, and others. As of 2019, only 8% of Minnesota waters bodies were reported as having AIS present (only 3.5% of lakes - 408 out of 11,842 - were reported to have zebra mussel infestations). In 2019, efforts on AIS also showed greatly improved awareness by the public: approximately 96% of boaters were taking action to drain their boats and 97% were removing weeds, up from 71% compliance reported in 2014. Minnesota financially supports its AIS work mostly through the state’s general tax fund, however some funding is derived from federal grants and a portion from a $10.60 AIS surcharge imposed on state boat licenses. In 2019, the state spent $9.7 million on AIS education, control and enforcement efforts (excluding academic research). Although AIS are continuing to spread in Minnesota waterbodies, the proliferation has likely been slowed significantly as a result of continued implementation of AIS planning actions.

Implementation Table

The NJ AISMP Implementation Table can be found in Appendix F and identifies appropriate lead agencies, cooperating entities, and estimated funding required to undertake actions listed in the plan during the first three years of implementation.

Priorities for Action

While actions in this plan were identified by a diverse working group of experts as essential to support a robust aquatic invasive species program for the State of New Jersey, staff capacity and resources are limited. Therefore, action items listed were assigned a rank of high, medium, or low priority by the AISMP Working Group. High-priority actions are those that should take place within the first year following plan adoption. Medium-priority actions are those that should take place between 2- and 4-years following plan adoption. Low-priority actions are those that should be completed within 5 years of plan adoption and prior to the first 5-Year evaluation of the Plan. A list of all action items with both lead and cooperating organizations identified to implement them, estimated annual cost, funding source, and priority rankings can be found in Appendix F: NJAISMP Strategy & Action Implementation Table. Three “Critical Actions” have been identified as critically required in order to implement the majority of other actions.

Critical Actions as identified in Objective 1:

1.1.1	Create AIS Coordinator Position within NJDEP
1.2.1	Establish Statewide AIS database manager position within NJDEP.
1.2.2	Establish iMapInvasives as the state-wide standard for AIS reporting and database in New Jersey.

Conclusion

This AISMP has described various components that a working group of scientific professionals, environmental stakeholders, and the public propose as needed to create a vital AIS prevention and response program within the State of New Jersey. Engagement with partner agencies and agreement on a coordination plan at the state level will help streamline goals, eliminate duplicative efforts, and ensure consistency in messaging. A set of strategies and action steps are outlined in order to achieve the goals set forth by this AISMP.

Case study data for a variety of AIS management projects in New Jersey are included in Appendix L to highlight the range of AIS early detection and rapid response (EDRR) efforts currently underway, protection of sensitive/protected NJ species, multi-agency partnership, and innovative surveillance techniques that could be supported by a state-wide AIS program.

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APPENDICES

APPENDIX A: Pathway Mitigation Measures Table

Appendix A: This appendix identifies pathways, vectors, and potential mitigation strategies to prevent AIS and provide guidance to regulators/agencies on action steps/protocols for each pathway and vector.

Vector	Potential Mitigation Measure
Ballast Water Discharge	Ballast water exchange involves replacing a vessel's ballast water with ocean water. Exchanging ballast water far off-shore removes organisms from a ship's ballast tanks by dilution and also exposes freshwater organisms to saltwater, thereby killing many of them.
	Saltwater flushing is an alternative to ballast water exchange for NOBOBs and is accomplished by allowing a limited amount of salt water to slosh around in an individual ballast tank as a result of the ship's rolling and pitching motion during passage. This agitation resuspends trapped sediments and provides a salinity shock to biota, which are then discharged into the open ocean.
	Shipboard treatment to kill organisms in ballast water is widely viewed as offering greater operational flexibility than either ballast water exchange or saltwater flushing, as well as the potential for greater effectiveness. A variety of proven water treatment technologies are available but adapting them for shipboard application presents major technical challenges. However, important progress has been made in recent years in response to the ballast water treatment standard proposed by the International Maritime Organization.
	Restriction of transit of transoceanic vessels to only those that have taken a proactive approach to preventing AIS in Ballast Water
Ship biofouling	Antifouling: A coating, paint, surface treatment, surface or device that is used on a ship to control or prevent attachment of unwanted organisms. Hydrophobic foul-release coatings: These low energy coatings enable an easy release of marine organisms; Copper-free antifouling: These paints are harmlessly repelling marine organisms from the hull, rather than killing them; Nano antifouling: These coatings create a surface so slippery that no organism can stick. Studies have indicated that it can work, but only on boats with speeds of 10 knots and higher.
Motorized watercraft, PWC, engine props, trailers	Self-certification of reasonable prevention measures upon launch or retrieval of watercraft. Basic prevention measure training incorporated into boating safety courses in NJ. Call before your Haul Program. Pull the plug law. Propose legislation that all public boat launches need to display AIS prevention signage. Install instructional signage at launches stating users must take reasonable prevention measures upon launch and retrieval of watercraft. Installation of decontamination stations at freshwater public access launches. Installation of AIS disposal stations at freshwater public access launches. Setup decontamination stations along highway corridor truck stops during summer months. Create K-9 training program for AIS inspection/detection at busy launches and highway stops for watercraft/trailers.
Non-motorized watercraft (canoes, kayaks, SUPs)	

Vector	Potential Mitigation Measure
Fishing tournaments, waterfowl hunters, float plane operators	Check off certification of reasonable prevention measures upon launch or retrieval of watercraft within tournament permit application. "Reasonable Prevention Measure" instructional document provided to permit applicant (fishing tournaments, duck stamps, etc.). Utilize mobile decontamination stations for boater use prior to launch in any tournament. Create float-plane specific guidance document to prevent spread of AIS (using AIS prevention in aviation-based fire response programs as a guide).
Angling, live bait, bait buckets, live wells, fishing gear/waders	Creation of a certified bait dealer program. Conduct random inspections of bait buckets and live wells for presence of AIS. Inspection can be done visually and using microscopy. Samples can also be sent for eDNA testing. Educate anglers about the importance of preventing the spread of AIS and why not to move bait fish from one waterbody to another.
SCUBA	Check off certification of reasonable prevention measures will be adhered to upon use of SCUBA equipment "Reasonable Prevention Measures" instructional document provided during SCUBA certification course along with best management practices for de-contamination and prevention measures specific to SCUBA (and for when SCUBA is combined with use of watercraft).
Aquarium/ Pet Trade	Broaden list of prohibited and regulated species that cannot be imported or sold within New Jersey based on AIS Risk Assessment for each species.
Water gardening	Broaden list of prohibited and regulated species that cannot be imported or sold within New Jersey. Restrict use of invasive and non-native vegetation in permitted projects. NJDEP permit required for aquatic gardens over a certain size that connect to any water source or are located within the 100-year floodplain, where species planted must be included in permit application. NJDEP to inspect nurseries and garden centers for prohibited/regulated species.
Aquaculture	SeaGrant Law Center released guidance based on case studies compiled with support from the US. Department of the Interior. Key Actors and Legal Responsibilities were identified to mitigate the risks of AIS in Commerce. Importers may not import prohibited species (regulated by the federal government and enforced through the legal mechanisms of proper labeling and invoicing). Domestic sellers may not possess, sell, or ship prohibited species (regulated by states and enforced through interstate compliance mechanisms). Transporters may not transport prohibited species, however some transporters may not know what they are transporting, representing a legal issue. Buyers may not import, buy, or possess prohibited species (however customers may not know what they are buying or which species are prohibited). Third party platforms represent a problem in this system as legal responsibility may not exist. Requiring all seafood processing facilities to have a biosecurity plan in place to prevent the introduction and spread of AIS.
Live seafood markets	NJDEP enforcement of properly tagged imports, properly labelled goods, and no prohibited/regulated species. Require all seafood imports to be accompanied by a health certificate from the exporting country, certifying that products have been inspected and are free of AIS. Conduct random inspections of seafood imports at the border. Requiring all seafood processing facilities to have a biosecurity plan in place to prevent the introduction and spread of AIS.

Vector	Potential Mitigation Measure
Biological supply	Outreach campaign to school districts/clubs not to release live animals from biological supply chain (i.e., crayfish, goldfish). Randomly inspect biological supply facilities for good manufacturing practices to ensure high quality standards, sterilization, and prevent contamination.
Contamination of products in channels of trade	Develop Best Management Practices for inspecting and cleaning shipping containers and other equipment before and after use. This can help to remove any AIS before they may have attached themselves to equipment. Inspecting and testing live seafood products for AIS before they are transported or imported. This can be done using visual inspections, microscopy, and eDNA testing. Developing BMPs for decontamination of tools and equipment used in trade. Creating education and outreach campaign for businesses and consumers about the risks of AIS and how to prevent their spread.
Sportfish, bait fish	Only allow stocking (in public or private waters) with fish that have been inspected and certified AIS and disease-free. Create BMPs regarding proper disinfection for fish transport equipment. Educate anglers about the importance of preventing spread of AIS and why not to move bait fish from one waterbody to another.
Live Release	Coordinate with NYSDEC's outreach initiatives in LI-Metro Area that discuss live releases as a cultural practice in some communities. Broaden scope of initiative to NJ.
Waterfowl	Naturalize grass and vegetation along riparian areas and shorelines of large waterbodies to make areas less attractive to (and less likely to be overpopulated with) geese.
Heavy equipment in streams	Develop trainings on decontamination BMPs and AIS prevention measures for heavy equipment in streams and riparian areas for local governments.

APPENDIX B: Relevant Species

Appendix B contains non-native species compiled by the NJAISMP Species Categorization Working Group. This table is compiled from a larger species database being utilized by the Species Categorization Working Group that includes socioeconomic and ecological rankings.
Status Key: Watch = AIS currently present outside eastern North America but has a known introduction pathway to New Jersey, Buffer = AIS within Eastern North America and New Jersey invasion potential is established, Encroaching = AIS found within 100 miles of New Jersey border/border waters, Emerging = AIS that occurs in low presence within New Jersey, management goal of eradication, Established = AIS that occurs in moderate presence within New Jersey, management goal of containment, Widespread = AIS that occurs in abundance within New Jersey, management goal of local control, Research Required = aquatic species with unknown survival capacity or invasiveness within New Jersey, monitoring is required, and Untiered = aquatic species including naturalized, native nuisance, and non-native game species as well as intentionally introduced (i.e. stocked) species without management goals.

Scientific Name	Common Name	ITISI Number	Taxa	Habitat	Status
Prymnesium parvum	golden algae	2170	Algae	Freshwater	Watch
Electra pilosa	hairy sea mat	155868	Cnidarian	Marine	Watch
Corella eumyota	orange-tipped sea squirt	159160	Tunicate	Marine	Watch
Styela canopus	rough sea squirt	159350	Tunicate	Marine	Watch
Caulerpa taxifolia	killer green algae	6974	Algae	Marine	Buffer
Colpomenia peregrina	sea potato	11426	Algae	Marine	Buffer
Dasysiphonia japonica	Siphoned feather weed		Algae	Marine	Buffer
Grateloupia turuturu	devil's tongue weed		Algae	Marine	Buffer
Membranipora membranacea	lacy crust bryozoan	155824	Bryozoan	Marine	Buffer
Tricellaria inopinata	unexpected bryozoan		Bryozoan	Marine	Buffer
Aiptasiogeton eruptaurantia	pink-spotted sea anemone	52771	Cnidarian	Marine	Buffer
Cambarus robustus	big water crayfish	97400	Crustacean	Freshwater	Buffer
Procambarus virginalis	marbled crayfish	1134174	Crustacean	Freshwater	Buffer
Hemimysis anomala	Bloody-red shrimp	90568	Crustacean	Freshwater	Buffer
Orconectes immunis	Calico Crayfish	97446	Crustacean	Freshwater	Buffer
Amphibalanus amphit1ucius11terite	red-striped barnacle	89616	Crustacean	Marine	Buffer
Channa maculata	blotched snakehead	166684	Fish	Freshwater	Buffer
Channa marulius	bullseye snakehead	166663	Fish	Freshwater	Buffer
Hypophthalmichthys motitnx	silver carp	163691	Fish	Freshwater	Buffer
Micropterus henshalli	splotched bass	1159345	Fish	Freshwater	Buffer
Piaractus brachypomus	red-bellied pacu	163280	Fish	Freshwater	Buffer
Pterois volitans	lionfish	166883	Fish	Freshwater	Buffer
Culaea inconstans	brook stickleback	166399	Fish	Freshwater	Buffer

Scientific Name	Common Name	ITISI Number	Taxa	Habitat	Status
Etheostoma blennioides	greenside darter	168375	Fish	Freshwater	Buffer
Bythotrephes longimanus	spiny waterflea	684624	Invertebrate	Freshwater	Buffer
Cercopagis pengoi	fishhook waterflea	684625	Invertebrate	Freshwater	Buffer
Rapana venosa	veined rapa whelk		Mollusk	Marine	Buffer
Sphaerium corneum	invasive fingernail clam	81392	Mollusk	Freshwater	Buffer
Batrachochytrium dendrobatidis	chytrid pathogen of frogs		Pathogen - Animal	Freshwater	Buffer
Batrachochytrium salamandrivorans	chytrid pathogen of salamanders		Pathogen - Animal	Freshwater	Buffer
Nitellopsis obtusa	starry stonewort		Plant	Freshwater	Buffer
Pistia stratiotes	water lettuce	42542	Plant	Freshwater	Buffer
Stratiotes aloides	water soldier	505383	Plant	Freshwater	Buffer
Vitex rotundifolia	beach vitex	505725	Plant	Marine	Buffer
Halichondria bowerbanki	yellow sun sponge	48398	Sponge	Marine	Buffer
Ascidiella aspersa	dirty sea squirt	159213	Tunicate	Marine	Buffer
Diplosoma listerianum	compound sea squirt/diplosoma tunicate	159099	Tunicate	Marine	Buffer
Myocastor coypus	nutria	180402	Mammal	Freshwater	Encroaching
Neogobius melanostomus	round goby	172072	Fish	Freshwater	Encroaching
Dreissena bugensis	quagga mussel	1089645	Mollusk	Freshwater	Encroaching
Dreissena polymorpha	zebra mussel	81339	Mollusk	Freshwater	Encroaching
Salvinia molesta	giant salvinia	181823	Plant	Freshwater	Encroaching
Trapa bispinosa	two-horned water chestnut	522771	Plant	Freshwater	Encroaching
Salvinia minima	salvinia	181822	Plant	Freshwater	Encroaching
Obelia bidentata	double-toothed hydroid	49532	cnidarian	Marine	Encroaching
Barentsia benedeni	entoproct	156746	Animal	Marine	Encroaching
Amathia verticillate	spaghetti bryozoan		Bryozoan	Marine	Encroaching
Buglua simplex	bushy bryozoan	206725	Bryozoan	Marine	Encroaching
Bugula neritina	purple bushy bryozoan	156056	Bryozoan	Marine	Encroaching
Diadumene lineata	orange-striped anemone	52757	Cnidarian	Marine	Encroaching
Caprella mutica	spiny red caprellid amphipod, skeleton shrimp	656389	Crustacean	Marine	Encroaching
Ianiropsis serricaudis	isopod	544802	Crustacean	Marine	Encroaching

Scientific Name	Common Name	ITISI Number	Taxa	Habitat	Status
Praunus flexuosus	mysid	90181	Crustacean	Marine	Encroaching
Radix auricularia	big-eared radix	76526	Mollusk	Freshwater	Encroaching
Valvata piscinalis	blue-eyed stream valvata	70348	Mollusk	Freshwater	Encroaching
Neodexiospira brasiliensis	tubeworm	68355	Mollusk	Marine	Encroaching
Alternanthera philoxeroides	alligatorweed	20770	Plant	Freshwater	Encroaching
Butomus umbellatus	flowering rush	38886	Plant	Freshwater	Encroaching
Didemnum vexillum	sea squirt / carpet tunicate		Tunicate	Marine	Encroaching
Clavelina lepadiformis	lightbulb sea squirt	158867	Tunicate	Marine	Encroaching
Styela plicata	pleated sea squirt	159338	Tunicate	Marine	Encroaching
Monopterus albus	swamp eel	166697	Fish	Freshwater	Emerging
Aldrovanda vesiculosa	water wheel plant		Plant	Freshwater	Emerging
Myosotella myosotis	mouse-ear snail	567926	Mollusk	Marine	Emerging
Gambusia affinis	Western mosquito fish	165878	Fish	Freshwater	Emerging
Hypophthalmichthys nobilis	bighead carp	163692	Fish	Freshwater	Emerging
Ictalurus furcatus	blue Catfish	163997	Fish	Freshwater	Emerging
Lepomis gulosus	warmouth	168138	Fish	Freshwater	Emerging
Leuciscus idus	ide	163576	Fish	Freshwater	Emerging
Micropterus punctulatus	spotted bass	168161	Fish	Freshwater	Emerging
Misgurnus anguillicaudatus	weatherfish	163978	Fish	Freshwater	Emerging
Pylodictis olivaris	flathead catfish	164029	Fish	Freshwater	Emerging
Scardinius erythrophthalmus	Rudd	163613	Fish	Freshwater	Emerging
Procambarus clarkii	red swamp crayfish	97491	Crustacean	Freshwater	Emerging
Faxonius virilis	virile crayfish	1133797	Crustacean	Freshwater	Emerging
Orconectes obscurus	obscure crayfish	97466	Crustacean	Freshwater	Emerging
Codium fragile ssp. fragile	green fleece, dead man's fingers	6897	Algae	Marine	Emerging
Gracilaria vermiculophylla	red algae	660046	Algae	Marine	Emerging
Lysmata vittata	peppermint shrimp	96907	Crustacean	Marine	Emerging
Microdeutopus gryllotalpa	tube builder	93477	Crustacean	Marine	Emerging
Palaemon elegans	rockpool shrimp	96466	Crustacean	Marine	Emerging
Palaemon macrodactlyus	ballast prawn	96450	Crustacean	Marine	Emerging

Scientific Name	Common Name	ITISI Number	Taxa	Habitat	Status
Synidotea laevidorsalis	biofouling isopod	546963	Crustacean	Marine	Emerging
Boccardiella ligerica	mudworm	67012	Mollusk	Marine	Emerging
Ischadium recurvum	hooked mussel	79561	Mollusk	Marine	Emerging
Anodontoides ferussacianus	cylindrical papershell	80148	Mollusk	Freshwater	Emerging
Bithynia tentaculata	faucet snail	70794	Mollusk	Freshwater	Emerging
Cipangopaludina chinensis	mysterysnail	70329	Mollusk	Freshwater	Emerging
Cipangopaludina japonica	elongate mystery snail	70332	Mollusk	Freshwater	Emerging
Ostrea edulis	edible oyster	79885	Mollusk	Marine	Emerging
Potamopyrgus antipodarum	right-handed mud snail	205006	Mollusk	Freshwater	Emerging
Sinanodonta woodiana	silty pond mussel	983676	Mollusk	Freshwater	Emerging
Viviparus georgianus	banded mystery snail	70307	Mollusk	Freshwater	Emerging
Cabomba caroliniana	fanwort	18408	Plant	Freshwater	Emerging
Callitriche stagnalis	pond water-starwort	32062	Plant	Freshwater	Emerging
Egeria densa	large-flowered waterweed	38972	Plant	Freshwater	Emerging
Eichhornia crassipes	common water hyacinth	42623	Plant	Freshwater	Emerging
Glossostigma cleistanthum	mudmat	834093	Plant	Freshwater	Emerging
Hydrilla verticillata	hydrilla	38974	Plant	Freshwater	Emerging
Hydrocharis morsus-ranae	common frog-bit	503098	Plant	Freshwater	Emerging
Ludwigia peploides ((ssp. glabrescens))	creeping waterprimrose	27355	Plant	Freshwater	Emerging
Marsilea quadrifolia	waterclover	17995	Plant	Freshwater	Emerging
Murdannia keisak	marsh dewflower	39145	Plant	Freshwater	Emerging
Myosoton aquaticum	giant chickweed	20314	Plant	Freshwater	Emerging
Myriophyllum aquaticum	parrotfeather	503904	Plant	Freshwater	Emerging
Najas minor	brittleleaf naiad	39002	Plant	Freshwater	Emerging
Nelumbo nucifera	pink lotus	18400	Plant	Freshwater	Emerging
Nymphoides peltata	yellow floating heart	29998	Plant	Freshwater	Emerging
Botryllus schlosseri	golden star tunicate	159373	Tunicate	Marine	Emerging
Styela clava	club tunicate	159337	Tunicate	Marine	Emerging
Harmothoe imbricata	scaleworm (no common name)	64513	Polychaeta	Marine	Established
Lepidonotus squamatus	scaleworm (no common name)	64604	Polychaeta	Marine	Established

Scientific Name	Common Name	ITISI Number	Taxa	Habitat	Status
Myriophyllum spicatum	spiked water-milfoil	27039	Plant	Freshwater	Established
Potamogeton crispus	curly-leaved pondweed	39007	Plant	Freshwater	Established
Channa argus	Northern snakehead	166680	Fish	Freshwater	Established
Gonionemus vertens	clinging jellyfish	50740	Hydrozoan	Marine	Established
Arundinaria gigantea ssp. gigantea	giant cane	787288	Plant	Freshwater	Established
Bassia hirsuta	hairy smotherweed	20587	Plant	Freshwater	Established
Bassia hyssopifolia	five-horn smotherweed	20588	Plant	Freshwater	Established
Carex extensa	long-bract sedge	39597	Plant	Freshwater	Established
Corydalis incisa	incised fumewort		Plant	Freshwater	Established
Cyperus difformis	variable flatsedge	39915	Plant	Freshwater	Established
Cyperus iria	ricefield flatsedge	39934	Plant	Freshwater	Established
Lobelia chinensis	lobelia	507722	Plant	Freshwater	Established
Lysimachia nummularia	moneywort	23993	Plant	Freshwater	Established
Lysimachia vulgaris	garden loosestrife	24002	Plant	Freshwater	Established
Lythrum salicaria	purple loosestrife	27079	Plant	Freshwater	Established
Murdannia keisak	marsh dewflower	39145	Plant	Freshwater	Established
Persicaria hydropiper	water-pepper	518732	Plant	Freshwater	Established
Phalaris arundinacea	reed canary-grass	41335	Plant	Freshwater	Established
Ranunculus lingua	greater spearwort		Plant	Freshwater	Established
Rorippa nasturtium-aquaticum	watercress	23255	Plant	Freshwater	Established
Spergularia marina	saltmarsh sandspurry				
Cygnus olor	mute swan	174985	Bird	Freshwater	Widespread
Carcinus maenas	green crab	98734	Crustacean	Marine	Widespread
Eriocheir sinensis	mitten crab	99058	Crustacean	Marine	Widespread
Faxonius rusticus	rusty crayfish	1133773	Crustacean	Freshwater	Widespread
Hemigrapsus sanguineus	banded shore crab	621740	Crustacean	Marine	Widespread
Carassius auratus	Goldfish	163350	Fish	Freshwater	Widespread
Ctenopharyngodon idella	grass carp	163537	Fish	Freshwater	Widespread
Cyprinus carpio	common carp	163344	Fish	Freshwater	Widespread
Lepomis cyanellus	green sunfish	168132	Fish	Freshwater	Widespread
Cepaea nemoralis	Brown-lipped snail	77910	Mollusk	Freshwater	Widespread
Corbicula fulminea	Golden clam	81387	Mollusk	Freshwater	Widespread
Littorina littorea	common periwinkle	70419	Mollusk	Marine	Widespread
Rangia cuneata	Wedge rangia	80962	Mollusk	Marine	Widespread

Scientific Name	Common Name	ITISI Number	Taxa	Habitat	Status
Utterbackia imbecillis	Paper pondshell	568432	Mollusk	Freshwater	Widespread
Littorina littorea	common periwinkle	70419	Mollusk	Marine	Widespread
Teredo navalis	naval shipworm	81862	Mollusk	Marine	Widespread
Haplosporidium nelsonii	MSX of Oysters	46167	Pathogen - Animal	Marine	Widespread
Iris pseudacorus	yellow iris	43194	Plant	Freshwater	Widespread
Acorus calamus	sweet flag	564989	Plant	Freshwater	Widespread
Trapa natans	water chestnut	522771	Plant	Freshwater	Widespread
Trachemys scripta elegans	red-eared slider	173823	Reptile	Freshwater	Widespread
Botrylloides violaceus	violate tunicate/orange sheath tunicate		Tunicate	Marine	Widespread
Craspedacusta sowerbyi	peach blossom jellyfish	50776	Cnidarian	Freshwater	Widespread
Bowerbankia gracilis	Creeping bryozoan	155559	Bryozoan	Marine	Widespread
Bowerbankia imbricata	bryozoan (no common name)	155562	Bryozoan	Marine	Widespread
Ficopomatus enigmaticus	estuarine tubeworm	68350	Polychaeta	Marine	Widespread
Alnus glutinosa	black alder		Plant	Freshwater	Widespread
Garveia franciscana	rope grass hydroid	48820	Cnidarian	Marine	Widespread
Gambusia holbrooki	Eastern Mosquitofish	165896	Fish	Freshwater	Untiered
Didymosphenia geminata	rock snot	591283	Algae	Freshwater	Untiered
Ambloplites rupestris	rock bass	168097	Fish	Freshwater	Untiered
Ameiurus melas	black bullhead	164039	Fish	Freshwater	Untiered
Amia calva	bowfin	161104	Fish	Freshwater	Untiered
Esox lucius	Northern Pike	162139	Fish	Freshwater	Untiered
Esox lucius x masquinongy	Tiger Muskellunge	162138	Fish	Freshwater	Untiered
Esox masquinongy	Muskellunge	162144	Fish	Freshwater	Untiered
Ictalurus punctatus	Channel Catfish	163998	Fish	Freshwater	Untiered
Lepomis macrochirus	Bluegill	168141	Fish	Freshwater	Untiered
Micropterus dolomieu	Smallmouth Bass	550562	Fish	Freshwater	Untiered
Micropterus salmoides	Largemouth Bass	168160	Fish	Freshwater	Untiered
Oncorhynchus mykiss	Rainbow Trout	553418	Fish	Freshwater	Untiered
Morone chrysops	white bass	167682	Fish	Freshwater	Untiered
Micropterus salmoides	largemouth bass	168160	Fish	Freshwater	Untiered
Salmo trutta	brown trout	161997	Fish	Freshwater	Untiered

Scientific Name	Common Name	ITISI Number	Taxa	Habitat	Status
Myriophyllum heterophyllum	variable-leaf milfoil	27044	Plant	Freshwater	Untiered
Obelia longissima		49515	Cnidarian	Marine	Untiered
Perkinsus marinus	dermo		Protozoan	Marine	Untiered
Tenellia adspersa	nudibranch	78554	Mollusk	Marine	Untiered
Teredo furcifera	deep-cleft shipworm	568362	Mollusk	Marine	Untiered

APPENDIX C: AIS Ranking Very Highly Invasive in New Jersey

Appendix C: identifies those species ranking very highly as invasive in New Jersey (i.e., the "Top 20"). This content is intended to be used to populate a webpage hosted by NJDEP and is not meant to be a standalone document.

Plants

Large-flowered waterweed (*Egeria densa*)
Taxonomic Serial No.: 38972
Description: Submerged perennial aquatic plant. Green, bushy, finely-toothed leaves growing in whorls of four around the stem. Reproduces via fragmentation, can form dense monotypic stands. Previously referred to as Brazilian waterweed.
Native Range: Native to South America
Pathway: A common aquarium release - now inhabits lakes and rivers, flowing and still waters.
Native look-alike: Common waterweed (*Elodea canadensis*).
Current Ranking in NJ: Emerging: Species with low enough abundance that eradication may still be possible.
Photo Credit: Heather Desko

Creeping water primrose (*Ludwigia peploides ssp. glabrescens*)
Taxonomic Serial No.: 27355
Description: Perennial wetland plant. Long narrow leaves in clusters on alternate branching reddish-colored stems with bright yellow five-petalled flowers. Spreads via fragmentation. Utilizes allelopathy to outcompete other species, forming in dense mats, altering flows and sedimentation.
Native Range: native to parts of North and South America.
Pathway: A potential aquatic garden escape because of the attractive long-lived flowers, has invaded quiescent rivers and streams, lakeshores, wetlands, and wet ditches.
Native look-alike: Common look-alike is native wetland plant evening primrose (Ludwigia palustris).
Current Ranking in NJ: Emerging: Species with low enough abundance that eradication may still be possible.
Photo Credit: USGS-NAS

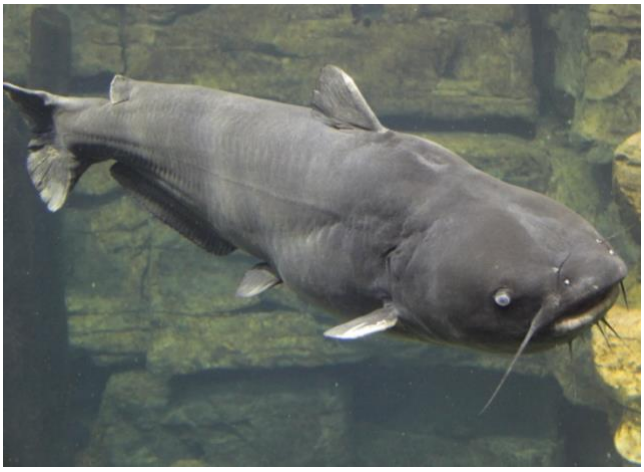
Fanwort (*Cabomba caroliniana*) - Taxonomic Serial No.: 18408
Description: Submerged, rooted perennial plant that can form very dense growth. Leaves are submerged, opposite and fan-shaped. Also, can have floating, entire, elliptical leaves and tiny white flowers. Spread via fragmentation and seed. Another common name is genus name: Cabomba. Previously called Carolina fanwort.
Native Range: Native to the southern United States.
Pathway: A common aquarium release, now invades flowing or still waters
Current Ranking in NJ: Emerging: Species with low enough abundance that eradication may still be possible.
Photo credit: Leslie J Mehrhoff, University of Connecticut, Bugwood.org.

Hydrilla (*Hydrilla verticillata*)
Taxonomic Serial No.: 38974
Description: Submerged perennial that invades many types of waterbodies. Small green leaves are visibly toothed in whorls of 3-8 around the stem. Spreads by fragments, tubers, and turions. Forms very dense mats of vegetation.
Native Range: native to Asia
Pathway: A common aquarium release, now invades rivers, streams, reservoirs, and lakes.
Native look-alike: Common waterweed (*Elodea canadensis*).
Current Ranking in NJ: Emerging: Species with low enough abundance that eradication may still be possible.
Photo credit: Nicole White

Parrotfeather (*Myriophyllum aquaticum*) -
Taxonomic Serial No.: 503904
Description: Emergent leaves are very bright green, heavily divided, in whorls of four to six around the stem. Submersed leaves are more limp and less brightly colored.
Native Range: Native to South America.
Pathway: A common aquarium release, now invades rivers, streams, reservoirs, and lakes.
Current Ranking in NJ: Emerging: Species with low enough abundance that eradication may still be possible.
Photo credit: Leslie J Mehrhoff, University of Connecticut, Bugwood.org.

Water chestnut (*Trapa natans*) –
Taxonomic Serial No.: 522771
Description: Floating annual plant that invades freshwater lakes, ponds, and slow-moving areas of rivers and streams. Leaves are large floating rosettes with saw toothed edges and air-filled sacs. Seeds are abundant with four barbed spines hanging from rosette stalks from June to August. Thin submerged stems can reach 12-15 feet in length and anchor to the sediment with fine roots.
Native Range: native to Eurasia and Africa
Pathway: Commonly transported by watercraft/boat trailers. Seeds may also be transported by currents/wave action and potentially by wildlife.
Current Ranking in NJ: Widespread: Species with great abundance within New Jersey that management goals are local control and protection of key native species.
Photo credit: Heather Desko

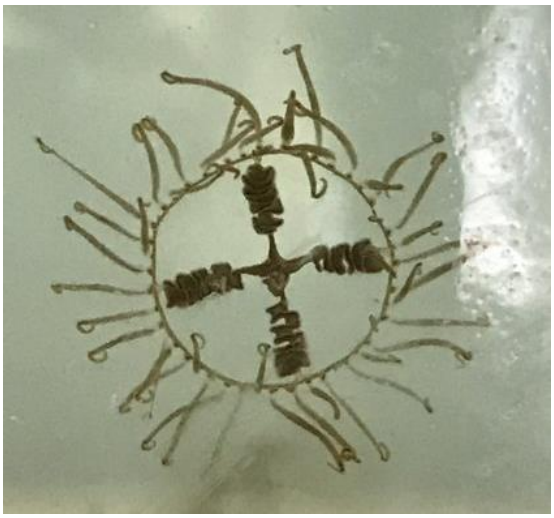
Mudmat (*Glossostigma cleistanthum*) -
Taxonomic Serial No.: 834093
Description: This freshwater wetland plant invades quiescent shorelines and can grow as a submerged or emergent plant. It has tiny leaves emerging from creeping horizontal stems. Leaves grow in pairs and are linear at the base with slightly broader tips. Submersed plants have self-fertilizing flowers, while emergent plants have insect pollinated flowers producing seed capsules.
Native Range: A native to Australia and New Zealand, now invades muddy substrates of littoral zones in full sun.
Pathway: Likely introduced to the United States as an aquarium release with subsequent spread by migrating waterfowl.
Native look-alike: Limosella (mudwort)
Current Ranking in NJ: Emerging: Species with low enough abundance that eradication may still be possible.
Photo credit: Heather Desko



Blue catfish (*Ictalurus furcatus*)
Taxonomic Serial No.: 163997
Description: This freshwater fish's distinguishing features are straight edge anal fin. Capable of tolerating a range of salinity, dissolved oxygen, and temperature conditions. Highly omnivorous. Spring to early summer spawning with male guarding eggs and fry.
Native Range: native to the Mississippi River basin and Gulf of Mexico drainage.
Pathway: A common sport fish may have been intentionally stocked by anglers or unintentionally stocked as an accidental contaminant in stocking of channel catfish (*Ictalurus punctatus*) and has since been introduced to large, turbid, mixed-bottomed freshwater or brackish waterbodies throughout the U.S.
Native look-alike: channel catfish (*Ictalurus furcatus*).
Current Ranking in NJ: Emerging: Species with low enough abundance that eradication may still be possible.

Mystery snail (*Cipangopaludina chinensis*)
Taxonomic Serial No.: 70329
Description: This freshwater mollusk has a large globose shell with concentrically marked opercula and can reach up to 64 mm in size. This species varies in color from olive green to greenish brown, to reddish brown.
Native Range: Native to Southeast Asia, Japan, and eastern Russia
Pathway: May have been released as intentional stocking for food source and more recently as aquarium release, now invades slow-moving freshwater rivers, streams, and lakes with soft, muddy or silty bottoms.
Look-alike: commonly mistaken for another invasive snail: *Cipangopaludina japonica*
Current Ranking in NJ: Currently ranked as Emerging in New Jersey: Species with low enough abundance that eradication may still be possible.
Photo credit: Amy Benson – USGS

Silty pond mussel (*Sinanodonta woodiana*)
Taxonomic Serial No.: 983676
Description: This freshwater mollusk is greenish to brownish in color, subovate in shape, and grows up to 12 inches in length. The inner mother-of-pear (nacre) is white to bluish white in color. Dependent upon fish host for part of its life cycle, it is a broad host generalist and can utilize a variety of fish species.
Native Range: Native to East Asia.
Pathway: It has been widely introduced outside its native range (including to Europe), most likely arrived as a hitchhiker in contaminated aquaculture (i.e. imported bighead carp) and has become highly invasive in slow running rivers and eutrophic ponds with muddier substrate.
Native look-alike: Eastern Floater (*Pyganodon cataracta*)
Current Ranking in NJ: Emerging: Species with low enough abundance that eradication may still be possible.
Photo credit: Allen Barlow



Clinging jellyfish (*Gonionemus vertens*)
Taxonomic Serial No.: 50740
Description: This marine hydrozoan, adults (medusae) ranging between 10 and 25 mm in diameter, is readily distinguished by the reddish-orange crosslike pattern visible across their transparent bell. Tentacles, ranging from 60 – 90 in number, have adhesive pads on the distal ends which allow this species to cling to benthic substrate (e.g., sea grasses, algae), which lends to this hydrozoan's common name.
Native Range: Coastal temperate regions of the western Pacific and along the coastlines of the Alaskan Aleution Islands and British Columbia, Canada.
Pathway: Mainly international shipping, though speculated that earlier introductions were achieved through Pacific oyster transplants and release from aquaria. Now invade shallow coastal alcoves and embayments where submerged aquatic vegetation and or macroalgae are abundant, and tidal disturbances and fluctuation are minimal...
Native look-alike: Can be confused with a marine/estuarine hydrozoan with no common name: *Nemopsis bachei*
Current Ranking in NJ: Emerging: Species with low enough abundance that eradication may still be possible in isolated cases; may be more difficult in larger areas (I.e., Barnegat Bay).
Photo Credit: NJDEP – Division of Science and Research.

Flathead catfish (*Pylodictis olivaris)*
Taxonomic Serial No.: 164029
Description: This freshwater fish has a flattened head with tiny eyes and a protruding lower jaw. Adults can grow up to 60 inches in length and weigh between 30 to 100 pounds. Usually brownish-yellow in color on top, with cream to yellow colored undersides.
Native Range: Native to the Mississippi River Basin, Great Lakes, and Ohio River drainage and now invades reservoirs, lakes, rivers, and large streams with deep still muddy waters and ample sheltering debris.
Pathway: Most likely spread via intentional stocking and release by anglers for game and food fishing.
Native look-alike: Most often confused with channel catfish (*Ictalarus punctuates*) but distinguishable by extending upper jaw and forked tail.
Current Ranking in NJ: Emerging: Species with low enough abundance that eradication may still be possible.
Photo credit: Bugwood.org.

Right-handed mud snail (*Potamopyrgus antipodarum*)
Taxonomic Serial No.: 205006
Description: This tiny freshwater mollusk usually only reaches 4-6mm in length and can vary in color between gray, light brown, and dark brown. The shell is elongated with right-hand coiling (dextral) and can have 7-8 whorls separated by deep grooves.
Native Range: Native to freshwater streams and lakes of New Zealand and adjacent small islands but has become naturalized in Australia and Europe and invasive within the Musconetcong River in New Jersey.
Pathway: Snails likely introduced via ship ballast water and in the water of live sportfish (can be transported in the guts of fish and wildlife). They can also be unintentionally moved in recreational gear. Now invade silty, disturbed watersheds with high nutrient flows and filamentous algae growth, preferring littoral zones in lakes or shallow streams with silt and organic matter substrates.
Current Ranking in NJ: Currently ranked as Emerging in New Jersey: Species with low enough abundance that eradication may still be possible.
Ecological and Socioeconomic Impacts: Due to high spread potential, this species may outcompete native grazers and inhibit colonization by other macroinvertebrates. Potentially alter nutrient flows, altering primary production in streams, and biofoul facilities drawing from infested waters.

Northern snakehead (*Channa argus*)
Taxonomic Serial No.: 166680
Description: This freshwater fish is long and thin, growing to a maximum of 33 inches. Overall brown in color with distinct dark splotches and a single dorsal fin running down the length of the fish. All fins are supported only by rays.
Native Range: China, Russia, and Korea.
Pathway: This species was most likely released intentionally both from the aquarium trade and from the live market trade as a food source and now invades a wide-range of aquatic habitats with capacity to overwinter under ice.
Native look-alike: Bowfin (Amia calva)
Current Ranking in NJ: Currently ranked as Established within New Jersey: Species with moderate abundance in New Jersey, management goal of containment.
Photo Credit: Ryan Hagerty, U.S. Fish and Wildlife Service

Red swamp crayfish (*Procambarus clarkii*)
Taxonomic Serial No.: 97491
Description: this crayfish now invades a variety of freshwater and brackish habitats that offer sheltering debris. Dark red in color with elongate claws. They can grow from 2 to almost 5 inches. Ecosystem engineer that digs burrows. Opportunistic feeder. Sexually mature in as few as two months with two reproductive cycles per year.
Native Range: Native to the Gulf of Mexico
Pathway: Multiple pathways exist for introduction from aquarium releases, biological supply trade, and aquaculture. Now invades a variety of freshwater habitats including rivers, lakes, ponds, streams, canals, seasonally flooded swamps and marshes, and ditches with mud or sand bottoms and plenty of organic debris.
Native look-alike: Distinct bright red color sets this species apart from natives.
Current Ranking in NJ: Emerging: Species with low enough abundance that eradication may still be possible.
Photo Credit: Drew Gaddy

Spiny waterflea (*Bythotrephes longimanus*) - Taxonomic Serial No.: 684624
Description: This freshwater invertebrate is a crustacean (and relative of crayfish and shrimp). A type of microscopic aquatic zooplankton, spiny water flea adults can measure as small as ¼ of an inch with a single long tail.
Native Range: Eastern Europe to Western Asia
Pathway: Believed to be an international shipping ballast water introduction to the Great Lakes, and is now potentially spread by various vectors including water currents, recreational boating (in live wells, ballast tanks, and bilge areas) and can even be transported on fishing nets and fishing lines. Now typically invades large, cold lakes and reservoirs (and have been found to tolerate slightly warmer waters and even brackish waters).
Native look-alike: Distinct from other native zooplankton due to the single long tail. However, very similar in appearance to the invasive fishhook waterflea (*Cercopagis pengoi*)
Current Ranking in NJ: Buffer: Species found within Eastern North America and New Jersey invasion potential is established.
Ecological and Socioeconomic Impacts: Has cause a decline in the population of zooplankton as a result of predation.
Photo: Gary Montz, Bugwood.org

Round Goby (*Neogobius melanostomus*) - Taxonomic Serial No.: 172072
Description: Bottom-dwelling fish now invades large fresh and brackish waterbodies. Brownish gray in color with dark brown and black splotches, they are distinguished from other species by fully scaled bodies, fused and scallop-shaped pelvic fins, and a prominent black spot on their first dorsal fin. Nesting season is April through September. Their voracious appetites allow them to displace and outcompete native species.
Native Range: native to Europe
Pathway:
Native look-alike:

Current Ranking in NJ: Buffer: Species found within Eastern North America and New Jersey invasion potential is established.
Ecological and Socioeconomic Impacts:
Photo: Brent Boscarino

Mittencrab *(Eriocheir sinensis)*
Taxonomic Serial No.: 99058
Description: Distinct dense patches of bristles (resembling mittens) covering their claws, except for white tips. Adults carapace are approximately 3 inches long, with legs being twice as long the carapace.
Native Range: Native to China, South Korea, and Macau.
Pathway: Most likely introduced in ballast water from transoceanic shipping and now invade brackish water (for breeding) and freshwater (during non-breeding).
Native look-alike: Mitten-like pads make this species distinct. Larval crabs require professional identification.
Current Ranking in NJ: Widespread: Highly invasive species with great abundance in New Jersey, management goal of local control
Photo credit: California Department of Fish and Game

Dead man's fingers (*Codium fragile*)
Taxonomic Serial No.: 6897
Description: Tissue is thick, spongy, finger-like forking branches from an irregular holdfast. The branches are covered with densly packed, short hairs, giving a felt-like slimy texture. Growing up to 3 feet long.
Native Range: Northwest Pacific (Japan)
Pathway: A true global invader, this species probably became introduced from spores in ballast water as well as in contaminated seafood shipments (oysters).
Current Ranking in NJ: Emerging: Species with low enough abundance that eradication may still be possible.
Photo credit: tangatwhenua, iNaturalist.

Swamp Eel *(Monopterus albus)*
Taxonomic Serial No.: 166697
Description: Fish with tapering tail, blunt snout, and lacking pectoral and pelvic fins. Dorsal, anal, and caudal fins are rudimentary, with caudal fins often absent. Adults can reach a meter in length. Olive or brown in color with irregular dark flecks
Native Range: Native to East and Southeast Asia, ranging as far west as India.
Pathway: Most likely introduced due to intentional stocking as food sources or cultural practices.
Native look-alike: Can be confused with native American eel or Bowfin.
Current Ranking in NJ: Emerging: Species with low enough abundance that eradication may still be possible.
Photo credit: iNaturalist

APPENDIX D: New Jersey Aquatic Invaders Watch List

Appendix B contains a subset of the non-native aquatic species compiled by the NJAISMP Species Categorization Working Group in Appendix B: Species List that were:

1.) *ranked as "watch", "buffer", or "encroaching"*
2.) *and may be significant-early detect species, or may require specialized surveys (i.e., they fall outside the line of traditional pond or lake management surveys) or technology (i.e., eDNA testing) to detect.*

Watch = AIS currently present outside eastern North America but has a known introduction pathway to New Jersey,
Buffer = AIS within Eastern North America and New Jersey invasion potential is established,
Encroaching = AIS found within 100 miles of New Jersey border/border waters,

Scientific Name	Common Name	ITISI Number	Taxa	Habitat	Status
Prymnesium parvum	golden algae	2170	Algae	Freshwater	Watch
Electra pilosa	hairy sea mat	155868	Cnidarian	Marine	Watch
Corella eumyota	orange-tipped sea squirt	159160	Tunicate	Marine	Watch
Styela canopus	rough sea squirt	159350	Tunicate	Marine	Watch
Caulerpa taxifolia	killer green algae	6974	Algae	Marine	Buffer
Colpomenia peregrina	sea potato	11426	Algae	Marine	Buffer
Dasysiphonia japonica	Siphoned feather weed		Algae	Marine	Buffer
Grateloupia turuturu	devil's tongue weed		Algae	Marine	Buffer
Membranipora membranacea	lacy crust bryozoan	155824	Bryozoan	Marine	Buffer
Tricellaria inopinata	unexpected bryozoan		Bryozoan	Marine	Buffer
Aiptasiogeton eruptaurantia	pink-spotted sea anemone	52771	Cnidarian	Marine	Buffer
Cambarus robustus	big water crayfish	97400	Crustacean	Freshwater	Buffer
Procambarus virginalis	marbled crayfish	1134174	Crustacean	Freshwater	Buffer
Hemimysis anomala	Bloody-red shrimp	90568	Crustacean	Freshwater	Buffer
Orconectes immunis	Calico Crayfish	97446	Crustacean	Freshwater	Buffer
Amphibalanus amphit1ucius11terite	red-striped barnacle	89616	Crustacean	Marine	Buffer
Bythotrephes longimanus	spiny waterflea	684624	Invertebrate	Freshwater	Buffer
Cercopagis pengoi	fishhook waterflea	684625	Invertebrate	Freshwater	Buffer
Rapana venosa	veined rapa whelk		Mollusk	Marine	Buffer
Sphaerium corneum	invasive fingernail clam	81392	Mollusk	Freshwater	Buffer
Batrachochytrium dendrobatidis	chytrid pathogen of frogs		Pathogen - Animal	Freshwater	Buffer
Batrachochytrium salamandrivorans	chytrid pathogen of salamanders		Pathogen - Animal	Freshwater	Buffer
Vitex rotundifolia	beach vitex	505725	Plant	Marine	Buffer
Halichondria bowerbanki	yellow sun sponge	48398	Sponge	Marine	Buffer

Scientific Name	Common Name	ITISI Number	Taxa	Habitat	Status
Ascidiella aspersa	dirty sea squirt	159213	Tunicate	Marine	Buffer
Diplosoma listerianum	compound sea squirt/diplosoma tunicate	159099	Tunicate	Marine	Buffer
Dreissena bugensis	quagga mussel	1089645	Mollusk	Freshwater	Encroaching
Dreissena polymorpha	zebra mussel	81339	Mollusk	Freshwater	Encroaching
Obelia bidentata	double-toothed hydroid	49532	cnidarian	Marine	Encroaching
Barentsia benedeni	entoproct	156746	Animal	Marine	Encroaching
Amathia verticillate	spaghetti bryozoan		Bryozoan	Marine	Encroaching
Buglua simplex	bushy bryozoan	206725	Bryozoan	Marine	Encroaching
Bugula neritina	purple bushy bryozoan	156056	Bryozoan	Marine	Encroaching
Diadumene lineata	orange-striped anemone	52757	Cnidarian	Marine	Encroaching
Caprella mutica	spiny red caprellid amphipod, skeleton shrimp	656389	Crustacean	Marine	Encroaching
Ianiropsis serricaudis	isopod	544802	Crustacean	Marine	Encroaching
Praunus flexuosus	mysid	90181	Crustacean	Marine	Encroaching
Radix auricularia	big-eared radix	76526	Mollusk	Freshwater	Encroaching
Valvata piscinalis	blue-eyed stream valvata	70348	Mollusk	Freshwater	Encroaching
Neodexiospira brasiliensis	tubeworm	68355	Mollusk	Marine	Encroaching
Didemnum vexillum	sea squirt / carpet tunicate		Tunicate	Marine	Encroaching
Clavelina lepadiformis	lightbulb sea squirt	158867	Tunicate	Marine	Encroaching
Styela plicata	pleated sea squirt	159338	Tunicate	Marine	Encroaching

APPENDIX E: New Jersey AIS Risk Assessment Tool

Appendix E is designed to rate AIS that occur or may occur within New Jersey and to determine their potential to become serious pests. This tool may be utilized to inform decision making (i.e., prioritize use of limited funds for EDRR or as justification for which species should be listed/not listed on a state-wide regulated species list).

For each of the following categories, select the number that best applies. Numerical values are weighted to increase the value of important factors over less important ones. Choose the best number that applies, intermediate scores can be used.

GEOGRAPHICAL INFORMATION

Invasive in other areas

0 *Very low*– not known to be invasive in other parts of the world, or invasiveness is unknown (research required)
2 *Low* – known to be invasive in climates dissimilar to New Jerseys' current climate
3 *Medium* – known to be invasive in climates similar to New Jerseys' predicted climate models for the next 10 years
5 *High* – known to be invasive in geographically/climactically similar areas to New Jersey

Habitat Availability: Are there susceptible habitats for this species and how common or widespread are they in New Jersey?
1 *Low* – Habitat is very limited, usually restricted to a small watershed or part of a watershed (e.g., waterflea in large lakes/reservoirs)
3 *Medium* – Habitat encompasses ¼ or less of New Jersey (e.g. nearshore areas)
5 *High* – Habitat covers large regions or multiple counties (freshwater ponds, lakes and wetlands); or its limited to a few locations of high economic or ecological value (e.g. ISPZs or RTE species habitat)

Proximity to New Jersey: What is the current distribution of the species?
1 *Watch* – Occurs outside eastern North America but has a known introduction pathway to New Jersey
2 *Buffer* – found within eastern North America and New Jersey invasion potential is established
3 *Encroaching* – found within 100 miles of New Jersey border/border waters
4 *Emerging* – occurs in low abundance within New Jersey
5 *Established* – occurs in medium or great abundance within New Jersey

Current Distribution: What is the current distribution within New Jersey?
0 *Not present* – Not known to occur in New Jersey
1 *Underreported* – Unreported in New Jersey but survey required, current survey methods would not account for species presence
2 *Emerging* – occurs in low abundance within New Jersey
3 *Established* – occurs in medium abundance within New Jersey
4 *Widespread* – occurs in great abundance within New Jersey

BIOLOGICAL INFORMATION

Environmental Factors: Do abiotic factors in the environment affect establishment and spread of the species? (e.g., calcium, pH, salt)
1 *Low* – Severely confined by abiotic factors (zebra mussels requiring >12ppm calcium)
2 *Medium* – Moderately confined by environmental factors (salinity)
3 *High* – Highly adapted to a variety of environmental conditions, facultative

Reproductive Traits: How does this species reproduce? Is rapid population increase likely?
0 *Negligible* – Not self-fertile, or is dioecious and opposite sex is not present; or complicated life stage requirement and not all hosts are present
1 *Very Low* – Reproduction is only by seed, produces few seeds, or seed viability and longevity are low.
2 *Low* – Reproduction is vegetative (e.g., by root fragments, rhizomes, tubers, turions)
3 *Medium* – Produces many seeds, and/or seeds of short longevity (<5 years)
4 *High* – Produces many seeds and/or seeds of moderate longevity (5-10 years)
5 *Very High* – Has two or more reproductive traits (e.g., seeds are long-lived >10 years and spreads vegetatively)

Biological Factors: Do biotic factors restrict or aid establishment and spread of the species?
0 *Negligible* – i.e., Host is not present for parasitic life stages.
1 *Low* – Biotic factors highly suppress reproduction or heavily damage reproduction for an extended period
2 *Medium* – Biotic factors partially restrict or moderately impact growth and reproduction, impacts sporadic or short-lived (i.e., natural predators or pathogens exist)
3 *High* – Few biotic interactions restrict growth and reproduction. Species expresses full growth and reproductive potential.

Reproductive potential and spread after establishment – Non-human factors: How well can the species spread by natural means?
0 *Negligible* – No potential for natural spread in New Jersey
1 *Low* – Low Potential for local spread within a year, has moderate reproductive potential or some mobility of propagules (e.g., propagules transported locally by animals, water movement in lakes or ponds, not wind-blown)
2 *Medium* – Moderate potential for natural spread with either high reproductive potential or highly mobile propagules (e.g., propagules spread by moving water, or dispersed over long distances by animals)
3 *High* – Potential for rapid natural spread throughout the susceptible range, high reproductive capacity and highly mobile propagules. Seeds/fragments are wind/water dispersed over large areas.

Potential of species to be spread by humans. What human activities contribute to the spread of species?

1 *Low* – Potential for introduction of movement minimal (not moved by trade, not readily transported by recreation)
2 *Medium* – Potential for introduction or off-site movement moderate (limited market potential, but recreational spread likely)
3 *High* – Potential to be introduced or moved within state high (widely propagated and sold, high potential for movement by contaminated watercraft and equipment in shipping or recreational activities)

IMPACT INFORMATION
Ecological Impact:
0 *Negligible*: Not yet assessed, equal outcome, or insignificant positive
1 *Low*: Insignificant negative
2 *Medium*: Significant negative
3 *High*: High negative, or Significant risk to ISPZs or RTE species habitat

Economic Impact: What impact does/can the species have on New Jersey's agriculture and economy?
0 *Negligible* – Causes few, if any, economic impacts
1 *Low* – Potential to, or causes low economic impact to agriculture; may impact urban areas
2 *Medium* – Potential to, or causes moderate impacts to property values, recreational access/activities, recreational fisheries
3 *High* – Potential to, or causes high impacts in recreational fisheries or commercial fishery yields, commodity value, or increasing production costs, impacts drinking water quality, impacts energy production or commercial infrastructure (e.g., Dressenid mussels clogging water intake pipes).

Impact on Health: What is the impact of this species on human, animal, and livestock health?
0 *Negligible* – Has no impact on human or animal health
1 *Low* – May cause minor health problems of short duration, minor allergy symptoms
2 *Medium* – May cause severe health problems through chronic toxicity, or significant injury
3 *High* – Causes death from ingestion of small amounts, acute toxicity (e.g., HABs)

Impact on Environmental Justice Areas
0 *Negligible* – Has no disproportionate impact to environmental justice areas
1 *Medium* – May moderately disproportionately affect environmental justice areas including historically minority, low-income, or indigenous populations
2 *High* – May severely disproportionately affect environmental justice areas including historically unrepresented, minority, low-income, or indigenous populations

Control efficacy: What level of control of this species can be expected with proper timing, equipment, pesticides, and biological control agents?
1 *Very low* – Easily controlled by common non-chemical control. Measures (e.g., hand-pulling)
2 *Low* – Somewhat difficult to control, generally requires pesticide treatments which reduce density/fecundity; biocontrol provides partial control
3 *Medium* – Treatment options marginally effective or costly. Significant non-target impacts may result from maximum control rates. Biological control agents are undeveloped or ineffective.
4 *High* – No effective treatments known or control costs very expensive. Species may occur in large water bodies or river system where containment and complete control are not feasible. Impacts to non-target species could not be avoided).

Total Score: Add Scores
Risk Category: 36-51 = A 24-36 = B <24 = unlisted

This risk assessment was modified by WG from the USDA-APHIS Risk Assessment for the introduction of new plant species Vers 3.6. (Accessed via: https://www.aphis.usda.gov/aphis/ourfocus/planthealth/import-information/commodity-import-approval-process/risk-assessment/analysis)

APPENDIX F: NJAISMP Strategy & Action Implementation Table

Appendix F is designed to identify appropriate lead agencies, cooperating entities, and estimated funding required to undertake actions listed in the plan. Actions are rated according to "Priority" with the understanding that all of the listed actions are important, and in-fact vital to implement a comprehensive AIS Management Plan for the State. The "Priority" ratings are included to set a realistic timeline for tasks to be implemented within the first five years. "High" Priority actions will need to be implemented within the first year and second year following approval of the Plan. "Medium" Priority actions will need to be implemented within three to four years following approval of the Plan, and "Low" Priority actions will need to be implemented before the end of Year 5 after the Plan is approved. Some actions require their own funding source, while other actions can be completed under previous budget lines. "NJDEP" may include staff from various divisions including NJ State Park Service, NJ Fish & Wildlife, NJ Natural Heritage Program, etc.

Special characters:

&: designates action items that can be accomplished under the creation of a NJAIS Coordinator Position

^: designates action items that can be accomplished under the creation of a Statewide AIS Database Manager

Actions	Lead Agcy	Coop. Orgs	$ or FTE FY1	$ or FTE FY2-5	State Funding($)	Federal Funding($)	Other Funding	Priority
1.1.1 Establish AIS Coordinator Position within NJDEP	**NJDEP**		**1.0&**	**1.0&**	**90,000**		**USFWS State Plan Grant Program**	**Critical**
1.1.2 Develop multi-year budget necessary for state program	NJDEP		&	&				High
1.1.3 Identify gaps in authority based on Existing Authorities and Programs	NJDEP	USFWS	&	&				High
1.1.4 Partner with neighboring states to coordinate cross jurisdictional goals	NJDEP	NJDA, NYSDEC, PADCNR, PFBC	&	&				High
1.2.1 Establish Statewide AIS Database Manager Position within NJDEP.	**NJDEP**	**iMapInvasives, NatureServe**	**1.0^**	**1.0^**	**18,750**	**56,250**	**USFWS**	**Critical**
1.2.2 Establish iMapInvasives as the state-wide standard for AIS reporting and database in New Jersey.	**NJDEP**	**iMapInvasives, NatureServe, NYNJTC**	**7,500**	**7,500**	**7,500**			**Critical**
1.2.3 Participate in standing meetings held by data managers from neighboring states each month to standardize data (including "NatureServe" and ANS task force data managers.	NJDEP	iMapInvasives, NatureServe, NYSDEC, PADCNR, PFBC, ANS Task Force	^	^				High
1.2.4 Forge partnerships with community science programs in an effort to contribute AIS data to iMapInvasives via various projects and events (i.e., Regional AIS Landing Blitz)	NJDEP	Rutgers, NJ SeaGrant, MAPAIS, NEANS,	^	^				High

Actions	Lead Agcy	Coop. Orgs	$ or FTE FY1	$ or FTE FY2-5	State Funding($)	Federal Funding($)	Other Funding	Priority
1.2.5 Bulk upload all validated reports for New Jersey from other sources into iMapInvasives	NJDEP	NJISST, NYNJTC, NY/PA iMap	^	^				High
1.2.6 Upload data sets (confidentially if needed) from AIS survey and management projects being conducted at the state or municipal to iMapInvasives. Make this practice standard in all new contract language.	NJDEP	iMapInvasives, Lake Managers/consultants, researchers, NJISST	^	^				High
2.1.1 Evaluate ecological and socio-economic risks associated with pathways identified in this AISMP.	NJDEP		&	&				Med
2.1.2 Create “Pathway Mitigation Measures Table” of current and potential mitigation measures for each pathway (a draft can be found in Appendix A).	NJDEP		&	&				Med
2.1.3 Identify any gaps in current regulatory or volunteer-driven pathway mitigation strategies and propose new regulations/protocols if needed.	NJDEP	USDA-APHIS	&	&				Med
2.1.4 Propose Education campaign that all users of public boat launches should take "reasonable" precautions to prevent the introduction/spread of AIS and coordinate with action items under Strategy 3D to ensure training, signage, and decontamination is prioritized within the state.		MWA, FoHVOS	&	&				Med
2.1.5 Create system to label species as prohibited/regulated/unregulated and provide procedure to review additions. Propose additions as needed through legislation.	NJDEP	USDA-APHIS						Med

Actions	Lead Agcy	Coop. Orgs	$ or FTE FY1	$ or FTE FY2-5	State Funding($)	Federal Funding($)	Other Funding	Priority
2.2.1 Establish Species Categorization Work Group (Chaired by NJ AIS Coordinator)	NJDEP	Lake Managers, researchers, NJISST Technical Advisory Committee aquatic experts	&	&				High
2.2.2 Compile species list as living document and categorize species based on distribution and risk (a draft can be found in Appendix B)	NJDEP	Species Categorization WG	&	&				High
2.2.3 Coordinate annual ranking of AIS by Species Categorization Working Group using data available and expert knowledge	NJDEP	Species Categorization WG	&	&				High
2.2.4 Maintain species profiles on NJDEP website for species listed in Appendix B	NJDEP		&	&				Med
2.2.5 Evaluate list of excluded AIS deemed harmful, injurious, or noxious and expand as needed for New Jersey	NJDEP	USDA-APHIS	&	&				Med
2.2.6 Periodically refine list of most important “watch species” as new data becomes available	NJDEP	Species Categorization WG	&	&				Med
2.2.7 Participate in existing AIS meeting with bordering states/tasks forces/panels to share species data			&	&				High
2.3.1 Establish the Prioritization Working Group with individuals serving on the Species Categorization Working Group as well as state/federal regulators such as USDA-APHIS, port authorities, NJDEP Fish & Wildlife, NJ Department of Agriculture, and AIS coordinators from neighboring States.	NJDEP	Species Categorization WG, USDA-APHIS, NJ Port Authority, NJDA, NY/PA	&	&				High
2.3.2 Utilize existing assessment and prioritization tools to model risk for various species within NJ.			&	&				Med

Actions	Lead Agcy	Coop. Orgs	$ or FTE FY1	$ or FTE FY2-5	State Funding($)	Federal Funding($)	Other Funding	Priority
2.3.3 Create and utilize procedure to review additions to New Jersey's State list of Prohibited/Regulated AIS (using risk assessments and distribution status).								Med
2.4.1 Establish an AIS Education and Outreach Working Group including environmental education staff from various NJDEP divisions (NJ State Park Service, NJ Fish & Wildlife, etc.), as well as staff/representatives from NJ Sea Grant, Rutgers Cooperative Extension, Rutgers Environmental Stewards, Indigenous Peoples, Riverkeepers, and Watershed Associations.	NJDEP	NJ State Park Service, NJ Fish & Wildlife, NJ Sea Grant, Rutgers Cooperative Extension, Rutgers Environmental Stewards, Indigenous Peoples, Riverkeepers, and Watershed Associations	&	&				High
2.4.2 Disseminate "Clean, drain, dry" protocols for New Jersey boaters/anglers and information page with self-certification section for and distribute to all Marine Services Bureau Boating Safety Course Locations.	NJDEP	NJ Sea Grant, NJ State Marine Police, NJ PARKS, Power Squadron	&	&				Med
2.4.3 Design and provide templates for AIS launch signage and disposal station construction to municipal groups.	NJDEP	County and town municipalities, NJ PARKS, Land Trusts	&	&				Med
2.4.4 Create and disseminate self-certification pledges with protocols for various user groups (e.g., boater safety course, fishing tournament permit applicants, waterfowl hunter permit applicants).	NJDEP	Power Squadron, NJ PARKS	&	&				Low
2.4.5 Create and distribute guidance on ways to properly dispose of unwanted aquarium pets/plants to retail locations.	NJDEP	Invasive Species Action Network / Don’t Let it Loose Campaign	&	&				Low
2.4.6 Create database of existing AIS prevention resources to appropriate user groups (e.g., GoBoatingNJ.org for boaters).	NJDEP	GoBoatingNJ		&				Low

Actions	Lead Agcy	Coop. Orgs	$ or FTE FY1	$ or FTE FY2-5	State Funding($)	Federal Funding($)	Other Funding	Priority
2.4.7 Create documentation and signage reflecting Indigenous names for waterbodies, species present, and historical water uses of various sites.	NJDEP	Nanticoke Lenni-Lenape, Powhatan Renape Nation, Ramapough Lenape Indian Nation, and Inter-Tribal People of New Jersey		&				Med
2.5.1 Develop state-wide Watercraft Inspection Program for New Jersey	NJDEP			&				Med
2.5.2 Develop a Watercraft Inspection Stewards Handbook (including inspection protocols), training materials, and statewide digital application (app).	NJDEP	AIS E&O WG		&				Med
2.5.3 Ensure that WISP guidelines are consistent and practical for the State of New Jersey (by incorporating working group/public feedback).	NJDEP	AIS E&O WG						Med
2.5.4 Develop a list of freshwater and marine launches that should have decontamination stations and/or disposal stations installed.	NJDEP	AIS E&O WG						Med
2.5.5 Provide design guidance and designate funding for installation of decontamination/disposal stations and instructional signage.	NJDEP	AIS E&O WG		&				Med
2.5.6 Create a self-certification process for launching/retrieving at launches with no steward on duty (including decontamination procedures for watercraft/equipment).	NJDEP	AIS E&O WG		&				Low
2.5.7 Develop AIS informational signage for installation at launches.	NJDEP	AIS E&O WG	&					Med

Actions	Lead Agcy	Coop. Orgs	$ or FTE FY1	$ or FTE FY2-5	State Funding($)	Federal Funding($)	Other Funding	Priority
2.5.8 Implement data collection and reporting systems to track the results of the watercraft inspection program (in collaboration with neighboring states).	NJDEP	iMapInvasives, NYSDEC, PADCNR		^				Low
2.6.1 The NJAIS Coordinator, with support from the Education and Outreach Working Group, should identify and develop materials for training opportunities to educate water resource managers that may encounter AIS.	NJDEP	AIS E&O WG		&				Low
2.6.2 Create and provide "AIS Identification" training (focus on Species List categories "Encroaching" and "Emerging" in New Jersey).	NJDEP	AIS E&O WG		&				Low
2.6.3 Create and provide "Reporting to iMapInvasives" training for professionals and the public.	NJDEP	IMapInvasives, NYSDEC, PADCNR		^				High
2.6.4 Create and provide "Watercraft Inspection Steward Protocol" training for launch attendants.	NJDEP	NJWSA		&				Med
2.6.5 Create and provide "Watercraft Decontamination Protocols" training for sites with decontamination stations.	NJDEP	NJWSA		&				Med
2.6.6 Provide Best Management Practices for AIS Management on Public Lands for State, County, and Local Park and Wildlife Management Area Managers (Case study presentations)	NJDEP	NJWSA		&				High
2.6.7 Provide Recommended Management Practices for Aquatic Farms – Agricultural Management Practices (AMPS) Aquatic Organism Health Management Plan (Rutgers Cooperative Extension).	NJDA							Med

Actions	Lead Agcy	Coop. Orgs	$ or FTE FY1	$ or FTE FY2-5	State Funding($)	Federal Funding($)	Other Funding	Priority
2.6.8 Provide Level 2 Inspector and Decontamination Training by the Pacific States Marine Fisheries Commission for marina employees.	NJDEP	NJ SeaGrant, PSMFC		&				Low
3.1.1 The NJAIS Coordinator along with the Prioritization Working Group will enlist a selection of AIS experts across various taxa to be on call to identify EDRR species and validate presence records.	NJDEP	Prioritization WG, NALMS, NEAPMS		&				Med
3.1.2 Foster partnerships with industries and universities to promote applied research and technology to survey and early detection efforts	NJDEP	Universities, researchers, NALMS, NEAPMS		&				Low
3.1.3 Use Appendix F: AIS Risk Assessment Tool to model risk for various species within New Jersey.	NJDEP	Prioritization WG, iMapInvasives, NYSDEC, PADCNR		& ^				Med
3.1.4 Implement an "early detection" system for regular monitoring and surveying of waterbodies for AIS, created by the Prioritization Working Group.	NJDEP	Prioritization WG, Species Categorization WG, iMapInvasives		& ^				Med
3.1.5 Provide uniform procedures for reporting and verifying new AIS detections within the state.	NJDEP	Prioritization WG,	& ^					High
3.2.1 Implement new tools from iMapInvasives state-wide database as they become available to organize AIS distribution and treatment records (including adding sources such as eDNA detections and other novel research methods).	NJDEP	iMapInvasives, NYSDEC, PADCNR		^				Low

Actions	Lead Agcy	Coop. Orgs	$ or FTE FY1	$ or FTE FY2-5	State Funding($)	Federal Funding($)	Other Funding	Priority
3.3.1 Establish an Invasive Species Protection Zone (ISPZ) Working Group made up of agency and other staff (including land managers) that work with federally or state-listed rare, threatened, and/or endangered species as well as ecologically significant natural communities (including the Register of Natural Areas).	NJDEP	NJ Natural Heritage Program, Natural Areas Council, Pinelands Commission, Highlands Council, USFWS National Wildlife Refuges, NJFWS Ecological Services Field Offices, Nanticoke Lenni-Lenape, Powhatan Renape Nation, Ramapough Lenape Indian Nation, and Inter-Tribal People of New Jersey	&	&				High
3.3.2 Designate list of "Invasive Species Protection Zones" ISPZs by identifying biodiversity-rich sites with sensitive/protected aquatic species.	NJDEP	ISPZ WG		&				High
3.3.3 Explore USFWS Recovery Challenge Grants (linked in Appendix G: Reference Links) as a potential funding source for development of ISPZs.	NJDEP	USFWS, ISPZ WG		&				Low
3.3.4 Rank list of ISPZs as priority for state-funded surveillance, EDRR, and restoration initiatives.	NJDEP	ISPZ WG		&				Low
4.1.1 Establish a Rapid Response Working Group (RRWG)	NJDEP	Environmental education staff from various NJDEP divisions (NJ State Park Service, NJ Fish & Wildlife, etc.), NJ Sea Grant, Rutgers Cooperative Extension, Rutgers Environmental Stewards, Indigenous Peoples	&					High

Actions	Lead Agcy	Coop. Orgs	$ or FTE FY1	$ or FTE FY2-5	State Funding($)	Federal Funding($)	Other Funding	Priority
4.1.2 Develop and implement a New Jersey AIS Rapid Response Plan to serve as an inter-agency decision support tool designed to aid regulatory agencies in conducting a coordinated and structured response to new AIS infestations within the state.	NJDEP	RRWG		&				Med
4.1.3 Create and implement an "Incident Command System" chart detailing current organizational structure and authority to establish a communication strategy and implementation workflow that outlines the steps to determine the appropriate management response (e.g., control/eradication).	NJDEP	RRWG		&				Med
4.1.4 Designate funding for rapid response projects for high priority species.	NJDEP			&				Med
4.1.5 Identify what type of training support personnel should receive and what equipment needs exist so that rapid response operations can be quickly mobilized.	NJDEP	RRWG		&				Med
4.1.6 Train relevant agency staff and water resource managers to use the protocol to ensure coordinated state-wide response efforts.	NJDEP	RRWG		&				Med
4.1.7 Develop BMP list containing rapid scientific assessment tools, management response, and adaptive management case studies for species identified in Species List. Include templates for management option decision-making process including eradication, control, no-action, education	NJDEP	RRWG		&				Med

Actions	Lead Agcy	Coop. Orgs	$ or FTE FY1	$ or FTE FY2-5	State Funding($)	Federal Funding($)	Other Funding	Priority
4.1.8 Compile case study examples from species identified in Appendix B: New Jersey Aquatic Invasive Species List and Appendix E: Ecological Risk Assessment Tool to be used in Rapid Response Plan.	NJDEP	RRWG		&				Low
4.1.9 Assess what legislative/regulatory barriers could impede rapid response action and whether blanket state-wide permits should be issued (including emergency authorization of pesticides) for specific control techniques for particular species or for particular settings (e.g., ISPZs) to speed up timeline.	NJDEP	USFWS		&				Med
4.1.10 Meet with neighboring states and relevant federal agencies to dovetail the Rapid Response Plan with existing IS/AIS Rapid Response in New York and Pennsylvania, including existing mutual aid.	NJDEP	NYSDEC, PADCNR, USFWS, USGS		&				Med
4.1.11 The New Jersey AIS Rapid Response Plan will be based on adaptive management – where impacts are assessed, management is applied, variables and results are properly documented, and changes made to strategies as treatment outcomes are assessed and options weighed.	NJDEP	RRWG		&				Low
4.2.1 Ensure state-permitted AIS control projects work to limit impacts to sensitive ecosystems by providing restoration BMPs to permittees.	NJDEP			&				Med
4.2.2 Compile and share a repository of regional restoration case studies.	NJDEP		&	&				Low

Actions	Lead Agcy	Coop. Orgs	$ or FTE FY1	$ or FTE FY2-5	State Funding($)	Federal Funding($)	Other Funding	Priority
4.2.3 Compile metrics and provide water resource managers with tools/guidance to measure success of restoration projects.	NJDEP		&	&				Med
4.2.4 Secure funding to create capacity for Indigenous participation in native plant and animal restoration projects.	NJDEP	Nanticoke Lenni-Lenape, Powhatan Renape Nation, Ramapough Lenape Indian Nation, and Inter-Tribal People of New Jersey		&				Med
5.1.1 Request an annual appropriation from NJ State Budget for invasive species plan implementation and priority projects.	NJDEP		&	&				High
5.1.2 Once NJAISMP is ANSTF-approved, apply annually for the USFWS State and Interstate Aquatic Nuisance Species Management Plan Grant Program to design, direction and coordination of AIS management activities, this funding could also be used to support an AIS coordinator position within the state. (Action 1.1.1)	NJDEP	ANSTF	&	&				High
5.1.3 Prepare and submit Annual Report to USFWS State and Interstate Aquatic Nuisance Species Management Plan Grant Program	NJDEP	All WGs	&	&				High
5.1.4 Ensure that tools can be updated for climate change scenarios	NJDEP	USGS		&				Low
5.2.1 Develop program evaluation metrics (using Strategy 5.2 as a guide) to evaluate AISMP every 5 years.	NJDEP	ANSTF		&				Low

APPENDIX G: Reference Links

Appendix G is a list of links and materials referenced throughout the AISMP. These include potential funding sources, regulatory documents and protocols.

Decontamination Protocol Recommendations for Freshwater Monitoring: (In Prep)

NJDEP Fish Stocking Permit Application and List of Commercial Fish Hatcheries: https://dep.nj.gov/njfw/fishing/freshwater/freshwater-fisheries-permits/#

New Jersey Department of Environmental Protection Grants and Loans Program: https://dep.nj.gov/grantandloanprograms/#full-list-of-grants-and-loans

Endangered Species – Conservation Wildlife Matching Grant: https://dep.nj.gov/grantandloanprograms/endangered-species-conserve-wildlife-matching-grant/

Green Acres Local Assistance Grants & Loans: https://dep.nj.gov/grantandloanprograms/green-acres-local-assistance-grants-loans/

Natural Climate Solutions Grant: https://dep.nj.gov/grantandloanprograms/natural-climate-solutions-grants/

Play Clean Go NAISMA: https://playcleango.org/about/what-is-playcleango/

APPENDIX H: Public Comments on the AISMP

Appendix H is a list of all public comments received during the 60-day public comment period between 12/5/23- 2/4/24 and the AISMP Core Team's responses to each.

[PLACEHOLDER]

APPENDIX I: New Jersey AIS Case Study Projects

Appendix I is a list of data for a variety of AIS management projects in New Jersey to highlight the range of AIS early detection and rapid response (EDRR) efforts currently underway, protection of sensitive/protected NJ species, multi-agency partnership, and innovative surveillance techniques that could be supported by a state-wide AIS program.

New Jersey AIS Case Studies

New Jersey Case Study Examples: Early Detection & Rapid Response: right-handed mudsnail in Musconetong River

The discovery of the right-handed mudsnail (*Potamopyrgus antipodarum*) in the Musconetcong River in 2018 marked the first sighting of this invasive species in New Jersey. In response to the discovery, the Musconetcong Watershed Association (MWA) has launched extensive educational campaigns targeting user groups such as the fishing and boating communities. MWA has also funded and installed gear cleaning stations and educational signage at all public access points along the river to prevent the spread of the invasive snail. To further prevent the spread, MWA volunteers are trained in species-specific decontamination protocols between monitoring sites. It is recommended that, in addition to using brushes to physically remove the snail, one should treat boots, waders and gear with 409 Degreaser Formula, Virkon Aquatic or if viable, freeze gear for a minimum of 8 hours. However, it is always good practice to clean, drain and dry gear between trips, when possible. To determine the extent and spread of the tiny, aquatic mudsnail within the watershed, MWA has partnered with the National Park Service and NJDEP for intensive monitoring, including eDNA analyses. As a result of these efforts, *P. antipodarum* was confirmed at four additional stations along the Musconetcong River in 2021. The continued monitoring of the invasive snail's distribution and spread is crucial to protecting the river's native species and ecosystem. The MWA's partnership with other organizations and volunteers, along with their educational campaigns and installation of cleaning stations, serves as a model for proactive invasive species management and prevention.

Early Detection & Rapid Response – Swamp Eels in Silver Lake

Swamp Eels (*Monopterus albus*) were first reported in Silver Lake, a privately-owned 10-acre lake in Gibbsboro, New Jersey in the spring of 2008. NJDEP Fish & Wildlife staff completed a thorough evaluation of the lake and surrounding waters via backpack electrofishing. Swamp Eels were predominantly found within the lake while a few individuals were collected nearby, both upstream and downstream of the lake. Multiple years classes were present in the lake with a wide range of sizes collected in 2008. Swamp Eels appear to favor the rip-rap banks which make up about 75% of the lake's shoreline. NJDEP Fish & Wildlife staff met with the property owners of the waterbody in 2008 to discuss plans to continue to monitor and remove Swamp Eels. Fish & Wildlife staff contacted Dr. Leo Nico, Ph.D., fisheries biologist with USGS, Florida, based on work that he had completed with swamp eels in Florida, and his investigations to whether introduced populations could be eradicated with rotenone. Swamp Eels can breathe air, using atmospheric oxygen absorbed via a vascularized breathing apparatus at the rear of their mouths (Shafland et al. 2010). This unique characteristic significantly impacts the efficacy of rotenone on Swamp Eels. A sight evaluation with Dr. Nico, at Silver Lake, confirmed that he

believed that due to the complexity of the habitat, rotenone would not be an effective methodology or guarantee a 100% success rate for removal of Swamp Eels from Silver Lake. The project was put on hold based on the uncertainty of success and associated cost. In addition, a paper published by Dr. Nico indicated that the concentration of rotenone required to attain 100% mortality in a lab far exceed recommended treatment concentrations.

Swamp Eels collected in 2008 were later aged by the Academy of Natural Science, fisheries biologist David Keller and determined that six year-classes were represented ranging from three to ten years. NJDEP Fish & Wildlife staff sampled surrounding waters in 2008 to determine if the species had spread throughout the Cooper River drainage. No significant numbers of Swamp Eels have been collected outside of Silver Lake, however sampling just downstream of the lake has consistently resulted in a few individuals collected. This introduction was presumably from an illegal release, possibly from an aquarium hobbyist. NJDEP Fish & Wildlife responded quickly and thoroughly with the resources that were available at the time in 2008. Staff diligently completed annual electrofishing surveys to monitor and remove Swamp Eels. Over 1800 individuals were collected and removed from 2008 – 2018. A more comprehensive study to evaluate the species distribution within the watershed is necessary and eDNA is a perfect screening tool that is now available to us.

Innovative Monitoring Technique: clinging jellyfish

The use of environmental DNA (eDNA) for species detection is an innovative monitoring technique accomplished through collection of environmental samples (e.g., water, sediment, plant materials), and proven to be cost-effective and less labor-intensive compared to traditional sampling. In cases requiring large geographical areas in need of survey, eDNA detection methods can provide water resource managers with a reasonably easy mechanism to discover the presence of invasive species despite the absence of detection of physical specimens. Since 2016, active monitoring and research has been conducted to assess the abundance and distribution of clinging jellyfish (*Gonionemus vertens*) in New Jersey. Both in-field, sweep-net sampling and water collection have been employed to detect new populations as well as verify known establishment of this hydrozoan. The NJDEP Division of Science and Research has been developing primer candidates to detect presence/absence of *G. vertens* and continues this work in concert with field validation. DNA primers built selectively off sequenced, NJ-collected specimens ensures higher probability of detection. Collectively, these efforts have provided information that is used to map observations of clinging jellyfish (i.e., presence vs. absence) and sampling efforts to detect this species in select coastal waters, which began June 9th, 2016, are currently ongoing. The purpose is to provide the public throughout the summer season with up-to-date information on the areas where this species has been observed, as well as estimates on abundance. This survey data serves to protect public health and reduce the impacts of AIS. An interactive map containing additional information on clinging jellyfish is available in the Reference Links section.

Education and Detection: AIS in Watershed Management Area 8

Raritan Headwaters Association's (RHA) annual stream monitoring program provides general detection of potential invasive macroinvertebrates and educates stream monitors on aquatic invasive species through our training program. All our stream monitors receive a fact-sheet guide of common AIS that they should be on the lookout for when conducting annual sampling. To prevent the spread of AIS, RHA scientists show monitors how to properly decontaminate their gear and sampling equipment before sampling the next site. RHA has included AIS in their summer education program for high school students as part of an aquatic macrophyte workshop that trains students on plant identification and proactive invasive species prevention and mitigation strategies. In 2022, RHA hosted a Centenary University student who assisted in conducting a modified Point-Intercept Methodology (PIM) aquatic vegetation survey to build an aquatic plant database of presence, abundance, and distribution in watershed (WMA8) and identify potential threats connected to other water resources. As a result of the survey and a literature review, the following invasive aquatic macrophyte species were detected within the watershed: Curly-leaf pondweed (*Potamogeton crispus*) and Common Frogbit (*Hydrocharis morus-ranae*).

Adaptive Management: Delaware and Raritan Canal Hydrilla Control

The Delaware and Raritan Canal is a 60-mile-long historic barge canal that was rehabilitated in the 1950's to serve as a water supply source. The New Jersey Water Supply Authority (NJWSA) is tasked with addressing aquatic plant growth affecting flow through the Delaware and Raritan Canal while balancing the requirements, demands and desires of a diverse range of interested parties, including historic and popular linear state park, golf courses and water treatment facilities that supply drinking water to more than one million people. In 2016, hydrilla (*Hydrilla verticillata*) was incidentally discovered during conventional mechanical raking and led to an initial baseline survey and discovery of more than 13 miles of hydrilla infestation. Subsequently, an Aquatic Plant Management Plan was developed, submersed aquatic vegetation was mapped, a low-dose herbicide application was conducted for six years, and the infestation was subject to an intensive monitoring plan. The NJWSA initiated a low-dose continuous (60-120 days) herbicide treatment using a liquid formulation of fluridone. After 5 years of treatment, no hydrilla vegetation nor tubers (reproductive structures) were found in the Canal. Due to hydrilla's presence in the adjacent and connected Delaware River, monitoring for hydrilla and other AIS will continue in the Delaware and Raritan Canal, and appropriate management options will be utilized as needed.

Multi-Agency Partnership: Silty Pond Mussel

In 2009, the Silty Pond Mussel (S*inanodonta woodiana*) was confirmed in former aquaculture ponds in the Wickecheoke Creek watershed in Hunterdon County on a property preserved by the New Jersey Conservation Foundation (NJCF). Nine aquaculture ponds had previously been used to raise grass carp (*Ctenopharyngodon Idella*). Bighead carp (*Hypophthalmichthys nobilis*) were also found in the aquaculture ponds, which have a severe invasion potential documented elsewhere in the United States. N.J. Admin. Code § Section 7:25-6.2 prohibits possession and stocking of bighead carp in the State of New Jersey and labels them "potentially dangerous". A multi-agency response effort was undertaken to control the bighead carp and it was at that time the silty pond mussel infestation was discovered and ultimately identified by Dr. Arthur Bogan, a mollusk researcher and curator at the University of North Carolina. Silty pond mussels have a complex life cycle including a juvenile form that is ectoparasitic (and must attach to the gills of fish). The accidental introduction of silty pond mussel to Europe has been linked to the aquaculture trade, specifically bighead carp and grass carp. Once introduced, silty pond mussel may utilize a variety of fish species as hosts. This introduction represented the first documented population of silty pond mussel in North America. To avoid potential contamination of surrounding fish populations, NJCF conducted a rotenone treatment to kill all host fish within the aquaculture ponds, as well as a copper treatments in 2015 and 2019 to kill the mussels. This effort was partially funded by the MAPAIS. NJCF worked with Rutgers University to conduct eDNA analyses in 2020-2022, and confirmed persistence of *S. woodiana* within the former aquaculture ponds, as well as potentially downstream in the Wickecheoke Creek and in the Raritan River. Additional funding and resources for monitoring efforts were supported by the USFWS, NJDEP, NJWSA, and the Lower Delaware Wild and Scenic River (US National Park Service). Additional efforts are underway in 2023 for a follow-up eradication effort using a copper molluscicide and additional eDNA and physical mussel surveys within the Wickecheoke Creek and Raritan River Watersheds. To date, the response effots including survey and pesticide treatments for this project total more than $160,000. This example stresses the importance of mitigating known introduction pathways and vectors. A sampling protocol to screen for the presence of both bighead carp and silty pond mussel prior to stocking in the aquaculture ponds could have prevented this introduction, significantly decreased ecological risks to Wickecheoke and Raritan watersheds, and decreased spending by orders of magnitude. Advancements in technology, namely, eDNA sampling should now be the standard of cost-effective AIS prevention efforts.