

Aquatic Vertebrate & Invertebrate Species Assessment Protocol

Executive Summary

NatureServe, in cooperation with The Nature Conservancy and the U.S. National Park Service, developed this Invasive Species Assessment Protocol as a tool for assessing, categorizing, and listing non-native invasive vascular plants according to their impact on native species and natural biodiversity in a large geographical area such as a nation, state, province, or ecological region. This protocol is designed to make the process of assessing and listing invasive plants objective and systematic, and to incorporate scientific documentation of the information used to determine each species' rank. This protocol was adopted and modified by Delaware Invasive Species Committee (DISC) for the purpose of updating the state's list of invasive plant and animal species. NatureServe's methodology has previously included assessments of the conservation significance of native plant species; this protocol extends that scope to include animals and non-native species as well. The protocol is used to assess species (or infraspecific taxa, as appropriate) individually for a specified "region of interest" and to assign each species an Invasive Species Impact Rank (I-Rank) of High, Medium, Low, or Insignificant to categorize its negative impact on natural biodiversity within that region. For Delaware's purposes, the "region of interest" has been designated as the entire state. The protocol includes 16 questions, each with four scaled responses (A-D, plus U = unknown). The original NatureServe survey included 20 questions, but was modified to remove 4 unnecessary questions due to Delaware's limited size. The 16 questions are grouped into four sections: Ecological Impact, Current Distribution and Abundance, Trend in Distribution and Abundance, and Management Difficulty. Each species is assessed by considering these questions, with the answers used to calculate a subrank for each of the four sections. An overall I-Rank is then calculated from the subranks. Text comments and citations to information sources are provided as documentation for each answer selected, along with a concise text summary of the major considerations leading to the overall rank. NatureServe is now using this protocol to assess the biodiversity impact of the approximately 3,500 non-native vascular plant species established outside cultivation in the United States.

Introduction and Background

NatureServe, in cooperation with The Nature Conservancy and the U.S. National Park Service, developed this Invasive Species Assessment Protocol as a tool for assessing, categorizing, and listing non-native invasive vascular plants according to their impact on biodiversity in a large area such as a nation, state or province, or ecological region. This protocol is designed to make the process of assessing and listing invasive plants and animals objective and systematic by using a specified set of questions and requiring documentation of the scientific information used to determine each species' rank. Species (or infraspecific taxa, as appropriate) are assessed one at a time for a specified "region of interest" to determine an Invasive Species Impact Rank (I-Rank) categorizing the species' negative impact on natural biodiversity within that region as high, medium, low, or insignificant.

The protocol is designed for assessing the biodiversity impact of those species considered non-native in a specified region of interest, in this instance Delaware, or at least non-native in a portion of the region different from their native range.

- Native Species are those present in part or all of a specified region without direct or indirect human intervention, growing within their native range and natural dispersal potential. Other terms for native species include indigenous and aboriginal.
- Non-native, invasive species are not native to North America (north of Mexico) and are thought to have been introduced by humans and have the ability to cause environmental harm. Non-native, invasive species have the potential for widespread dispersal and establishment, are able to out-compete and displace native flora and fauna, have the potential for rapid growth and high reproductive output, and are capable of becoming established in natural areas.

Note that a species is considered native to a region if it is (or historically was) present as a native in at least one place within that region, even if the species is present as a non-native in a different portion of the same region.

Some but not all of the non-native species present in a given region of interest actually threaten biological diversity. The protocol can be used to rank and list the non-native invasive plant and animal species that threaten biological diversity, which we define as those species that:

1. are present but not native in the region of interest,
2. maintain themselves or recurrently appear in conservation areas or other native species habitats, and
3. negatively affect the native species and other natural biodiversity within the region of interest, generally by outcompeting or hybridizing with native species, or by altering ecological communities or ecosystem processes.

Similar terms include harmful invasive plants and animals.

Assessing the biodiversity impact of the non-native species in a region of interest requires an understanding of the various native plant, animal, fungal, and other species there, as well as the

region's ecological communities and important ecosystems processes, and the conservation importance of various lands and waters within the region of interest. Biodiversity (or biological diversity) has been defined as the variety of life on earth (Wilson, 1988), but is often considered as the variety of naturally occurring life in a specified area. Biodiversity can be assessed at any geographic scale (e.g., county-wide, eco-regional, state/provincial, national, continental, or global) and includes:

- Genetic diversity, or variations in genetic structure among individuals of a species or populations;
- Species diversity, or the variety of species (and infraspecific taxa);
- Higher taxonomic diversity, or the variety of higher taxonomic groups (e.g., families or orders);
- Community diversity, or the variety of identifiable groups of species that occupy and interact in the same habitats;
- Ecosystem diversity, or the variety of ecological units composed of biological communities interacting with the physical environment.

See Wilson (1992) for further discussion.

The Invasive Species Assessment Protocol consists of two yes-no screening questions and 20 weighted multiple-choice assessment questions grouped into four sections which address four major aspects of an invasive species' total impact (Table 1):

I. Ecological Impact (5 questions)

II. Current Distribution and Abundance (2 questions)

III. Trend in Distribution and Abundance (6 questions)

IV. Management Difficulty (3 questions)

Table 1. Summary of Natureserve's Invasive Species Protocol

I. Ecological Impact (5 questions; 50% of I-Rank Score)
1. Impact on Ecosystem Processes (33 points)
2. Impact on Ecological Community Structure (18 points)
3. Impact on Ecological Community Composition (18 points)
4. Impact on Individual Native Plant or Animal Species (9 points)
5. Conservation Significance of the Communities and Native Species Threatened (24 points)
II. Current Distribution and Abundance (2 questions; 25% of I-Rank Score)
6. Current Known Range in Delaware (15 points)
7. Diversity of Habitats or Ecological Systems Invaded in Delaware (3 points)
III. Trend in Distribution and Abundance (6 questions; 15% of I-Rank Score)
8. Current Trend in Total Range Within Delaware (18 points)
9. Long-Distance Dispersal Potential Within Delaware (9 points)
10. Local Range Expansion or Change in Abundance (18 points)
11. Inherent Ability to Invade Conservation Areas and Other Native Species Habitats (6 points)
12. Similar Habitats Invaded Elsewhere (9 points)
13. Reproductive Characteristics (9 points)
IV. Management Difficulty (3 questions; 10% of I-Rank Score)
14. General Management Difficulty (33 points)
15. Impacts of Management on Native Species (15 points)
16. Accessibility of Invaded Areas (3 points)

For each question, assessors may select one of four defined answers (A-D) or specify Unknown (U).

Protocol

Consider the two screening questions (below) before investing substantial effort in assessing a species.

S-1 Establishment in Delaware

Is the species currently established as a non-native (i.e., as a direct or indirect result of human activity) somewhere in Delaware?

- **YES.** Proceed to screening question S-2, below.
- **NO. STOP.** The Invasive Species Assessment Protocol is not applicable to this species. Enter 'Not Applicable' as the Invasive Species Impact Rank (I-Rank), summarize reasons in I-Rank Reasons Summary, and cite at least one information source.

Note: If this question is not readily answered, assessment of the species may either be deferred or as an interim measure, further information on the species' status in Delaware can be sought.

S-2 Occurrence in Native Species Habitat in Delaware

Is this species known to be present in native species habitats somewhere in Delaware?

- **YES.** Proceed to the assessment (16 questions), below.
- **NO. STOP.** This species is an insignificant threat to natural biodiversity in Delaware. Enter 'Insignificant' as the Invasive Species Impact Rank (I-Rank), summarize reasons in I-Rank Reasons Summary, and cite at least one information source.

Note: If this question is not readily answered, assessment of the species may be deferred or as an interim measure, further information on the species' status in native species habitat can be sought. Until this point is verified, the I-Rank should either be 'Insignificant' or 'Unknown.'

Assessment Questions

The following 16 questions are grouped into four sections, for which separate subranks are determined. The Invasive Species Impact Rank (I-Rank) is then determined from the four subranks. The 'Other Considerations' data field may be used to present and document significant information not readily accommodated under any of the 16 assessment questions.

Section I. Ecological Impact

Assess the current impact of the species on the ecosystem processes, ecological communities, and native species within Delaware, to the extent it is known. Where appropriate, give greatest attention to the cumulative impact (e.g., over a period of several decades) of the species on conservation areas and other native species habitats where it is abundant or well established in Delaware, recognizing that impacts may be less severe in places where the species is less established. Impacts on areas that are recovering from disturbance or being restored to native species habitats may be included. However, do not consider impacts restricted to areas such as croplands, orchards, roadsides, industrial sites, and other developed areas that are not native

species habitats, even if such places are included within the boundaries of parks, preserves, or other lands managed for conservation purposes.

1. Impact on Ecosystem Processes

Some non-native species can alter the natural range and variation of abiotic ecosystem processes in ways that significantly diminish the ability of the native species to survive and reproduce. Alterations in ecosystem processes that determine the types of communities that exist in a given area are of greatest concern.

Examples of abiotic ecosystem processes include:

- Fire occurrence, frequency, and intensity
- Geomorphological changes (e.g., erosion and sedimentation rates)
- Hydrological regimes (including soil water table)
- Nutrient and mineral dynamics
- Reductions in light availability (e.g., an aquatic invader covering an entire water body which would otherwise be open)
- Changes in salinity, alkalinity, or pH

Select the single-letter answer (A, B, C, or D) that best characterizes the species, or the single-letter U if unknown. However, if you have not substantially considered the question, leave the answer null.

- A. **Significant.** Major, possibly irreversible, alteration or disruption of abiotic ecosystem processes.
- B. **Moderate.** Substantial alteration in abiotic ecosystem processes.
- C. **Low.** Limited influences abiotic processes.
- D. **Insignificant.** No perceivable impact on abiotic ecosystem processes.
- U. **Unknown.**

2. Impact on Ecological Community Structure

Some non-native species alter the physical structure (at least at some sites), thereby affecting many native species.

Select the single-letter answer (A, B, C, or D) that best characterizes the species, or the single-letter U if unknown. However, if you have not substantially considered the question, leave the answer null.

- A. **Significant.** Major alteration of ecological community structure
- B. **Moderate.** Substantial alteration of ecological community structure
- C. **Low.** Limited influences ecological community structure

- D. **Insignificant.** No impact, establishes within existing community structure without perceivable impact
- U. **Unknown.**

3. Impact on Ecological Community Composition

Some non-native species greatly alter the composition of ecological communities (whether or not they also alter their structure), changing the relative abundance of native species.

Select the single-letter answer (A, B, C, or D) that best characterizes the species, or the single-letter U if unknown. However, if you have not substantially considered the question, leave the answer null.

- A. **Significant.** Causes major alteration in ecological community composition. For example, results in:
- The extirpation or sharp reduction of several locally common native plant or animal species
 - Significant increase in the proportion of other non-native species in the community
 - Suppression of reproduction success of native species, leading to altered community composition over time
- B. **Moderate.** Substantially alters ecological community composition (e.g. produces a significant reduction in the population size of one or more locally common native species in an ecological community)
- C. **Low.** Influences ecological community composition (e.g., reduces recruitment of one or more locally common native species which will likely result in significant reduction in the long-term abundance of these species)
- D. **Insignificant.** No impact; causes no perceivable change in locally common native species populations
- U. **Unknown.**

4. Impact on Individual Native Animal Species

Non-native species often impact the native species of an area. Example of such impacts on native species include:

- Strongly outcompetes a particular native species
- Hybridizes with a particular native species
- Parasitizes a particular native species
- Hosts a non-native disease which damages a particular native species

Select the single-letter answer (A, B, C, or D) that best characterizes the species, or the single-letter U if unknown. However, if you have not substantially considered the question, leave the answer null.

- A. **Significant.** Major impacts on particular native species (e.g., in places they co-occur, has negative impacts on more than 50% of the individuals of one or more native species)
- B. **Moderate.** Substantial impact on particular native species (e.g., has negative impacts on 20 to 50% of the individuals of one or more native species)
- C. **Low** Occasional impact on particular native species (e.g., has negative impacts on 5 to 20% of the individuals of one or more native species)
- D. **Insignificant.** Little or no impact on particular native species (e.g., no reports of competitive suppression, hybridization, parasitism or other particular disproportionate negative impacts)
- U. **Unknown.**

5. Conservation Significance of the Communities and Native Species Threatened

Many non-native species occur primarily in disturbed, low quality habitats that are dominated by widespread native species and other non-native species. Non-native species have a greater impact if they:

- Directly or indirectly threaten native species or ecological communities that are considered rare or vulnerable (e.g., legally protected in the region, such as those federally listed in the U.S.; or considered globally rare)
- Threaten outstanding, high quality occurrences of common ecological communities (e.g., those with NatureServe Element Occurrence Ranks of A or B)

Select the single-letter answer (A, B, C, or D) that best characterizes the species, or the single-letter U if unknown. However, if you have not substantially considered the question, leave the answer null.

- A. **Significant.** For example, often threatens one or more rare or vulnerable native species or ecological communities, and/or high-quality occurrences of more common ecological communities
- B. **Moderate.** For example, may occasionally threaten one or more rare or vulnerable native species or ecological communities, and/or high-quality occurrences of more common ecological communities
- C. **Low.** For example, usually inhabits common unthreatened and rarely threatens rare or vulnerable native species or ecological communities, and/or high-quality occurrences of more common ecological communities
- D. **Insignificant.** For example, found primarily or only in human-disturbed habitats and not known to threaten rare or vulnerable native species or ecological communities, and/or high-quality occurrences of more common ecological communities
- U. **Unknown.**

Section II. Current Distribution and Abundance

Assess the current distribution and abundance of the species within Delaware.

6. Current Known Range in Delaware

The range or distribution is the entire area where the species is present within Delaware as non-native as you currently understand it, not just the range where it has its greatest impacts. The area of distribution is usually much greater than actual acreage infested.

Select the single-letter answer (A, B, C, or D) that best characterizes the species, or the single-letter U if unknown. However, if you have not substantially considered the question, leave the answer null.

- A. **Significant.** Widespread in the state (e.g., >30% of state)
- B. **Moderate.** Substantial part of the state (e.g., 10 - 30% of state)
- C. **Low.** Small part of the state (e.g., 0.1 - 10% of state)
- D. **Insignificant.** Isolated or spotty range in the state (e.g., < 0.1% of state)
- U. **Unknown.**

7. Diversity of Habitats or Ecological Systems Invaded in Delaware

Examples of habitats or ecological systems include:

- Early successional grasslands, shrub-lands and forests
 - Forested wetlands
 - Forested Uplands
 - Tidal and non-tidal wetlands
 - Rivers and Streams
 - Estuarine and marine waters

Select the single-letter answer (A, B, C, or D) that best characterizes the species, or the single-letter U if unknown. However, if you have not substantially considered the question, leave the answer null.

- A. **Significant.** Many distinct habitats or ecological systems invaded
- B. **Moderate.** Moderate number of distinct habitats or ecological systems invaded
- C. **Low.** Small number of habitats or ecological systems invaded, or moderate number (4-5) of similar habitats
- D. **Insignificant.** Only a single habitat or ecological system invaded
- U. **Unknown.**

Section III. Trends in Distribution and Abundance

Assess various trends in the species' distribution and abundance here, as well as its reproductive characteristics and its ability to invade natural habitats.

8. Current Trend in Total Range within Delaware

Select the single-letter answer (A, B, C, or D) that best characterizes the species, or the single-letter U if unknown. However, if you have not substantially considered the question, leave the answer null.

- A. **Significant.** Range expanding in most or all directions, and/or spreading into new portions of the state
- B. **Moderate.** Range increasing in some directions but not most or all
- C. **Low.** Range stable, or areas of range contraction balancing areas of expansion
- D. **Insignificant.** Range decreasing
- U. **Unknown.**

9. Long-Distance Dispersal Potential within Delaware

What is this species' potential for long-distance dispersal on its own, by humans (intentionally or unintentionally), by other animals, or by abiotic factors (e.g., wind, rivers, or floods)?

Select the single-letter answer (A, B, C, or D) that best characterizes the species, or the single-letter U if unknown. However, if you have not substantially considered the question, leave the answer null.

- A. **Significant.** Long-distance dispersal frequent (e.g., species capable of long-distance movements, species frequently carried long distances by humans, wide-ranging birds or mammals, wind and/or river currents [especially eggs or planktonic species or species with planktonic life stages]; or-species sold and/or transported substantial distances)
- B. **Moderate.** Long-distance dispersal infrequent (e.g., species capable of only limited mobility, species carried occasionally by unusually strong winds, more localized birds or mammals, or periodic floods, or species occasionally transported by human actions)
- C. **Low.** Long-distance dispersal rare but known (e.g., major floods, hurricanes, or other unusual weather events)
- D. **Insignificant.** Long-distance dispersal seldom or never
- U. **Unknown.**

10. Local Range Expansion or Change in Abundance

Is the species increasing in abundance within its current non-native range in Delaware and/or locally expanding within or at the edges of this range?

Select the single-letter answer (A, B, C, or D) that best characterizes the species, or the single-letter U if unknown. However, if you have not substantially considered the question, leave the answer null.

- A. **Significant.** Local range and/or species abundance increasing rapidly (e.g., area occupied likely to double within 10 years in most areas where it doesn't already fully occupy its potential habitat), and/or abundance increasing significantly (by >25% of current values) in >75% of the area that it has already invaded
- B. **Moderate.** Local range expanding at a moderate rate (e.g., area occupied likely to increase by 50% in 10 years or to double within 50 years) and/or species abundance increasing significantly (by >25% of current values) in 25%-75% of the area that it has already invaded
- C. **Low.** Local range expanding slowly and/or abundance increasing significantly (by >25% of current values) in only a small portion (<25%) of the area that it has already invaded
- D. **Insignificant.** Species abundance and local range stable or decreasing across the entire area it has already invaded within the region
- U. **Unknown.**

11. Inherent Ability to Invade Native Species Habitats

Consider information indicating the extent to which this species invades well-established, habitats which helps predict whether it will do so in other places.

Select the single-letter answer (A, B, C, or D) that best characterizes the species, or the single-letter U if unknown. However, if you have not substantially considered the question, leave the answer null.

- A. **Significant.** Regularly establishes in undisturbed portions of intact or otherwise healthy, late-successional or mature native species habitats
- B. **Moderate.** Regularly establishes in mid-successional native species habitats, but may establish in late-successional or mature native species habitats following minor one-time or recurrent disturbances (e.g., tree falls, hiking trails, streambank erosion); however, rarely if ever establishing in undisturbed portions of intact mature native species habitat
- C. **Low.** Often establishes in areas where major natural or human-caused disturbance has occurred in the previous 20 years (e.g., post-hurricane sites, landslides, highway corridors), but seldom if ever in undisturbed areas or areas with only minor disturbance
- D. **Insignificant.** Not known to spread significantly into native species habitats on its own (e.g., species may be present only along edges, or may persist from former cultivation)
- U. **Unknown.**

12. Similar Habitats Invaded Elsewhere

Is this species established outside its native range in states outside of Delaware, such as Pennsylvania, New Jersey, Maryland and Virginia? If so, has this species escaped in habitats/ecosystem types that are comparable to habitats/ecosystem types that exist in Delaware, but which it has not yet invaded?

Select the single-letter answer (A, B, C, or D) that best characterizes the species, or the single-letter U if unknown. However, if you have not substantially considered the question, leave the answer null.

- A. **Significant.** Escaped in many surrounding states, which it has not yet invaded in Delaware, but which the habitats exist in Delaware
- B. **Moderate.** Escaped in several habitats or ecosystem types in surrounding states, which it has not yet invaded in Delaware
- C. **Low.** Escaped elsewhere but only in habitat types comparable to those it has already invaded in Delaware
- D. **Insignificant.** Not known as an escape except in Delaware
- U. **Unknown.**

13. Reproductive Characteristics

The following are some reproductive characteristics typical of invasive species; consider which of these characterize this species.

- Produces large numbers of young annually
- Reproduces more than once per year
- Reaches reproductive maturity more rapidly than most species of its lifeform
- Adults protect offspring for an extended period after hatching/birth
- Has other comparable reproductive factors suggesting potential aggressiveness
(Explain in comments)

Select the single-letter answer (A, B, C, or D) that best characterizes the species, or the single-letter U if unknown. However, if you have not substantially considered the question, leave the answer null.

- A. **Significant.** Extremely aggressive (e.g., strongly exhibits three or more of the above characteristics)
- B. **Moderate.** Moderately aggressive (e.g., strongly exhibits two of the above characteristics)
- C. **Low.** Somewhat aggressive (e.g., strongly exhibits one of the above characteristics, or more weakly exhibits a few)
- D. **Insignificant.** Not aggressive (e.g., has none of the above characteristics or weakly exhibits only one)
- U. **Unknown.**

Section IV. Management Difficulty

In addressing the questions in this section, consider particularly known control methods for this species that are feasible and appropriate for use in natural areas and other native species habitats.

14. General Management Difficulty

Given the current state of knowledge regarding management methods, how difficult is it to control an established populations of this species? Consider both the difficulty of control and the extent of existing knowledge regarding the management of this species. Also consider the minimum time commitment needed to control this species (e.g., reduction to acceptable levels which can be maintained with little effort) at a site in which it is abundant or well established, including follow-up surveys and monitoring.

Select the single-letter answer (A, B, C, or D) that best characterizes the species, or the single-letter U if unknown. However, if you have not substantially considered the question, leave the answer null.

- A. **Significant.** Managing this species normally requires a major, long-term investment of human and/or financial resources and time commitment or is not possible with available technology
- B. **Moderate.** Management requires a moderate long-term investment of human and financial resources
- C. **Low.** Managing this species requires a minor short-term investment in human and financial resources
- D. **Insignificant.** Management of this species requires no investment in human and financial resources.
- U. **Unknown.**

15. Impacts of Management on Native Species

Do the effective methods for managing this species normally cause significant and persistent reductions in the abundance of native species or cause other unacceptable damage (sometimes referred to as collateral or non-target damage)?

Select the single-letter answer (A, B, C, or D) that best characterizes the species, or the single-letter U if unknown. However, if you have not substantially considered the question, leave the answer null.

- A. **Significant.** Management impacts often severe, with the only effective methods for managing this species normally causing significant and persistent reductions in the abundance of native species or cause other unacceptable damage (>75% of the time)
- B. **Moderate.** Management impacts moderate, with the only effective methods for managing this species reducing native species abundance or causing other unacceptable damage 25-75% of the time
- C. **Low.** Management impacts minor, with the only effective methods causing significant persistent reductions in native species abundance or cause other unacceptable damage <25% of the time
- D. **Insignificant.** Management impacts insignificant or rare, with effective control methods rarely or never causing significant reductions in native species abundance, or causing only ephemeral reductions (lasting <2 years)
- U. **Unknown.**

16. Accessibility of Invaded Areas

The accessibility of infestations within areas that can't be accessed without specific permissions is considered here, because species found in inaccessible areas are more difficult to control. Consideration should also be given here to accessibility of adjacent areas that are sources of recurrent reintroduction, but not infestations remote from native species habitats.

Select the single-letter answer (A, B, C, or D) that best characterizes the species, or the single-letter U if unknown. However, if you have not substantially considered the question, leave the answer null.

- A. **Significant.** Accessibility problems high, with many invaded areas (>30% of area it infests) not accessible for treatment
- B. **Moderate.** Accessibility problems medium, with a substantial percentage of the area invaded by this species inaccessible (5-30% of the area it infests)
- C. **Low.** Accessibility problems low, with a significant but relatively small percentage of the area invaded by this species inaccessible (<5% of area it infests)
- D. **Insignificant.** Accessibility problems insignificant or rare, with little or none of the area infested by this species inaccessible
- U. **Unknown.**

Aquatic Vertebrates & Invertebrates

Common Name	Scientific Name
Asian Clam	<i>Corbicula fluminea</i>
Asian Shore Crab	<i>Hemigrapsus sanguineus</i>
Chinese Mitten Crab	<i>Eriocheir sinensis</i>
Chinese Mystery Snail	<i>Bellamya chinensis</i>
Chinese Mystery Snail	<i>Cipangopaludina chinensis</i>
Didymo	<i>Didymosphenia geminata</i>
Eel Swimbladder Nematode	<i>Anguillicola crassus</i>
Green Crab	<i>Carcinus maenas</i>
European Periwinkle	<i>Littorina littorea</i>
Japanese Mystery Snail	<i>Bellamya japonica</i>
Japanese Mystery Snail	<i>Cipangopaludina japonica</i>
New Zealand Mud Snail	<i>Potamopyrgus antipodarum</i>
Quagga Mussel	<i>Dreissena bugensis</i>
Red Swamp Crayfish	<i>Procambarus clarkii</i>
Rusty Crayfish	<i>Orconectes rusticus</i>
Southern White River Crayfish	<i>Procambarus zonangulus</i>
Spiny Water Flea	<i>Bythotrephes cederstroemi</i>
Spiny Water Flea	<i>Bythotrephese longimanus</i>
Suminoe Oyster	<i>Crassostrea ariakensis</i>
Veined Rapa Whelk	<i>Rapana venosa</i>
Virile Crayfish	<i>Orconectes virilis</i>
Zebra Mussel	<i>Dreissena polymorpha</i>
Asian Swamp Eel	<i>Monopterus albus</i>
Bigheaded Carp	<i>Hypophthalmichthys nobilis</i>
Blue Catfish	<i>Ictalurus furcatus</i>
Blue Tilapia	<i>Oreochromis aureus</i>
Bullseye Snakehead	<i>Channa marulius</i>
Chinese Mitten Crab	<i>Eriocheir sinensis</i>
Common Carp	<i>Cyprinus carpio</i>
Common Lionfish	<i>Pterois miles</i>
Eastern Mosquitofish	<i>Gambusia holbrooki</i>
European Rudd	<i>Scardinius erythrophthalmus</i>
Flathead Catfish	<i>Pylodictis olivaris</i>
Giant Snakehead	<i>Channa micropeltes</i>
Goldfish	<i>Carassius auratus</i>
Grass Carp	<i>Ctenopharyngodon idella</i>
Grass Carp (triploid)	<i>Ctenopharyngodon idella var. triploid</i>
Ide	<i>Leuciscus idus</i>

Common Name	Scientific Name
Largescale Silver Carp	<i>Hypophthalmichthys harmandi</i>
Lionfish	<i>Pterous volitans</i>
Northern Snakehead	<i>Channa argus</i>
Oriental Weatherfish	<i>Misgurnus anguillicaudatus</i>
Red Lionfish	<i>Pterois volitans</i>
Round Goby	<i>Neogobius melanostomus</i>
Silver Carp	<i>Hypophthalmichthys molitrix</i>
Western Mosquitofish	<i>Gambusia affinis</i>
Mimic Shiner	<i>Notropis volucellus</i>
Blotched Snakehead	<i>Channa maculata</i>
Pacific Oyster	<i>Crassostrea gigas</i>