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Evaluation of Five Freshwater Fish Screening-Level Risk Assessment Protocols and Application to Non-Indigenous Organisms in Trade in Canada

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Canada

Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

Research documents are produced in the official language in which they are provided to the Secretariat.

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TABLE OF CONTENTS

ABSTRACT

Identification and prioritization of aquatic non-indigenous species (NIS) in trade that pose a potential risk to Canada's aquatic ecosystems (i.e., screening-level risk assessment (SLRA)) is an integral component of a three-stage biological risk assessment process developed by Fisheries and Oceans Canada's (DFO) Center of Expertise for Aquatic Risk Assessment (CEARA). DFO has identified fishes in live trade in Canada, but not yet present in Canadian waters, as a priority for screening. There are an estimated 1648 fish species imported to Canada each year through the aquarium, live food, biological supply, and water garden trades. The present document first evaluates the performance of five biological risk assessment tools for predicting establishment and impact of fishes using a validation dataset and then applies a chosen subset of these protocols to a list of freshwater fishes in live trade in Canada identified as having an environmental match (i.e., habitat and climate) to Canada. The five SLRA protocols identified from previous initiatives included: Freshwater Fish Invasiveness Scoring Kit Protocol (FISK); Modified Alberta Risk Assessment Tool (RAT); Montreal RAT; Great Lakes Nonindigenous Species Information System (GLANSIS); and, Notre Dame Statistical RAT. Following evaluation, two questionnaire-based SLRA protocols (Montreal RAT and GLANSIS) and one statistically-based protocol (Notre Dame Statistical RAT) were selected. These three protocols were subsequently applied to the 12 freshwater fishes in live trade that were identified to have an environmental match to Canada. This produced a scientifically defensible species list that allows for better prioritization of national and regional NIS program activities and resource allocation.

Évaluation de cinq protocoles d'évaluation préalable des risques des poissons d'eau douce et application aux organismes non indigènes apparaissant dans le commerce au Canada

RÉSUMÉ

L'identification et la priorisation des espèces aquatiques non indigènes (EANI) apparaissant dans le commerce et qui présentent un risque potentiel pour les écosystèmes aquatiques du Canada (c.-à-d. évaluation préalable des risques [EPR]) font partie intégrante d'un processus en trois étapes d'évaluation du risque biologique élaboré par le Centre d'expertise pour l'analyse des risques aquatiques de Pêches et Océans Canada (MPO). Le MPO a désigné les poissons apparaissant dans le commerce des espèces vivantes au Canada, mais qui ne sont pas encore présentes dans les eaux canadiennes, comme une priorité de l'évaluation préalable. On estime que 1 648 espèces de poissons sont importées au Canada chaque année par l'intermédiaire du commerce d'espèces vivantes destinées aux aquariums, aux jardins d'eau, à l'alimentation, et du commerce de produits biologiques. Le présent document évalue d'abord le rendement de cinq outils d'évaluation du risque biologique servant à prévoir l'établissement et les répercussions des poissons à partir d'un ensemble de données de validation, puis applique un sous-ensemble choisi de ces protocoles à une liste de poissons d'eau douce apparaissant dans le commerce des espèces vivantes au Canada et désignés comme ayant une correspondance environnementale (habitat et climat) avec le Canada. Les cinq protocoles d'EPR cernés dans le cadre d'initiatives antérieures sont les suivants : le protocole Freshwater Fish Invasiveness Screening Kit (FISK); l'outil d'évaluation des risques (OER) modifié de l'Alberta; l'OER de Montréal; le Système d'information sur les espèces aquatiques non indigènes des Grands Lacs (GLANSIS) et l'outil d'évaluation statistique du risque de Notre Dame. Suite à l'évaluation, deux protocoles d'EPR sous forme de questionnaire (OER de Montréal et GLANSIS) et un protocole fondé sur des statistiques (outil d'évaluation statistique du risque de Notre Dame) ont été choisis. Ces trois protocoles ont ensuite été appliqués aux 12 espèces de poissons d'eau douce apparaissant dans le commerce des espèces vivantes désignés comme ayant une correspondance environnementale avec le Canada. Cela a permis d'obtenir une liste d'espèces défendable sur le plan scientifique qui aide à mieux prioriser les activités de programmes et l'affectation des ressources visant les EANI à l'échelle régionale et nationale.

INTRODUCTION

Aquatic invasive species (AIS) threaten global biodiversity (Sala et al. 2000) and are the second leading cause of decline of Canadian freshwater species at risk (Dextrase and Mandrak 2006). The establishment of AIS can reduce the abundance or productivity of sport, commercial, or culturally important species and can cause habitat alteration (Rahel 2002). Therefore, preventing the arrival, establishment, and spread of AIS is an important step to protecting aquatic environments (Kolar 2004).

Fisheries and Oceans Canada (DFO) is mandated to manage and protect Canada's aquatic ecosystems, the health of which are currently jeopardized by the arrival of AIS that can cause ecosystem harm. For example, at least 69 non-indigenous fish species have been introduced to the Great Lakes, half of which are considered established (Mandrak and Cudmore 2010) and include high impact species, such as the Round Goby (*Neogobius melanostomus*) that have altered the ecosystem (Lederer et al. 2008, Poos et al. 2010). To aid in the development of DFO regulation, legislation, and management plans to protect Canadian aquatic environments from the impacts of AIS, DFO's Centre of Expertise for Aquatic Risk Assessment (CEARA) is tasked with identifying, assessing, and prioritizing the threats of current and potential aquatic non-indigenous species (NIS). Biological risk assessment protocols provide an appropriate approach to meet this need, as they generate science advice for informed decision making to prevent potential, or deal with ongoing, invasions by predicting the identity, range, and/or impact of potential invaders (Kolar 2004).

CEARA is developing a three-stage biological risk assessment process for aquatic NIS (Chapman et al. 2006, DFO 2009). The three stages include: (a) *rapid assessment process* (RAP) to assess a species within a few days using minimal information; (b) *screening-level risk assessment* (SLRA) to assess and prioritize a species in about a week using additional information that is readily available (Snyder et al. 2013); and, (c) *detailed-level risk assessment* (DLRA) to assess a species within several months using detailed information (Mandrak et al. 2012). Depending on the goal of the risk assessment, increasingly more detailed risk assessments can be undertaken, with the DLRA providing the strongest defensible advice with the least amount of uncertainty.

NIS are introduced into Canadian fresh waters through various vectors and pathways, some of which are associated with the live trade pathway. A large number of live fishes are imported into Canada every year through stocking, live fish markets, aquarium and baitfish trade, biological supply for research/aquaculture, and garden centres (Marson et al. 2009a,b, Drake 2011, Stephens et al. unpubl. data). This extensive live fish industry poses a potential risk of introducing into, and/or spreading non-indigenous fishes within, Canadian freshwater ecosystems through accidental or deliberate unauthorized release. The Canadian Food Inspection Agency (CFIA) and DFO regulate the import and export of aquatic animal species susceptible to reportable (i.e., diseases of significant importance to aquatic animal health or the Canadian economy) and immediately notifiable (i.e., diseases that do not exist in Canada) diseases through the National Aquatic Animal Health Program, consistent with the international standards set by the World Organisation for Animal Health (OIE). However, there is currently no national regulation of live fish species imported to Canada related to invasiveness. There are also no guidelines for assessment and prioritization as to which fish species in trade are of highest risk should they be accidentally or intentionally introduced into Canadian fresh waters. Using an appropriate SLRA protocol, fish species in live trade can be identified and ranked based on the biological risk they pose to Canada.

BACKGROUND

In 2010, DFO's Aquatic Invasive Species program was tasked by both the Office of the Auditor General and an internal evaluation to establish a protocol to provide a scientifically defensible and relatively quick way of screening and prioritizing aquatic NIS. The national ranking of aquatic NIS, based on the biological risk they pose to Canadian aquatic ecosystems, is necessary to screen species for inclusion in AIS regulatory proposals and to better prioritize national and regional NIS program activities and resource allocation. DFO's Legislative and Regulatory Affairs, also a client in this process, requested science advice to support the development of a national regulatory proposal for addressing aquatic NIS. Specifically, it had requested: (1) a protocol to prioritize aquatic NIS; and, (2) a list of high risk aquatic NIS including those NIS already present in some regions of Canada whose transport into other areas in Canada where not present should be limited. This protocol would allow the ranking of aquatic NIS for national priorities and would be used as a biological screening tool for aquatic NIS to determine (in a short time frame) if a detailed-level risk assessment or a risk management evaluation was required based on existing information.

Screening-level risk assessment was identified as the appropriate level to support the development of these regulations by the Department. A suitable SLRA protocol is applicable in a variety of risk assessment contexts and is a means to quickly assess species known to occur in Canada, as well as species proposed for, or currently found in, trade and other pathways that have intermediate or end points within Canada. Prioritization of aquatic NIS can also be determined using the estimated level of risk posed by the species and associated uncertainty, as quantified by the SLRA (Mandrak et al. 2012). Furthermore, with the establishment of appropriate threshold criteria or parameters, the SLRA can supply a risk-based biological screening of aquatic NIS, providing a priority species list for managers and decision makers that requires either a detailed-level risk assessment or a risk management evaluation (Locke et al. 2011). A SLRA protocol would provide DFO with a scientifically defensible and relatively quick means of screening and prioritizing aquatic NIS based on the biological risk they pose to Canadian aquatic ecosystems.

In 2011, a national Canadian Science Advisory Secretariat (CSAS) science advisory process was initiated to provide science advice on the SLRA protocol for aquatic NIS. This process was to consist of at least two peer-review meetings attended by experts from DFO Science, Legislative and Regulatory Affairs, and other sectors of the Department, as well as invited external participants (e.g., other governmental departments, provincial governments, and academics) who could meaningfully contribute to the science review. Part 1 was held in Montreal, Quebec on November 22-24, 2011 (DFO 2012). At that meeting, participants examined the criteria and methodology used to evaluate the various risk assessment protocols (Snyder et al. 2013) and developed a framework for a SLRA protocol for aquatic NIS. Based on this peer review, it was identified that different SLRA protocols may be required for different aquatic taxa and, hence, prioritization using a single protocol may not be possible. Part 2 was held in Burlington, Ontario on March 19-21, 2013. Participants evaluated the selection and application of the best-performing SLRA protocols for freshwater fishes, molluscs, and plants currently in trade within Canada. The process used to generate species lists for screening for each taxon was also assessed. DFO Legislative and Regulatory Affairs confirmed that screening species not yet in Canada was the priority; therefore, NIS already present in some regions of Canada were not included. Additional meetings, not yet scheduled, will be required in the future to evaluate SLRA protocols for marine NIS, to assess the ability to prioritize all NIS using the chosen SLRA protocols and to screen NIS already present in some regions of Canada.

PURPOSE

This research document evaluates and applies selected SLRA protocols for screening of freshwater fishes in live trade within Canada. Five SLRA protocols were evaluated based on a validation dataset of establishment and ecological impact of known freshwater fishes introduced to the Great Lakes Basin. The SLRA protocols that performed best were then used to screen a list of freshwater fishes in North American trade. This list of freshwater fishes was generated following family-level and species-level habitat and climate matching to Canada for fishes in live trade in Canada. By applying the optimal screening protocol(s) to this list, high risk freshwater fishes not yet in Canada can be identified and considered for inclusion in any regulatory proposals.

METHODS

SELECTION AND EVALUATION OF SLRA PROTOCOLS

Following a review of available screening and prioritization risk assessment protocols using standardized criteria for the determination of their conceptual, scientific, and pragmatic strengths and weaknesses (Snyder et al. 2013) and a scientific peer-review of this methodological review (DFO 2012), a pool of appropriate SLRA protocols for screening AIS was identified. Using criteria and methodology from this review process, five SLRA protocols were selected for evaluation and application for freshwater fishes in live trade within Canada. These included the following: (1) Freshwater Fish Invasiveness Scoring Kit Protocol (FISK, v1.19 Calibrated) (Vilizzi et al. 2007; Appendix 1); (2) modified Alberta Risk Assessment Tool (RAT) (Snyder et al. unpubl. data; Appendix 2); (3) Montreal RAT (DFO 2012; Appendix 3); (4) Great Lakes Nonindigenous Species Information System (GLANSIS) (Sturtevant and Rutherford 2010) risk assessment tool (unpubl. data; Appendix 4); and, (5) Notre Dame statistical RAT (Howeth et al. unpubl. data; Appendix 5). The first four protocols are questionnaire based, while the last protocol is statistically based.

These five protocols were tested using a validation dataset of known successful (n=37) and failed (n=28) NIS in the Great Lakes Basin based primarily on Mandrak and Cudmore (2010). The validation dataset contained information on establishment (i.e., successful/failed from Mandrak and Cudmore (2010)) and impact. Impact was determined using a fish ecological impact questionnaire disseminated to Great Lakes academics, scientists, and managers (Howeth et al. unpubl. data). For each established NIS in the region, the experts were asked to rank the ecological impact (in the categories Unknown, None-low, Moderate, High, Very High) and their confidence in the response (Low or High) (Table 1). Experts were also asked to provide additional information about species that had failed to establish in the region. Twenty-seven experts provided responses (Figure 1). Given that the screening-level risk assessment is to be applied at a national scale, a validation dataset for all of Canada would be preferable for evaluation of these SLRA protocols; however, such data at this scale are lacking.

Table 1. *Ecological impact questions for established species in the Great Lakes, distributed as part of the expert opinion questionnaire in the Great Lakes Basin (Howeth et al. unpubl. data).*

Impact level	**Description**
1 *(none to low)*	Species has little to no discernible impact on existing biota
2 *(moderate)*	Species causes discernible decline in the abundance of existing biota in most locations
3 *(high)*	Species causes discernible decline in the abundance of existing biota and becomes a dominant component of the food web
4 *(very high)*	Species causes discernible decline in the abundance of existing biota with extirpation of species likely. Food webs are highly altered and ecosystem-level consequences apparent

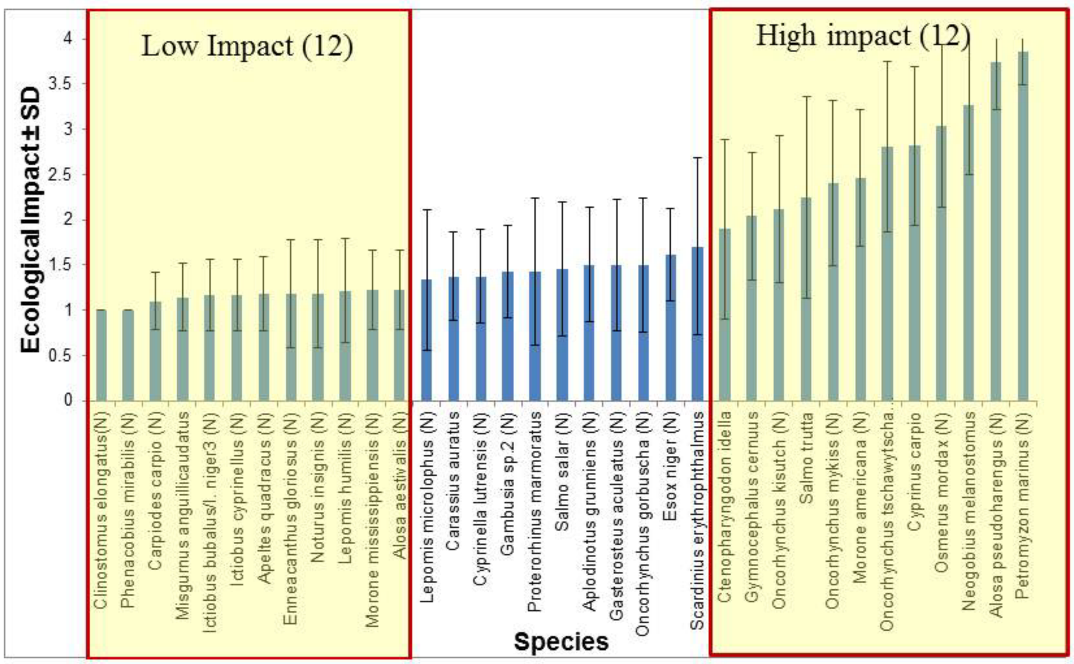

Figure 1. Perceived ecological impact of Great Lakes fishes determined from questionnaire distributed to experts in the Great Lakes Basin (Howeth et al. unpubl. data).

To evaluate the performance of the five SLRA protocols, each of the 65 species was scored using each of the SLRA protocols. For each of the four questionnaire SLRA protocols, a Receiver Operating Characteristic (ROC) curve analysis (pROC package (Robin et al. 2011) in R Version 2.15.1 (R Development Core Team 2012)), and Area Under the Curve (AUC) (Fawcett 2006), which is independent of the proportion of established and not established species included (Caley and Kuhnert 2006), were calculated as metrics of performance. This accounts for the lack of knowledge about the base-rates (Smith et al. 1999) of the species; that is, the proportion of the test data set to the total population of NIS. An AUC score of 1.0 indicates that the model discriminates perfectly between established and not established species (or low and high impact species if that is the measurement), while values near 0.5 indicate no discrimination.

The establishment analysis is straight forward as the categories being compared are established or not established (Table 2). The results of the perceived ecological impact surveys follow a gradient of high to low impact (Figure 1); however, any perceived impact or establishment may be cause for concern. Additionally, because we cannot predict whether species currently considered to be of low impact will become more invasive over time, we compared the AUC when these species were classified with not established species and established NIS species in various combinations (Table 2).

Table 2. Establishment and impact analyses for the SLRA protocol evaluation.

Analysis type	Definition
Establishment	Established or failed
Impact 1	Upper 1/3 of established vs all other species
Impact 2	Upper 2/3 of established species vs lower 1/3 + failed invaders
Impact 3	Upper 1/3 of established species vs lower 1/3 + failed invaders
Impact 4	Top + bottom 1/3 of established species only

Once SLRA protocols were decided upon, the next step was to determine the threshold score required for NIS establishment and impact. For chosen SLRA protocols, thresholds distinguishing either established from failed NIS or high impact from low impact species (as defined in Table 2) were identified by plotting the classification accuracy by score for each of the analysis types identified in Table 2. The optimal threshold would be at the intersection of the two classification accuracy lines (successful, failed) for each analysis type. For each SLRA protocol, this would provide a threshold for establishment and a range of thresholds for impact dependent upon the definition of impact.

FRESHWATER FISHES IN LIVE TRADE IN CANADA

The list of freshwater fishes in live trade in Canada to be screened was generated in the following manner (Figure 2): (1) develop a fish species in trade list; (2) include families considered to be freshwater or euryhaline for further assessment; (3) within these families, select species considered to be freshwater or euryhaline for further assessment; (4) of these fish families and species within that are a habitat match to Canada, select those families whose native range is a climate match to Canada for further assessment; (5) within these remaining families, include only those species whose native and established introduced range is a climate match to Canada; and, (6) screen the remaining species for invasiveness using the SLRA protocol(s) determined to perform the best.

Fish Species in Trade List

Vectors identified through which fish species may arrive in Canada include live food trade, aquarium trade, biological supply for research or aquaculture, and water garden centres. While data describing the import of freshwater fishes in to Canada is generally scarce, species in trade within these vectors were identified using results from a study of live fish import activities in 2004-2005 (Stephens et al. unpubl. data), a survey of species in trade in Toronto, Ontario conducted during 2008-2012 (DFO/OMNR, unpubl. data), the “Great Canadian Aquarium Survey” conducted in 2006 (Marson et al. 2009a), the “Great Canadian Water Garden Survey” conducted in 2006 (Marson et al. 2009b), and a review of data collected on fish by U.S. Fish and Wildlife Service’s Law Enforcement Management Information System (LEMIS) for the period October 2004-November 2005 (Romagosa, unpubl. data). In a collaborative effort by

Canadian Border Services Agency (CBSA) and DFO to estimate the magnitude of the live fish trade in Canada, species and trade volume data were collected for live fishes imported to Canada for food (kg) and aquarium (number) purposes over a one-year period, 2004-2005 (Stephens et al. unpubl. data). Taxonomy (i.e., family, genus and species) of identified fish species in live trade was checked for accuracy, and corrected where necessary, using FishBase (Froese and Pauly 2013) and the *Catalog of Fishes* from the California Academy of Sciences (Eschmeyer 2012). It is possible; however, that some fish species in trade were misidentified by importers (Stephens et al. unpubl. data). Therefore, all misclassified taxa and reports with only common names were removed prior to habitat and climate matching analysis.

Habitat Matching

Fish species in live trade in Canada were included in further analyses if they were a freshwater or euryhaline species. To quickly rule out species in trade from strictly marine families, the habitat associated with each fish family in trade was assessed using FishBase (Froese and Pauly 2013), and *Fishes of the World* (Nelson 2006). Families were assigned to one of three categories: Freshwater, Marine, or Euryhaline. The Euryhaline category identified those families that had euryhaline species, and/or both freshwater and marine species. Species in strictly Freshwater families were considered potentially able to survive within Canadian fresh waters based on the habitat match and were included for further assessment. Species in Marine families were excluded from further analyses. Species belonging to a Euryhaline family were then individually assessed as freshwater, marine, or euryhaline. Freshwater and euryhaline species in Euryhaline families were included for further assessment.

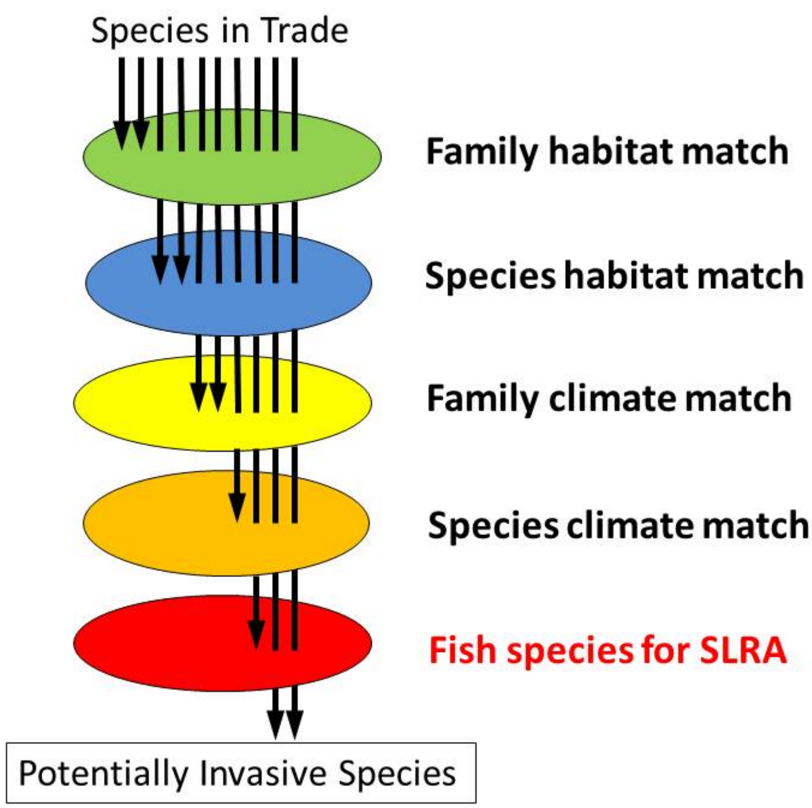

Figure 2. A schematic diagram representing the process to generate the list of freshwater fishes in live trade in Canada to be screened.

Climate Matching

Comparisons of climate characteristics between regions can be used for predicting the potential establishment and spread of NIS in applications of risk assessments for live animal imports (Crombie et al. 2008). *Climatch*, a climate-matching algorithm interface, provides regional climatic scores from a global climate database consisting of information from over 9,000 weather stations around the world (Bureau of Rural Sciences 2008). Using a Euclidean measure, it determines the climatic similarity between a Source region (e.g., fish family or species distribution) and a Target region (e.g., Canada). The climate-match scores range from 10 for the highest level match to zero for the poorest match. Based on freshwater fish introductions in 10 countries, Bomford et al. (2010) determined that at least 20% of the *Climatch* scores were at level 6 or higher for established species; therefore, this was set as the minimum threshold required to include families and species for screening based on climate match.

Climatch Source region files were developed for the native distributions of 153 fish families with freshwater and/or euryhaline species based on Berra (2007). Three families with high species richness and broad distributions were divided into subsets and *Climatch* Source files were developed for each subset (Table 3). *Climatch* analyses were undertaken separately to determine the climatic similarity between each of the 150 fish family and 16 family subset distributions (i.e., Source region) and Canada (i.e., Target region; Figure 3). Families with at least 20% of the *Climatch* scores at level 6 or higher were included for further climate matching assessment.

Table 3. Fish family distributions divided into subsets for the family-level climate match analysis.

Family	**Subsets**
Characidae	North America Central and South America
Cobitidae	Europe Middle East Siberia Central Asia East Asia Southeast Asia
Cyprinidae	North America Africa Europe Middle East Siberia Central Asia East Asia Southeast Asia

Species with a family-level climate match to Canada were then subjected to species-level climate matching. Distribution maps for species within these families were developed using point occurrence data obtained from FishBase (Froese and Pauly 2013), Global Biodiversity Information Facility (GBIF 2013), FishNet2 (2012), and Ocean Biogeographic Information System (OBIS) (Intergovernmental Oceanographic Commission (IOC) of UNESCO 2012). Point occurrence data were supplemented with written species distribution descriptions from these databases and cross-checked with primary literature for outliers where possible. Species distributions were then drawn on to maps created using R 2.15.2.tar.gz (R Development Core Team 2012) and the package ‘maps’ (Brownrigg 2012). These maps were used to develop *Climatch* Source region files, which were subsequently used to determine the climate match between each species and Canada. Species with at least 20% of the *Climatch* scores at level 6 or higher and not currently present in Canada were included for screening.

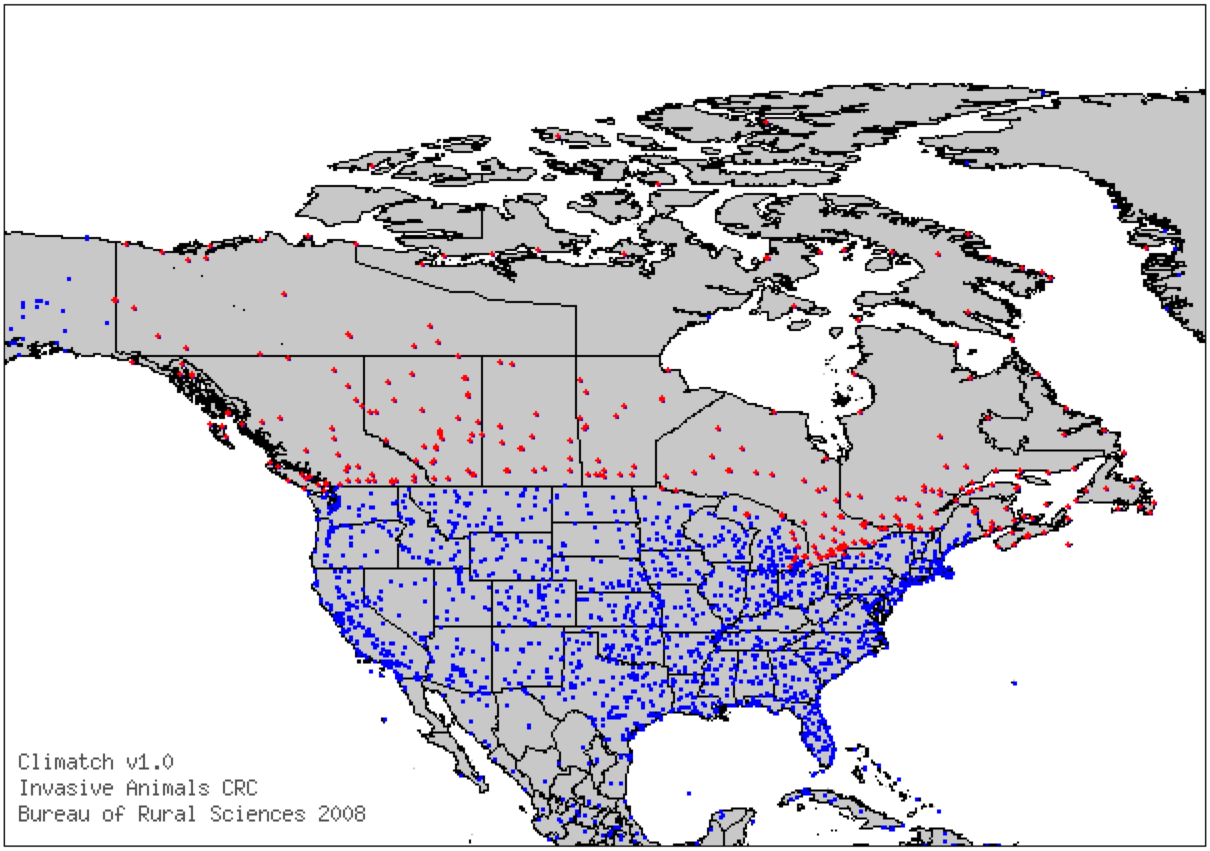

Figure 3. The Climatch Target region layer for Canada.

Screening Species Using SLRA Protocols

Species included following the habitat and climate matching exercises were then screened using the best performing SLRA protocols.

RESULTS AND DISCUSSION

EVALUATION OF SLRA PROTOCOLS

All five of the SLRA tools performed well in distinguishing either established from failed invaders or high impact from low impact species (Table 4). Alberta RAT, GLANSIS, and Montreal RAT performed best based on establishment. Montreal RAT and GLANSIS performed best based on the impact analyses and were selected as the optimal SLRA protocols.

For each of these two optimal SLRA protocols, thresholds distinguishing either established from failed NIS or high impact from low impact species (as defined in Table 2) were identified by plotting the classification accuracy by score for each of the analysis types identified in Table 2 (Figures 4 and 5). For the Montreal RAT, the threshold for establishment was a score of 22, and ranged 24-31 for impact (Table 5). For the GLANSIS protocol, the threshold for establishment was a score of 79, and ranged 88-99 for impact (Table 5).

Table 4. Area under the Curve (AUC) values for the SLRA protocols applied to the Great Lakes test database by analysis type. AUC Interpretation (Hosmer and Lemeshow 2000): 0.7<AUC<0.8 – acceptable; 0.8≤AUC<0.9 – excellent; AUC>0.9 – outstanding.

Analysis type	Definition	FISK	Montreal RAT	Alberta RAT	GLANSIS	ND Stats RAT
Establishment	Established or failed	0.8061	0.8601	0.8817	0.8873	0.774
Impact 1	Upper 1/3 of established vs all other species	0.799	0.9371	0.8374	0.9208	
Impact 2	Upper 2/3 of established species vs lower 1/3 + failed invaders	0.8173	0.9199	0.9049	0.8948	
Impact 3	Upper 1/3 of established species vs lower 1/3 + failed invaders	0.8451	0.969	0.9135	0.9583	
Impact 4	Top + bottom 1/3 of established species only	0.7847	0.9792	0.9236	0.941	0.875

Table 5. Thresholds for establishment and impact were identified by plotting the classification accuracy by score for each of the analysis types (see Figures 4 and 5 for plots).

Analysis type	Definition	Montreal RAT	GLANSIS
Establishment	Established or failed	22	79
Impact 1	Upper 1/3 of established vs all other species	31	99
Impact 2	Upper 2/3 of established species vs lower 1/3 + failed invaders	24, 25	88
Impact 3	Upper 1/3 of established species vs lower 1/3 + failed invaders	29, 30, 31	97
Impact 4	Top + bottom 1/3 of established species only	29, 30, 31	92-99

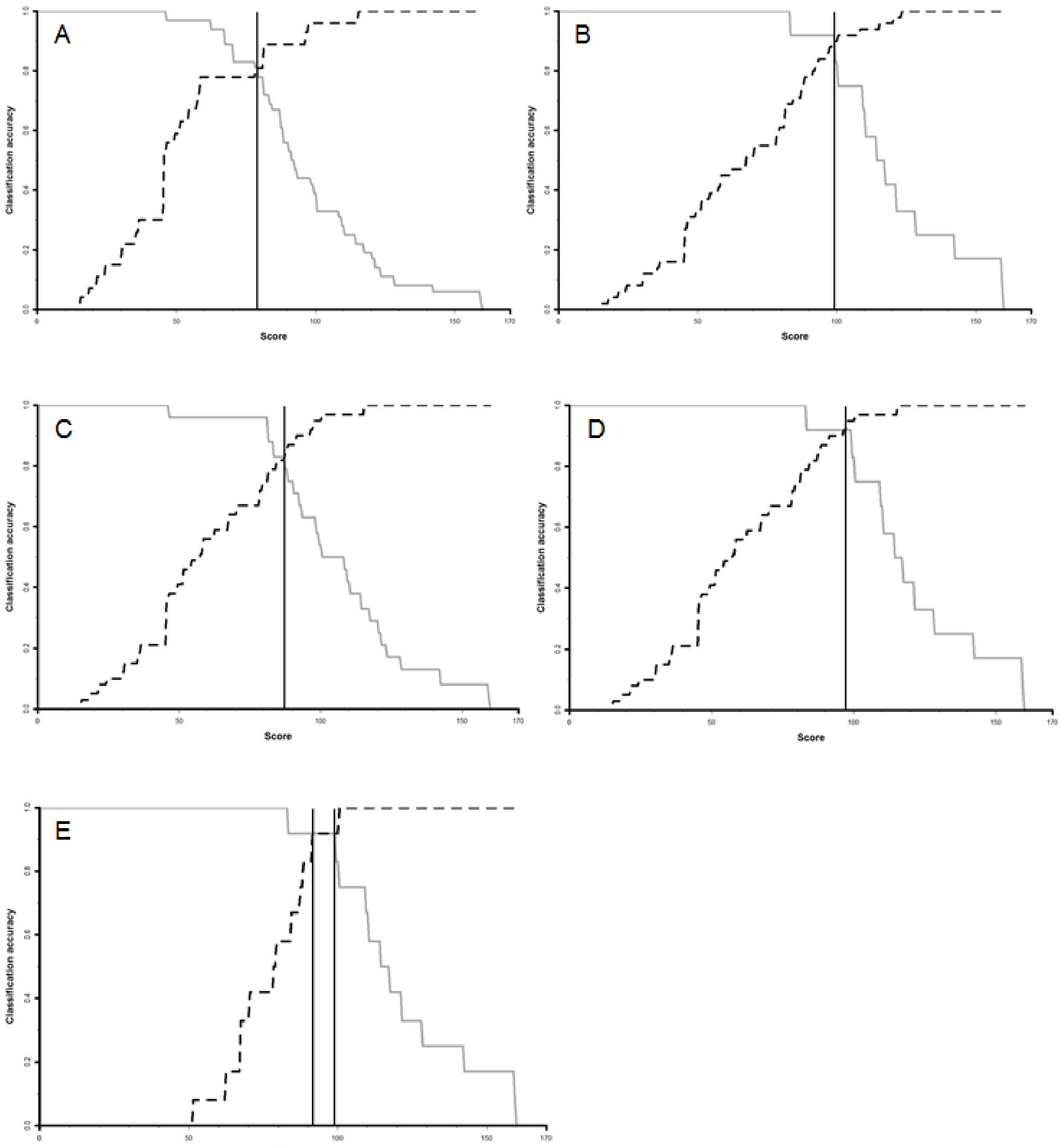

Figure 4. Classification accuracy of the GLANSIS protocol for: A) establishment; B) impact based on upper 1/3 of established vs all other species; C) impact based on upper 2/3 of established species vs lower 1/3 + failed invaders; D) impact based on upper 1/3 of established species vs lower 1/3 + failed invaders; and, E) impact based on top + bottom 1/3 of established species only.The black dashed curve represents the species that failed to establish, or the grouping of low impact and species that failed to establish; the gray solid curve represents the established species or the grouping of high impact and established species, depending upon analysis type. The threshold that maximizes accuracy is the SLA score at the intersection of the two classification accuracy lines. These thresholds are represented by vertical lines.

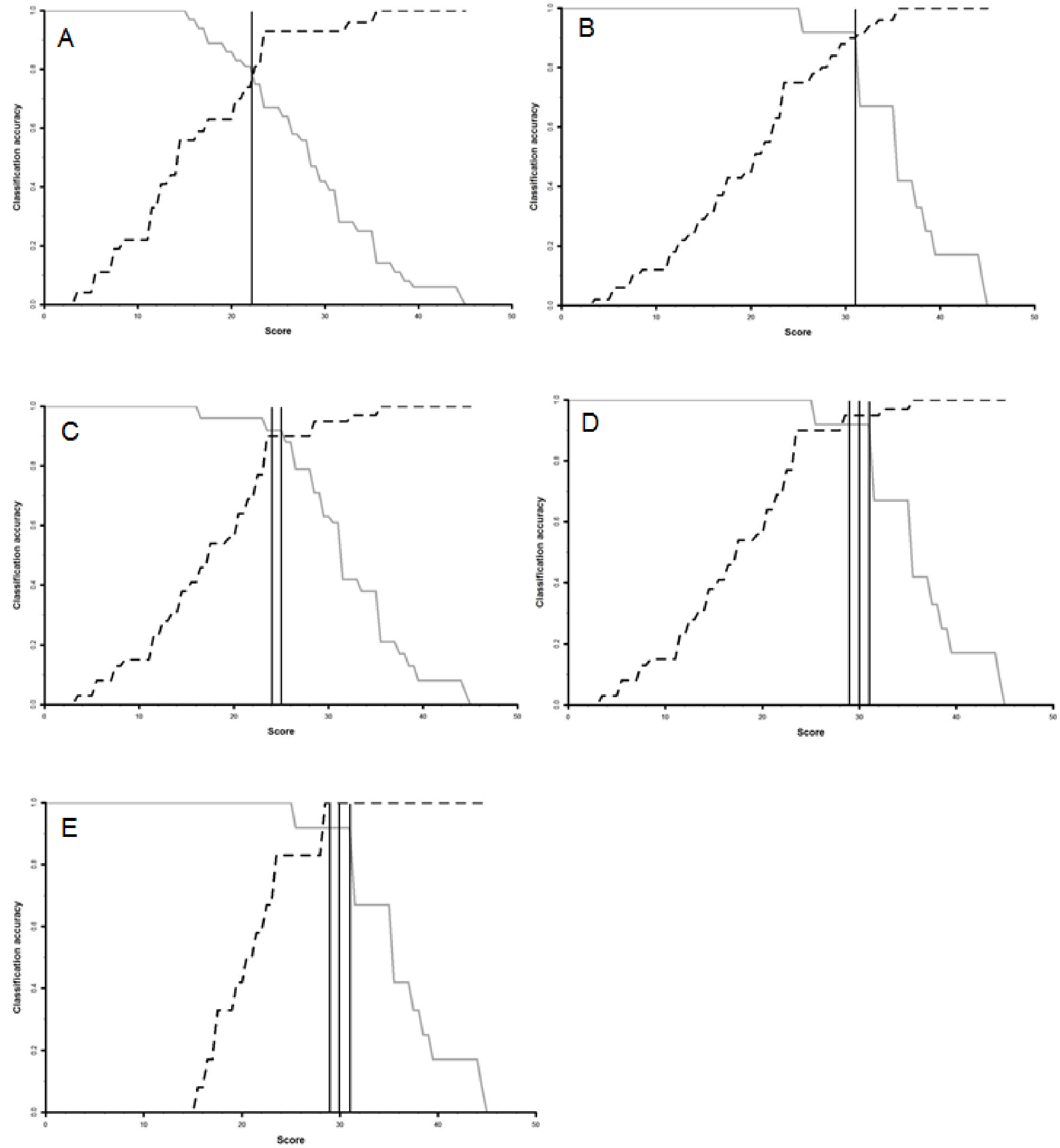

Figure 5. Classification accuracy of the Montreal RAT protocol for: A) establishment; B) impact based on upper 1/3 of established vs all other species; C) impact based on upper 2/3 of established species vs lower 1/3 + failed invaders; D) impact based on upper 1/3 of established species vs lower 1/3 + failed invaders; and, E) impact based on top + bottom 1/3 of established species only.The black dashed curve represents the species that failed to establish, or the grouping of low impact and species that failed to establish; the gray solid curve represents the established species or the grouping of high impact and established species, depending upon analysis type. The threshold that maximizes accuracy is the SLA score at the intersection of the two classification accuracy lines. These thresholds are represented by vertical lines.

FISH SPECIES IN TRADE LIST, HABITAT- AND CLIMATE-MATCH ANALYSIS

A total of 1648 species of fish in 185 families were identified as being part of the live fish trade involving vectors through which fish species may arrive in Canada (Appendix 6). Of these families, 106 were considered a habitat match (i.e., Freshwater or Euryhaline). A total of 825 species within these families were freshwater or euryhaline and were included for climate-match analysis. Of the families with a habitat match to Canada, 28 were identified to have a climate match to Canada. Due to an averaging effect, this family-level climate-match analysis may have excluded some species that would have a climate match to Canada at the species level (e.g., Northern Snakehead (*Channa argus*), family Channidae; Herborg et al. 2007). A total of 30 species were included following species-level climate matching, 18 of which are already established within Canada.

Following family- and species-level climate-match analysis, 12 species were identified for screening using the selected SLRA protocols.

SCREENING SPECIES USING SLRA PROTOCOLS

Based on the evaluation of the SLRA protocols, GLANSIS, Montreal RAT, and Notre Dame Statistical RAT were chosen to screen the list of 12 species for establishment and invasiveness and impact. Although the Notre Dame Statistical RAT did not perform as well as the other protocols, it is not subject to user bias as it is based on objective ecological traits, and requires less time to conduct compared to the questionnaire-based protocols. On average, a species assessment using GLANSIS or the Montreal RAT takes an experienced user approximately 8 hours to complete. The Notre Dame Statistical RAT takes substantially less time (~ 1 hour) to complete. Duration to complete a species assessment may be longer if a user is inexperienced, particularly for the GLANSIS and Montreal RAT protocols, which provide very limited user guidance, and the potential effect of user bias on the results has not been evaluated. This may result in variability in scores depending on the user that, in turn, may influence those species screened in or out. GLANSIS also requires a certain number of questions to be answered in order for assessment to occur, while the Montreal RAT has no such requirement. As such, 5 of 12 species identified for screening could not be assessed by GLANSIS but all 12 species were successfully assessed using the Montreal RAT and Notre Dame Statistical RAT (Table 6). Selection of which SLRA protocol to use may also be influenced by the scale at which the assessment is to be applied. While each protocol was evaluated using Great Lakes data (no similar Canada-wide validation data is available), the Notre Dame Statistical Tool may be less relevant for Canada-wide species assessments because this model was developed using a training dataset from the Great Lakes alone.

The threshold chosen to screen species with will also influence which species are screened in or out. For those species successfully assessed using GLANSIS and Montreal RAT, the outcome varied depending on the threshold for four species (Table 6). The range of possible thresholds represents the range of risk uncertainty. Identifying the tolerance specific threshold is a risk management decision; therefore, screening results are provided for a range of thresholds relating to establishment and impact. Risk managers will need to decide which threshold best represents their risk tolerance. Species screened in or out by more than one protocol and at more than one threshold should increase the confidence in the result.

*Table 6. Results of species screened using GLANSIS, Montreal RAT, and Notre Dame (ND) Statistical RAT SLRA protocols.Thresholds for GLANSIS and Montreal RAT correspond to scores generated from plots of the point of intersection of the two classification accuracy curves for each analysis type described in Table 5. For GLANSIS and Montreal RAT threshold assessment: 0 – not invasive; 1 – invasive; 1/0 – meets one threshold but not the other; inc – incomplete due to inability to answer the required number of questions (GLANSIS only). For ND Statistical RAT, Establishment (Est): 0 – predicted not to establish; 1 – predicted to become established, Impact: 0 – predicted not to have an impact; 1 – predicted to have an impact. * indicates impact score for GLANSIS is unknown due to lack of information; therefore, final score is incomplete.*

	GLANSIS						**Montreal RAT**						**ND Statistical RAT**	
		Threshold						**Threshold**						
	Score	**79**	**99**	**88**	**97**	**92-99**	**Score**	**22**	**31**	**24-25**	**29-31**	**29-31**	**Est**	**Impact**
Carassius carassius	105	1	1	1	1	1	32	1	1	1	1	1	1	0
Cobitis taenia	54*	inc	inc	inc	inc	inc	20	0	0	0	0	0	1	0
Danio albolineatus	60*	inc	inc	inc	inc	inc	14	0	0	0	0	0	1	1
Ictalurus furcatus	66*	inc	inc	inc	inc	inc	30	1	0	1	1	1	1	1
Leuciscus idus	87*	1	inc	inc	inc	inc	26	1	0	1	0	0	1	1
Misgurnus fossilis	58*	inc	inc	inc	inc	inc	18	0	0	0	0	0	1	1
Morone saxatilis x chrysops	93	1	0	1	0	1/0	24	1	0	1	0	0	1	1
Silurus glanis	123	1	1	1	1	1	37	1	1	1	1	1	1	1
Siniperca chuatsi	81	1	0	0	0	0	33	1	1	1	1	1	1	1
***Ctenopharyngodon idella* (diploid)**	121	1	1	1	1	1	35	1	1	1	1	1	1	1
***Ctenopharyngodon idella* (triploid)**	70	0	0	0	0	0	35	1	1	1	1	1	1	1
Cyprinella lutrensis	98	1	0	1	1	1	31	1	1	1	1	1	1	1
Misgurnus anguillicaudatus	97	1	0	1	1	1	29	1	0	1	1	1	1	1

Note: Species highlighted in grey were used to train the ND Statistical RAT. However, based on the fish ecological impact questionnaire disseminated to Great Lakes academics, scientists, and managers (Table 1, Figure 1) these species were considered to be high impact and were independently included for environmental matching analysis.

CONCLUSIONS

- Modified Alberta RAT, GLANSIS, and Montreal RAT SLRA protocols performed best based on establishment.
- Montreal RAT and GLANSIS SLRA protocols performed best based on impact analyses.
- Following evaluation, GLANSIS, Montreal RAT, and the Notre Dame Statistical RAT were selected to screen fishes in live trade in Canada.
- 1648 species of fish in 185 families were identified as being part of the live fish trade in Canada. Of these families, 106 were considered a habitat match (i.e., Freshwater or Euryhaline).
- Following species-level habitat-match analysis, 825 of the 1648 species were freshwater or euryhaline and included for climate-match analysis.
- 12 species in 6 families were identified for screening following family- and species-level habitat- and climate-match analyses. A detailed-level risk assessment has been conducted for Grass Carp, *Ctenopharyngodon idella* (Mandrak and Cudmore 2004).
- Screening assessment for 5 of the 12 species was not possible using GLANSIS because this protocol requires a certain number of questions to be answered for assessment to occur and not enough data were available for these species.
- GLANSIS identified fewer species to be invasive than the Montreal RAT, regardless of threshold used.
- Notre Dame Statistical RAT predicted all 12 species to establish and 10 of these species to have an impact.
- Two species, *Silurus glanis* and *Ctenopharyngodon idella* (diploid), were assessed similarly regardless of threshold across SLRA protocols as being able to establish and have a high impact.

RECOMMENDATIONS

- 20% threshold for family-level climate-match analysis may be too high resulting in the premature exclusion of some species. A lower family-level threshold (e.g., 10-20% match) for *Climatch* analysis or regional climate matching should be investigated, particularly for southwestern British Columbia.
- Depending on the species and scale of risk assessment, regional species-level climate-match analysis may be preferable, particularly for regions with extreme climates such as southwestern British Columbia which may not be accurately assessed using a Canada-wide *Climatch* analysis.
- Length of time required, potential for user bias, applicability to scale of assessment (e.g., regional or national), and lack of user guide for Montreal RAT and GLANSIS, should be considered when selecting which SLRA protocol to use.
- A detailed user guide for Montreal RAT and GLANSIS should be developed to reduce influence of user bias.

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APPENDIX 1 – FISK RISK ASSESSMENT TOOL

Questionnaire risk assessment method using the Freshwater Fish Invasiveness Scoring Kit (FISK) Protocol (v1.19 Calibrated) (Vilizzi et al. 2007).

Species:					
Question number	**Question**	**Answer**	**Score**	**Reference**	**Source data**
1.01	Is the species highly domesticated or cultivated for commercial, angling or ornamental purposes?				
1.02	Has the species become naturalised where introduced?				
1.03	Does the species have invasive races/varieties/sub-species?				
2.01	Is species reproductive tolerance suited to climates in Great Britain (0-low, 1-intermed, 2-high)?				
2.02	Quality of climate match data (0-low; 1-intermediate; 2-high).				
2.03	Broad climate suitability (environmental versatility).				
2.04	Native or naturalised in regions with equable climates.				
2.05	Does the species have a history of introductions outside its natural range?				
3.01	Has the species naturalised (established viable populations) beyond its native range?				
3.02	In its naturalised range are there impacts to wild stocks of angling or commercial species?				
3.03	In its naturalised range are there impacts to aquacultural, aquarium or ornamental species?				

Question number	Question	Answer	Score	Reference	Source data
3.04	In its naturalised range are there impacts to rivers, lakes or amenity values?				
3.05	Does the species have invasive congeners?				
4.01	Is the species poisonous, or pose other risks to human health?				
4.02	Does the species out-compete with native species?				
4.03	Is the species parasitic of other species?				
4.04	Is the species unpalatable to, or lacking, natural predators?				
4.05	Does species prey on a native species (e.g., previously subjected to low (or no) predation)?				
4.06	Host and/or vector for recognised pests and pathogens, especially non-native?				
4.07	Does the species achieve a large ultimate body size (i.e., > 10 cm FL) (more likely to be abandoned)?				
4.08	Has a wide salinity tolerance or is euryhaline at some stage of its life cycle.				
4.09	Is desiccation tolerant at some stage of its life cycle.				
4.10	Is tolerant of a range of water velocity conditions (e.g., versatile in habitat use).				
4.11	Feeding or other behaviours reduce habitat quality for native species.				
4.12	Does the species require minimum population size to maintain a viable population?				

Question number	Question	Answer	Score	Reference	Source data
5.01	Piscivorous or voracious predator (e.g., of native species not adapted to a top predator).				
5.02	Omnivorous.				
5.03	Planktivorous.				
5.04	Benthivorous.				
6.01	Exhibits parental care of eggs and/or young and/or known to reduce age-at-maturity in response to environment.				
6.02	Produces viable gametes.				
6.03	Hybridizes naturally with native species (or uses males of native species to activate eggs).				
6.04	Hermaphroditic				
6.05	Dependent on presence of another species (or specific habitat features) to complete life cycle.				
6.06	Highly fecund (>10,000 eggs/kg), iteropatric or extended spawning season.				
6.07	Minimum generation time.				
7.01	Life stages likely to be dispersed unintentionally.				
7.02	Life stages likely to be dispersed intentionally by humans (and suitable habitats abundant nearby).				
7.03	Life stages likely to be dispersed as a contaminant of commodities.				

Question number	Question	Answer	Score	Reference	Source data
7.04	Natural dispersal occurs as a function of dispersal of eggs.				
7.05	Natural dispersal occurs as a function of dispersal of larvae (along linear and/or 'stepping stone' habitats).				
7.06	Juveniles or adults are known to migrate (spawning, smolting, feeding).				
7.07	Eggs dispersed by other animals (externally)?				
7.08	Density dependent dispersal.				
8.01	Any life stages likely to survive out of water transport?				
8.02	Tolerates a wide range of water quality conditions, in particular oxygen depletion and high temperature.				
8.03	Susceptible to piscicides.				
8.04	Tolerates or benefits from environmental disturbance.				
8.05	Effective natural enemies present in Great Britain.				
		total score	0		
		outcome	more info		

		section	# questions answered	satisfy minimum?	
		A	0	no	
		B	0	no	
		C	0	no	
		total	0	no	

APPENDIX 2 – MODIFIED ALBERTA RISK ASSESSMENT TOOL

Questionnaire risk assessment method using a modified version of the Alberta Risk Assessment Tool (RAT) (Snyder et al. unpubl. data). Existing risk assessment guidelines were reviewed (Snyder et al. 2013) and the Alberta RAT was identified to be the most relevant for DFO's needs. The Alberta RAT was subsequently modified and calibrated to better suit DFO's uses and existing framework for risk assessments.

SPECIES INFORMATION		**ASSESSOR'S INFORMATION**	
Scientific Name:		Assessor:	
Synonyms:		Assessor's Affiliation:	
Common Names:		Mailing Address:	
Risk Assessment Area (RAA):		Telephone:	
		Email:	
		Date Evaluated (mm/dd/yyyy):	

QUESTIONS ON INVASION STAGES		**SCORE**	**COMMENTS & CITATIONS**	**CONFIDENCE LEVEL**	**EXPLANATION OF CONFIDENCE**
1. ARRIVAL					
1.1 Is the species known to occur in a natural or human-mediated pathway with intermediate or end points within the RAA, has it been proposed for import, or is it present in areas adjacent to the RAA?					
Score: 0 not in a pathway or adjacent areas					
Score: 1 not in a pathway; locally distributed or occurring at low population densities in adjacent areas					
Score: 2 not in a pathway; widely distributed and abundant in adjacent areas					
Score: 3 in a pathway with intermediate or end points within the assessment area or proposed for import					
1.2 Given natural dispersal characteristics and vectors, and existing barriers, how great is the potential of the species to arrive in the RAA by means of natural pathways?					
Score: 0 no known characteristics or vectors that could overcome barriers					
Score: 1 some characteristic or vector could likely overcome barriers or has done infrequently with low numbers of individuals					

QUESTIONS ON INVASION STAGES		**SCORE**	**COMMENTS & CITATIONS**	**CONFIDENCE LEVEL**	**EXPLANATION OF CONFIDENCE**
Score: 2 characteristics and vectors have resulted in frequent overcoming of barriers with low numbers of individuals, or infrequent with high numbers					
Score: 3 characteristics and vectors have resulted in frequent and ongoing arrivals with high numbers of individuals					
1.3 How great is the potential of the species to arrive in the RAA by means of human-mediated pathways with intermediate or end points within the RAA?					
Score: 0 no known pathways					
Score: 1 pathways likely exist, have resulted or (if species proposed for import) would likely result in infrequent arrivals with low numbers of individuals					
Score: 2 pathways result or (if species proposed for import) would likely result in frequent arrivals with low numbers of individuals or infrequent with high numbers					
Score: 3 pathways result or (if species recently proposed for import) would likely result in frequent and ongoing arrivals with high numbers of individuals					
1.4 How likely are individuals of the species to survive in transit?					

QUESTIONS ON INVASION STAGES		**SCORE**	**COMMENTS & CITATIONS**	**CONFIDENCE LEVEL**	**EXPLANATION OF CONFIDENCE**
Score: 0 unlikely to survive					
Score: 1 limited survival					
Score: 2 likely to survive but population size reduced					
Score: 3 likely to survive with no negative effect to population size					
2. ESCAPE OR RELEASE					
2.1 What is the probability of individuals of the species being released into the RAA?					
Score: 0 no known pathway ending in release					
Score: 1 few individuals released infrequently					
Score: 2 many individuals released infrequently, or few frequently					
Score: 3 many individuals released frequently					
2.2 What is the probability of detecting and preventing individuals of the species where they are most likely to escape into the environment of the RAA?					
Score: 0 readily detected and effective prevention mechanisms in place					

QUESTIONS ON INVASION STAGES		**SCORE**	**COMMENTS & CITATIONS**	**CONFIDENCE LEVEL**	**EXPLANATION OF CONFIDENCE**
Score: 1 somewhat difficult to detect or prevention mechanisms not always effective					
Score: 2 difficult to detect or no specific mechanisms for prevention in place					
Score: 3 likely to be undetected or escape unpreventable					
2.3 If escaped, how many individuals of the species are likely to enter the RAA?					
Score: 0 no known pathway ending in escape					
Score: 1 few individuals escape infrequently					
Score: 2 many individuals escape infrequently, or few frequently					
Score: 3 many individuals escape frequently					
3. SURVIVAL					
3.1 Is the species known to have survived in the RAA?					
Score: 0 instances of entry without completion of the life cycle of the species					
Score: 1 instances of entry followed by survival of some life stages during some seasons					

QUESTIONS ON INVASION STAGES		**SCORE**	**COMMENTS & CITATIONS**	**CONFIDENCE LEVEL**	**EXPLANATION OF CONFIDENCE**
Score: 2 localized instances of entry followed by survival of all life stages over at least one year					
Score: 3 widespread instances of entry followed by survival of all life stages over at least one year					
3.2 Are the abiotic conditions for the species' survival satisfied by resources available in the RAA?					
Score: 0 no resources are available					
Score: 1 the availability of resources is minimal					
Score: 2 the availability of resources is restricted in some way					
Score: 3 resources are available in relative abundance					
3.3 Are the biotic conditions for the species' survival satisfied by resources available in the RAA?					
Score: 0 no resources are available					
Score: 1 the availability of resources is minimal					
Score: 2 the availability of resources is restricted in some way					
Score: 3 resources are available in relative abundance					

QUESTIONS ON INVASION STAGES		**SCORE**	**COMMENTS & CITATIONS**	**CONFIDENCE LEVEL**	**EXPLANATION OF CONFIDENCE**
3.4 Is the likelihood of the species' survival affected by environmental stressors, i.e., decreasingly poor sediment or surface water conditions?					
Score: 0 not found in poor or degraded habitats					
Score: 1 prefers high quality conditions but is mildly tolerant of poor conditions					
Score: 2 can tolerate poor quality habitat but does not benefit from it					
Score: 3 is pollution tolerant and is highly successful in degraded conditions					
4. ESTABLISHMENT					
4.1 Is the species known to have established in the RAA?					
Score: 0 individuals of the species, capable of reproduction, have survived without establishment					
Score: 1 individuals have reproduced, but the succeeding generation has not					
Score: 2 localized reproducing populations occur					
Score: 3 widespread reproducing populations occur					

QUESTIONS ON INVASION STAGES		**SCORE**	**COMMENTS & CITATIONS**	**CONFIDENCE LEVEL**	**EXPLANATION OF CONFIDENCE**
4.2 If the species is not known to have established but is believed to be capable of survival, how many individuals of the species are likely to survive in the RAA?					
Score: 0 individuals of the species are not believed to be capable of survival long enough to establish					
Score: 1 given common points of entry, there is potential for few individuals to survive long enough to reproduce					
Score: 2 given common points of entry, there is potential for many individuals to survive long enough to reproduce locally					
Score: 3 given common points of entry, there is potential for many individuals to survive long enough to reproduce throughout the area					
4.3 How available are the species' requirements for reproduction?					
Score: 0 specific conditions not available					
Score: 1 specific requirements are locally available during the reproductive season					
Score: 2 specific requirements are widely available during part of the reproductive season					
Score: 3 species has no specific requirements, or all requirements are available					

QUESTIONS ON INVASION STAGES		**SCORE**	**COMMENTS & CITATIONS**	**CONFIDENCE LEVEL**	**EXPLANATION OF CONFIDENCE**
4.4 Is asexual reproduction (e.g., vegetative reproduction or self-fertilization) an important aspect of this species' reproduction?					
Score: 0 no asexual reproduction					
Score: 1 asexual reproduction is used but is not the primary means of population increase					
Score: 2 asexual reproduction is the primary means of reproduction resulting in rapid population growth					
Score: 3 asexual reproduction occurs in conjunction with sexual reproduction resulting in a maximized increase in population size					
5. EXPANSION					
5.1 Is the species known to have expanded its distribution in the RAA?					
Score: 0 established populations have remained localized in the area of establishment					
Score: 1 established populations have expanded infrequently within an area bounded by barriers					
Score: 2 established populations have expanded regularly within an area bounded by barriers					

QUESTIONS ON INVASION STAGES		**SCORE**	**COMMENTS & CITATIONS**	**CONFIDENCE LEVEL**	**EXPLANATION OF CONFIDENCE**
Score: 3 established populations have expanded widely over most of the RAA					
5.2 Based on biological characteristics that contribute to dispersal, and human-mediated pathways within the RAA, what is the potential of the species to spread within the RAA?					
Score: 0 no known characteristics or pathways that could overcome barriers					
Score: 1 some characteristic or pathway could likely overcome barriers or has done infrequently with low numbers of individuals					
Score: 2 characteristics and pathways could result or have resulted in frequent overcoming of barriers with low numbers of individuals, or infrequent with high numbers					
Score: 3 characteristics and pathways could result or have resulted in frequent and ongoing spread with high numbers of individuals					
5.3 What is the rate of population growth of the species?					
Score: 0 no growth					
Score: 1 slow rate of growth					
Score: 2 moderate rate of growth					

QUESTIONS ON INVASION STAGES		SCORE	COMMENTS & CITATIONS	CONFIDENCE LEVEL	EXPLANATION OF CONFIDENCE
Score: 3 rapid rate of growth					
5.4 What percentage of the risk assessment area has a climate suitable for the species' establishment?					
Score: 0 <1%					
Score: 1 1-10%					
Score: 2 11-25%					
Score: 3 >25%					
5.5 What percentage of the area of suitable climate has suitable abiotic conditions for the species' establishment?					
Score: 0 <1%					
Score: 1 1-10%					
Score: 2 11-25%					
Score: 3 >25%					
6. EXPLOSION					
6.1Frequency of reproduction?					

QUESTIONS ON INVASION STAGES		**SCORE**	**COMMENTS & CITATIONS**	**CONFIDENCE LEVEL**	**EXPLANATION OF CONFIDENCE**
Score: 0 almost never					
Score: 1 less than once a year					
Score: 2 once per year					
Score: 3 more than once per year					
6.2 Is the production of offspring prolific and consistent?					
Score: 0 very few offspring produced					
Score: 1 few offspring produced					
Score: 2 moderate numbers of offspring produced					
Score: 3 many offspring produced					
6.3 Is there rapid growth to reproductive maturity?					
Score: 0 very slow growth - misses at least 5 reproductive seasons before being able to reproduce					
Score: 1 slow growth - misses 2-4 reproductive seasons before being able to reproduce					
Score: 2 moderate growth - misses 1 reproductive season before being able to reproduce					
Score: 3 rapid growth - is able to reproduce as soon as environmental conditions allow					

QUESTIONS ON INVASION STAGES		**SCORE**	**COMMENTS & CITATIONS**	**CONFIDENCE LEVEL**	**EXPLANATION OF CONFIDENCE**
6.4 Is there an opportunity to hybridize with native species in the RAA?					
Score: 0 no close relatives, little or no chance of hybridization					
Score: 1 few hybridization opportunities and likelihood of occurrence is low					
Score: 2 many hybridization opportunities exist but likelihood of occurrence is low					
Score: 3 many hybridization opportunities exist and likelihood of occurrence is high					
6.5 Are there known natural controls on the population of the species in the RAA, or could there be such controls?					
Score: 0 control agents' effects on population growth is significant, or likely so, throughout the area					
Score: 1 control agents' effects on population growth is significant, or likely so, in parts of the area					
Score: 2 control agents' effects on population growth is minimal, or likely so, throughout the area					
Score: 3 no known control agents present in the area					

QUESTIONS ON CONSEQUENCES OF INVASION

QUESTIONS ON INVASION STAGES		**SCORE**	**COMMENTS & CITATIONS**	**CONFIDENCE LEVEL**	**EXPLANATION OF CONFIDENCE**
7. ENVIRONMENTAL IMPACTS					
7.1 What impact does the species have, or is it likely to have, as a result of competition with (including parasitism of) native species?					
Score: 0 no impact					
Score: 1 low impact					
Score: 2 moderate impact					
Score: 3 severe impact					
7.2 What impact does the species have, or is it likely to have, as a result of predation upon native species?					
Score: 0 no impact					
Score: 1 low impact					
Score: 2 moderate impact					
Score: 3 severe impact					
7.3 What impact does the species have, or is it likely to have, as a result of being a host or vector for known diseases, parasites or pests?					
Score: 0 no impact					

QUESTIONS ON INVASION STAGES		**SCORE**	**COMMENTS & CITATIONS**	**CONFIDENCE LEVEL**	**EXPLANATION OF CONFIDENCE**
Score: 1 low impact					
Score: 2 moderate impact					
Score: 3 severe impact					
7.4 What impact does the species have, or is it likely to have, as a result of hybridization with native species?					
Score: 0 no impact					
Score: 1 low impact					
Score: 2 moderate impact					
Score: 3 severe impact					
7.5 What impact does the species have, or is it likely to have, on ecosystem processes?					
Score: 0 no impact					
Score: 1 low impact					
Score: 2 moderate impact					
Score: 3 severe impact					
8. MANAGEMENT IMPACTS					

QUESTIONS ON INVASION STAGES		SCORE	COMMENTS & CITATIONS	CONFIDENCE LEVEL	EXPLANATION OF CONFIDENCE
8.1 What is the potential for control methods to negatively impact other species?					
Score: 0 no impact					
Score: 1 low impact					
Score: 2 moderate impact					
Score: 3 severe impact					

ESTIMATION OF RISK AND CERTAINTY							
9. ESTIMATION OF RISK							
9.1 What is the number of questions answered in section 1?		What it the sum of scores in section 1?		What is the average score for section 1?		What is the percent score for section 1?	
9.2 What is the number of questions answered in section 2?		What it the sum of scores in section 2?		What is the average score for section 2?		What is the percent score for section 2?	
9.3 What is the number of questions answered in section 3?		What it the sum of scores in section 3?		What is the average score for section 3?		What is the percent score for section 3?	
9.4 What is the number of questions answered in section 4?		What it the sum of scores in section 4?		What is the average score for section 4?		What is the percent score for section 4?	
9.5 What is the number of questions answered in section 5?		What it the sum of scores in section 5?		What is the average score for section 5?		What is the percent score for section 5?	
9.6 What is the number of questions answered in section 6?		What it the sum of scores in section 6?		What is the average score for section 6?		What is the percent score for section 6?	
9.7 What is the number of questions answered in section 7?		What it the sum of scores in section 7?		What is the average score for section 7?		What is the percent score for section 7?	
9.8 What is the number of questions answered in section 8?		What it the sum of scores in section 8?		What is the average score for section 8?		What is the percent score for section 8?	
9.9 What is the risk score for the species?							

10. ESTIMATION OF CERTAINTY							
10.1 What is the number of questions answered in section 1?		What it the sum of scores in section 1?		What is the average score for section 1?		What is the percent score for section 1?	
10.2 What is the number of questions answered in section 2?		What it the sum of scores in section 2?		What is the average score for section 2?		What is the percent score for section 2?	
10.3 What is the number of questions answered in section 3?		What it the sum of scores in section 3?		What is the average score for section 3?		What is the percent score for section 3?	
10.4 What is the number of questions answered in section 4?		What it the sum of scores in section 4?		What is the average score for section 4?		What is the percent score for section 4?	
10.5 What is the number of questions answered in section 5?		What it the sum of scores in section 5?		What is the average score for section 5?		What is the percent score for section 5?	
10.6 What is the number of questions answered in section 6?		What it the sum of scores in section 6?		What is the average score for section 6?		What is the percent score for section 6?	
10.7 What is the number of questions answered in section 7?		What it the sum of scores in section 7?		What is the average score for section 7?		What is the percent score for section 7?	
10.8 What is the number of questions answered in section 8?		What it the sum of scores in section 8?		What is the average score for section 8?		What is the percent score for section 8?	
10.9 What is the certainty score for the species?							

APPENDIX 3 – MONTREAL RISK ASSESSMENT TOOL

Questionnaire risk assessment method using the Montreal RAT (DFO 2012).

Definitions of ‘Effect’ levels: 0=No Effect (undetectable change in the structure or function of the ecosystem); 1=Mild (minimally detectable change in the structure of the ecosystem, but small enough that it would not change the functional relationships or survival of species; 2=Moderate (detectable change in the structure or function of the ecosystem); and, 3=Severe (significant changes to the structure or function of the ecosystem leading to changes in the abundance of native species and a new food web).

Uncertainty scoring: 1=Very low uncertainty (e.g., extensive, peer-reviewed information); 2=Low uncertainty (e.g., primarily peer reviewed information); 3=Moderate uncertainty (e.g., information and expert opinion); 4=High uncertainty (e.g., little information; largely expert opinion); and, 5=Very high uncertainty (e.g., no information; expert opinion).

Risk Assessor Confidence in final score based on information available was recorded as: 1=High; 2=Medium; and 3=Low

Question Number	Score Value	**Question:**	Score	Source	Comments	Uncertainty	Confidence
1		What is the likelihood of arrival of the species into the assessment area?					
	1	infrequently with low number of individuals					
	2	frequently with low numbers or infrequently with high numbers					
	3	frequently with high numbers					
	4	Already present					
	U	Unknown					
2		What proportion of the assessment area has suitable climate for the species?					
	0	None					
	1	Less than half of the area					
	2	Majority of the area					
	3	Entire area					
	U	Unknown					

Question Number	Score Value	**Question:**	Score	Source	Comments	Uncertainty	Confidence
3		What proportion of available habitat is suitable for the species within the assessment area?					
	0	None					
	1	Less than half of the area					
	2	Majority of the area					
	3	Entire area					
	U	Unknown					
4		Are the organism's specific requirements for reproduction available in the assessment area?					
	0	Specific requirements not available					
	1	Less than half of the requirements					
	2	Majority of the requirements					
	3	All requirements are available.					
	U	Unknown					
5		Does the organism's specific traits enhance establishment?					
	0	None					
	1	Low					
	2	Medium					
	3	High					
	U	Unknown					
6		Are there known natural control agents in the assessment area?					

Question Number	Score Value	**Question:**	Score	Source	Comments	Uncertainty	Confidence
	0	Control agents severely or completely restricts population growth					
	1	Control agents moderately restricts population growth					
	2	Control agents unlikely to affect population growth					
	3	No known control agents present					
	U	Unknown					
7		To what degree can the organism disperse naturally in the assessment area?					
	0	None					
	1	Less than half of the area					
	2	Majority of the area					
	3	Entire area					
	U	Unknown					
8		To what degree will anthropogenic mechanisms assist the dispersal of this species within the assessment area?					
	0	None					
	1	Less than half of the area					
	2	Majority of the area					
	3	Entire area					
	U	Unknown					
9		What effect could the species have on populations in the assessment area?					

Question Number	Score Value	**Question:**	Score	Source	Comments	Uncertainty	Confidence
	0	No effect					
	1	Mild effect					
	2	Moderate effect					
	3	Severe effect					
	U	Unknown					
10		What effect could the species have on communities in the assessment area?					
	0	No effect					
	1	Mild effect					
	2	Moderate effect					
	3	Severe effect					
	U	Unknown					
11		What could be the effect of diseases, parasites, or fellow travellers associated with the species on species in the assessment area?					
	0	No effect					
	1	Mild effect					
	2	Moderate effect					
	3	Severe effect					
	U	Unknown					
12		What could be the genetic effects to species currently in the assessment area?					
	0	No effect					
	1	Mild effect					

Question Number	Score Value	**Question:**	Score	Source	Comments	Uncertainty	Confidence
	2	Moderate effect					
	3	Severe effect					
	U	Unknown					
13		What could be the effects on habitat in the assessment area?					
	0	No effect					
	1	Mild effect					
	2	Moderate effect					
	3	Severe effect					
	U	Unknown					
14		What effect could the species have on ecosystems in the assessment area?					
	0	No effect					
	1	Mild effect					
	2	Moderate effect					
	3	Severe effect					
	U	Unknown					
15		What effect could the species have on "at-risk" species in the assessment area?					
	0	No effect					
	1	Mild effect					
	2	Moderate effect					
	3	Severe effect					
	U	Unknown					

Question Number	Score Value	**Question:**	Score	Source	Comments	Uncertainty	Confidence
16		Is the species invasive elsewhere?					
	0	No					
	1	Yes					
	U	Unknown					
17		Does the organism's specific traits enhance invasiveness?					
	0	None					
	1	Low					
	2	Medium					
	3	High					
	U	Unknown					
		Total:	0				

APPENDIX 4 – GLANSIS RISK ASSESSMENT TOOL

Questionnaire risk assessment method using the GLANSIS RAT developed by the Great Lakes Aquatic Nuisance Species Information System group at the National Oceanographic and Atmospheric Agency, Ann Arbor, MI. For an assessment to be successfully completed, this tool requires a minimum number of unknowns.

SPECIES INFORMATION

Scientific Name:

Synonyms:

Common Names:

Risk Assessment Area (RAA):

Date of assessment:

POTENTIAL INTRODUCTION VIA DISPERSAL

1 Does this species occur near waters (natural or artificial) connected to the Great Lakes basin* (e.g.,, streams, ponds, canals, or wetlands)? (*Great Lakes basin = below the ordinary high water mark, including connecting channels, wetlands, and waters ordinarily attached to the Lakes)

Yes, this species occurs near waters connected to the Great Lakes basin and is mobile or able to be transported by wind or water.	100
No, this species does not occur near waters connected to the Great Lakes basin and/or is not mobile or able to be transported by wind or water.	0
Unknown	U
Score	
if unknown enter a 1 below the score	

2 What is the proximity of this species to the Great Lakes basin?

This species occurs in waters within 20 kilometers of the Great Lakes basin, and no barrier (e.g.,, electric barrier, dam) to dispersal is present.	Score x 1
This species occurs in waters within 20 kilometers of the Great Lakes basin, but dispersal to the basin is blocked; or, this species occurs in waters within 100 kilometers of the Great Lakes basin, and no barrier to dispersal is present.	Score x 0.75
This species occurs in waters within 100 kilometers of the Great Lakes basin, but dispersal to the basin is blocked.	Score x 0.5
This species occurs in waters >100 kilometers from the Great Lakes basin.	Score x 0.25
Unknown	U
Score	
if unknown enter a 1 below the score	

POTENTIAL INTRODUCTION VIA HITCHHIKING/FOULING

3 Is this species likely to attach to or be otherwise transported by, or along with, recreational gear, boats, trailers, fauna (e.g.,, waterfowl, fish, insects), flora (e.g.,, aquatic plants), or other objects (e.g.,, packing materials), including as parasites or pathogens, entering the Great Lakes basin?

Yes, this species is known to be able to adhere to certain surfaces or to be transported by other organisms entering the Great Lakes basin.	100
No, this species is not known to be able to adhere to certain surfaces or to be transported by other organisms entering the Great Lakes basin.	0
Unknown	U
Score	
if unknown enter a 1 below the score	

4 What is the proximity of this species to the Great Lakes basin?

This species occurs in waters within 20 km of the Great Lakes basin.	Score x 1
This species occurs in waters within 100 km of the Great Lakes basin.	Score x 0.5
This species occurs in waters >100 km from the Great Lakes basin.	Score x 0.1
Unknown	U
Score	
if unknown enter a 1 below the score	

POTENTIAL INTRODUCTION VIA UNAUTHORIZED INTENTIONAL RELEASE

5 Is this species sold at aquarium/pet/garden stores ("brick & mortar" or online), catalogs, biological supply companies, or live markets (e.g.,, purchased for human consumption, bait, ornamental, ethical, educational, or cultural reasons) and as a result may be released into the Great Lakes basin?

Yes, this species is available for purchase.	100
No, this species this species is rarely/never sold.	0
Unknown	U
Score	
if unknown enter a 1 below the score	

6 How easily is this species obtained within the Great Lakes region (states/provinces)?

This species is widely popular, frequently sold, and/or easily obtained within the Great Lakes region.	Score x 1
This species is widely popular, and although trade, sale, and/or possession of this species is prohibited, it is frequently sold on the black market within the Great Lakes region.	Score x 0.5
This species is not very popular or is not easily obtained within the Great Lakes region.	Score x 0.1
Unknown	U
Score	
if unknown enter a 1 below the score	

POTENTIAL INTRODUCTION VIA STOCKING/PLANTING OR ESCAPE FROM RECREATIONAL CULTURE

7 Is this species being stocked/planted to natural waters or outdoor water gardens around the Great Lakes region?

Yes, this species is being stocked/planted and/or has ornamental, cultural, medicinal, environmental (e.g.,, biocontrol, erosion control), scientific, or recreational value in the Great Lakes region.	100
No, this species cannot be stocked/planted or there is not enough interest to do so in the Great Lakes region.	0
Unknown	U
Score	
if unknown enter a 1 below the score	

8 What is the nature and proximity of this activity to the Great Lakes basin?

This activity is authorized and/or is occurring directly in the Great Lakes.	Score x 1
This activity is occurring in Great Lakes tributaries or connecting waters, or within 20 km of the Great Lakes basin.	Score x 0.75
This activity is <u>likely</u> to occur within 20 km of the Great Lakes basin because of its popularity/value and there are no widespread regulations against stocking/planting.	Score x 0.5
This activity is occurring in waters >20 km from the Great Lakes basin, or despite federal or state regulations in more than half the basin (> 5 states/provinces), this activity <u>may</u> occur within 20 km of the basin because of the species' popularity/value.	Score x 0.25
Unknown	U
Score	
if unknown enter a 1 below the score	

POTENTIAL INTRODUCTION VIA ESCAPE FROM COMMERCIAL CULTURE

9 Is this species known to be commercially cultured in or transported through the Great Lakes region?

Yes, this species is being commercially cultured in or transported through the Great Lakes region.	100
No, this species is not commercially cultured in or transported through the Great Lakes region.	0
Unknown	U
Score	
if unknown enter a 1 below the score	

10 What is the nature and proximity of this activity to the Great Lakes basin?

This activity is unregulated or minimally regulated and is occurring directly in the Great Lakes.	Score x 1
This activity is unregulated or minimally regulated and is occurring in Great Lakes tributaries or connecting waters, or within 20 km of the Great Lakes basin.	Score x 0.75
This activity is strictly regulated but occurs directly in the Great Lakes, and/or this activity involves transport of live organisms on/across the Great Lakes.	Score x 0.5

This activity is strictly regulated but occurs in Great Lakes tributaries, connecting waters, or within 20 km of the Great Lakes basin, and/or this activity involves transport of live organisms within 20 km of the Great Lakes basin.	Score x 0.25
This activity occurs >20 km from the Great Lakes basin and typically does not involve transport of live organisms closer to the basin.	Score x 0.1
Unknown	U
Score	

if unknown enter a 1 below the score

POTENTIAL INTRODUCTION VIA SHIPPING

11 Is this species likely to be taken up in ballast, and capable of surviving adverse environments (i.e., extreme temperatures, absence of light, low oxygen levels) and partial-to-complete ballast water exchange/flushing (e.g.,, is euryhaline, buries in sediment, produces resistant resting stages, has other attributes or behaviors facilitating survival under these conditions)?

Yes, this species is able to survive in ballast tank environments for weeks at a time and is not substantially impacted by current regulatory requirements (e.g.,, exchange, flushing).	100
Yes, this species is able to survive in ballast tank environments for weeks at a time, but survival is substantially impacted by current regulatory requirements.	80
No, but this species is capable of fouling transoceanic ship structures (e.g.,, hull, chains, chain locker) while in its active or resting stage.	40
No, this species is unlikely to be taken up in ballast, not able to survive adverse environments, does not foul transoceanic ship structures, or is unable to survive current ballast water regulations.	0
Unknown	U
Score	
if unknown enter a 1 below the score	

12 Does this species occur in waters from which shipping traffic to the Great Lakes originates?

Yes, and this species has been observed in ballast of or fouling ships entering the Great Lakes.	Score x 1
Yes, and this species has been observed in ports that have direct trade connections with the Great Lakes (e.g.,, Baltic Sea).	Score x 0. 5
Yes, but this species has neither been observed in ballast/fouling ships entering the Great Lakes nor in ports in direct trade with the Great Lakes.	Score x 0.1
No, this species does not occur in waters from which shipping traffic to the Great Lakes originates.	Score x 0
Unknown	U
Score	
if unknown enter a 1 below the score	

Vector Potential Scorecard				
Vector	**Raw Points Scored**	**Proximity Multiplier**	**Total Points Scored**	**Prob. of Introduction**
Dispersal: Natural dispersal through waterbody connections or wind	**0**	0	**0**	Low
Hitchhiking/fouling: Transport via recreational gear, boats, trailers, mobile fauna, stocked/planted organisms, packing materials, host organisms, etc.	**0**	0	**0**	Low
Release: Unauthorized intentional release of organisms in trade (e.g.,, aquaria, water gardens, live food)	**0**	0	**0**	Low
Stocking/planting/escape from recreational culture: Intentional authorized or unauthorized introduction to natural waters in the Great Lakes OR Accidental introduction to Great Lakes by escape from recreational culture (e.g.,, water gardens)	**0**	0	**0**	Low
Escape from commercial culture: Accidental introduction to Great Lakes by escape from commercial culture (e.g.,, aquaculture)	**0**	0	**0**	Low
Trans-oceanic shipping: Ballast (BOB) or no-ballast-on-board (NOBOB) water exchange/discharge, sediment discharge, hull fouling	**0**	0	**0**	Low
Total Unknowns (U)	**0**	**Confidence Level**	High	

Scoring	
Points (per vector)	**Probability for Introduction**
80-100	High
40-79	Moderate
0-39	Low
# of Unknowns (overall)	**Conf. Level**
0	High
1 to 2	Moderate
3 to 5	Low
>5	Very low

INVASIVE BIOLOGICAL/ECOLOGICAL ATTRIBUTES

13 How would the physiological tolerance of this species (survival in varying temperature, salinity, oxygen, and nutrient levels) be described?

This species has broad physiological tolerance. It has been reported to survive in wide ranges of temperature (0°C-30°C), salinity (0-16 parts per thousand), oxygen (0-saturated), AND nutrient (oligotrophic-eutrophic) levels.	9
This species has somewhat broad physiological tolerance. It has been reported to survive in a wide range of temperature, salinity, oxygen, OR nutrient levels. Tolerance to other factors is narrower, unknown, or unreported.	6
This species has narrow physiological tolerance. It has been reported to survive in limited ranges of temperature, salinity, oxygen, and nutrient levels.	3
Unknown	U
Score	
if unknown enter a 1 below the score	

14 How likely is it that any life stage of this species can overwinter in the Great Lakes (survive extremely low levels of oxygen, light, and temperature)?

Likely (This species is able to tolerate temperatures under 5°C and oxygen levels ≤0.5 mg/L)	9
Somewhat likely (This species is able to tolerate some of these conditions OR has adapted behaviorally to avoid them)	6
Somewhat unlikely (This species is able to tolerate conditions close to those specified, but it is not known as an overwintering species)	3
Unlikely	0
Unknown	U
Score	
if unknown enter a 1 below the score	

15 If this species is a heterotroph, how would the flexibility of its diet be described?

This species is a dietary generalist with a broad, assorted, AND flexible diet.	9
This species is moderately a dietary generalist with a broad, assorted, OR flexible diet.	6
This species is a dietary specialist with a limited and inflexible diet.	3
This species is an autotroph.	0
Unknown	U
Score	
if unknown enter a 1 below the score	

16 How likely is this species to outcompete species in the Great Lakes for available resources?

Likely (This species is known to have superior competitive abilities and has a history of outcompeting other species, AND/OR available literature predicts it might outcompete native species in the Great Lakes)	9

Somewhat likely (This species is known to have superior competitive abilities, but there are few reported cases of this species outcompeting another and no predictions regarding species in the Great Lakes)	6
Somewhat unlikely (This species has average competitive abilities, and there are no reported cases of this species outcompeting another and no predictions regarding species in the Great Lakes)	3
Unlikely (This species is known as a poor competitor that thrives only in environments with low biodiversity, AND/OR available literature predicts it might be outcompeted by a species in the Great Lakes)	0
Unknown	U
Score	
if unknown enter a 1 below the score	

17 How would the fecundity of this species be described relative to other species in the same taxonomic Class?

Very high	9
High	6
Moderate	3
Low	0
Unknown	U
Score	
if unknown enter a 1 below the score	

18 How likely are this species' reproductive strategy and habits to aid establishment in new environments, particularly the Great Lakes (e.g.,, parthenogenesis/self-crossing, self fertility, vegetative fragmentation)?

Likely (The reproductive strategy or habits of this species are known to aid establishment in new environments, AND available literature predicts establishment in the Great Lakes based on these attributes)	9
Somewhat likely (The reproductive strategy or habits of this species are known to aid establishment in new environments, but there is no literature available regarding establishment in the Great Lakes based on these attributes)	6
Somewhat unlikely (The reproductive strategy or habits of this species could potentially aid establishment in new environments, but there is no literature available regarding establishment in the Great Lakes based on these attributes)	3
Unlikely (The reproductive strategy or habits of this species are not known to aid establishment in new environments)	0
Unknown	U
Score	
if unknown enter a 1 below the score	

ENVIRONMENTAL COMPATIBILITY

19 How similar are the climatic conditions (e.g.,, air temperature, precipitation, seasonality) in the native and introduced ranges of this species to those in the Great Lakes region?

Very similar (The climatic conditions are practically identical to those of the Great Lakes region)	9
Similar (Many of the climatic conditions are similar to those of the Great Lakes region)	6
Somewhat similar (Few of the climatic conditions are similar to those of the Great Lakes region)	3
Not similar	0
Unknown	U
Score	
if unknown enter a 1 below the score	

20 How similar are other abiotic factors (e.g.,, pollution, water temperature, salinity, pH, nutrient levels, currents) that are relevant to the establishment success of this species in the native and introduced ranges to those in the Great Lakes?

Very similar (These factors are practically identical to those of the Great Lakes region)	9
Similar (Many of these factors are similar to those of the Great Lakes region)	6
Somewhat similar (Few of these factors are similar to those of the Great Lakes region)	3
Not similar	0
Unknown	U
Score	
if unknown enter a 1 below the score	

21 How abundant are habitats suitable for the survival, development, and reproduction of this species in the Great Lakes area (e.g.,, those with adequate depth, substrate, light, temperature, oxygen)?

Abundant (Suitable habitats can be easily found and readily available)	9
Somewhat abundant (Suitable habitats can be easily found but are in high demand by species already present)	6
Somewhat scarce (Suitable habitats can be found occasionally)	3
Scarce (Suitable habitats are rarely found)	0
Unknown	U
Score	
if unknown enter a 1 below the score	

22 How likely is this species to adapt to or to benefit from the predicted effects of climate change on the Great Lakes freshwater ecosystems (e.g.,, warmer water temperatures, shorter duration of ice cover, altered streamflow patterns, increased salinization)?

Likely (Most of the effects described above make the Great Lakes a better environment for establishment and spread of this species OR this species could easily adapt to these changes due to its wide environmental tolerances)	9

Somewhat likely (Several of the effects described above could make the Great Lakes a better environment for establishment and spread of this species)	6
Somewhat unlikely (Few of the effects described above would make the Great Lakes a better environment for establishment and spread of this species)	3
Unlikely (Most of the effects described above would have no effect on establishment and spread of this species or would make the environment of the Great Lakes unsuitable)	0
Unknown	U
Score	
if unknown enter a 1 below the score	

23 How likely is this species to find an appropriate food source (prey or vegetation in the case of predators and herbivores, or sufficient light or nutrients in the case of autotrophs)?

Likely (All possible nutritive food items—including species in the Great Lakes that may be considered potential food items—are highly abundant and/or easily found)	9
Somewhat likely (Some nutritive food items—including species in the Great Lakes that may be considered potential food items—are abundant and/or search time is low to moderate)	6
Somewhat unlikely (Few nutritive food items—including species in the Great Lakes that may be considered potential food items—are abundant and/or search time is moderate to high)	3
Unlikely (All possible nutritive food items—including species in the Great Lakes that may be considered potential food items—are relatively scarce and/or search time is high)	0
Unknown	U
Score	
if unknown enter a 1 below the score	

24 Does this species require another species for critical stages in its life cycle such as growth (e.g.,, root symbionts), reproduction (e.g.,, pollinators, egg incubators), spread (e.g.,, seed dispersers), or transmission (e.g.,, vectors)?

Yes, and the critical species (or one that may provide a similar function) is common in the Great Lakes and can be easily found in environments suitable for the species being assessed; OR, No, there is no critical species required by the species being assessed	9
Yes, and the critical species (or one that may provide a similar function) is moderately abundant and relatively easily found in particular parts of the Great Lakes	6
Yes, and the critical species (or one that may provide a similar function) is relatively rare in the Great Lakes AND/OR can only be found occasionally in environments suitable for the species being assessed	3
Yes, and the critical species (or one that may provide a similar function) is not present in the Great Lakes but is likely to be introduced	0
Yes, but the critical species (or one that may provide a similar function) is not present in the Great Lakes and is not likely to be introduced	-80% total points (at end)

Unknown	U
Score	
if unknown enter a 1 below the score	
if score is -80% adjustment, then enter it on this line as 0.8	

25 How likely is the establishment of this species to be aided by the establishment and spread of another species already in the Great Lakes?

Likely (A non-indigenous species to the Great Lakes that facilitates the development of this species—a major host, food item, pollinator—has already established and spread in the Great Lakes, AND available literature predicts this previous invader might promote the establishment of this species, AND/OR there have been cases reported of this species aiding the establishment of this species in other areas)	9
Somewhat likely (A non-indigenous species to the Great Lakes that facilitates the development of this species—a major host, food item, pollinator—has already established and spread in the Great Lakes)	6
Somewhat unlikely (A non-indigenous species to the Great Lakes that facilitates the development of this species—a major host, food item, pollinator—has already established in the Great Lakes BUT it is still confined to a small area of the Lakes and the likelihood of encounter with this species assessed is hard to predict)	3
Unlikely (A non-indigenous species to the Great Lakes that facilitates the development of this species has not been established in the Great Lakes)	0
Unknown	U
Score	

if unknown enter a 1 below the score

26 How likely is establishment of this species to be prevented by the herbivory, predation, or parasitism of a natural enemy this is already present in the Great Lakes and may preferentially target this species?

Likely (The ability of the natural enemy to prevent the establishment of this species in introduced ranges or limiting populations of this species in native ranges is well documented in the literature AND this natural enemy is abundant and widespread in the Great Lakes)	-80% total points (at end)
Somewhat likely (The ability of the natural enemy to prevent the establishment of this species in introduced ranges or limiting populations of this species in native ranges is suggested in the literature OR this natural enemy has limited distribution in the Great Lakes)	-60% total points (at end)
Somewhat unlikely (There are few cases reported of such a natural enemy preventing the establishment of this species in introduced ranges or limiting populations of this species in native ranges OR this natural enemy has low abundance in the Great Lakes)	-10% total points (at end)
Unlikely (Such a natural enemy is particularly rare or is not present in the Great Lakes)	0
Unknown	U
Score (enter as 0.8, 0.6 or 0.1).	
if unknown enter a 1 below the score	

PROPAGULE PRESSURE

27 On average, how large and frequent are inoculations (introduction events) from the potential vectors identified in Section A for this species? (What is the total number of individuals introduced?)

Frequent, large inocula	9
Frequent, moderate inocula	6
Frequent, small inocula OR infrequent, large inocula	3
Infrequent, small or moderate inocula	0
Unknown	U
Score	
if unknown enter a 1 below the score	

HISTORY OF INVASION AND SPREAD

28 How extensively has this species established reproducing populations in areas outside its native range as a direct or indirect result of human activities?

Very extensively (many invasive populations of this species have been reported in areas widely distributed from the native range)	9
Extensively (some invasive populations of this species have been reported in areas widely distributed from the native range)	6
Somewhat extensively (few invasive populations of this species have been reported in areas widely distributed from the native range OR all invasive populations are in close proximity to each other)	3
Not extensively (no invasive populations of this species have been reported)	0
Unknown	U
Score	
if unknown enter a 1 below the score	

28 How rapidly has this species spread by natural means or by human activities once introduced to other locations?

Rapidly (This species has a history of rapid spread in introduced ranges)	9
Somewhat rapidly (This species has a history of moderately rapid spread in introduced ranges)	6
Somewhat slowly (This species has a history of moderately slow spread in its introduced ranges)	3
Slowly (This species has a history of slow to no spread in its introduced ranges)	0
Unknown	U
Score	
if unknown enter a 1 below the score	

29 Are there any existing control measures in the Great Lakes set to prevent the establishment and/or spread of this species?

Yes, and they are likely to prevent establishment or spread of the species. (There are no reported cases of this species adapting or avoiding current measures. These measures are highly effective in preventing the establishment and spread of this species)	-90% total points (at end)

Yes, and they are moderately likely to prevent establishment or spread of the species. (There are few reported cases of this species adapting or avoiding current measures used to control its establishment and spread)	-50% total points (at end)
Yes, but they are unlikely to prevent establishment or spread of the species. (There are many reported cases of this species adapting or avoiding current measures used to control its establishment and spread)	-20% total points (at end)
No control methods have been set to prevent the establishment and/or spread of this species	0
Unknown	U
Score (enter as 0.9, 0.5, or 0.2)	
if unknown enter a 1 below the score	

Establishment Potential Scorecard				
Points	**Probability for Establish.**	A. Total Points (pre-adjustment)		0
>100	High	**Adjustments**		
		B. Critical species	A*(1-0%)	0
51-99	Moderate	C. Natural enemy	B*(1- 0%)	0
		Control measures	C*(1- 0%)	**0**
0-50	Low	**Potential for Establishment**		Low
# of questions answered as "unable to determine"	**Conf. Level**			
0-1	High	Total # of questions unknown		0
two to five	Moderate			
six to nine	Low	Confidence Level		High

POTENTIAL ENVIRONMENTAL IMPACT

NOTE: In this section, a "Not significantly" response should be selected if the species has been studied but there have been no reports of a particular impact. An "Unknown" response is appropriate if the species is poorly studied.

30 Does the species pose some hazard or threat to the health of native species (e.g.,, it magnifies toxin levels; is poisonous; is a pathogen, parasite, or a vector of either)?

Yes, and it has impacted threatened/endangered species, resulted in the reduction or extinction of one or more native populations, affects multiple species, or is a reportable disease	6

Yes, but negative consequences have been small (e.g.,, limited number of infected individuals, limited pathogen transmissibility, mild effects on populations and ecosystems)	1
Not significantly	0
Unknown	U √
Score	
if unknown enter a 1 below the score	

31 Does it out-compete native species for available resources (e.g.,, habitat, food, nutrients, light)?

Yes, and it has resulted in significant adverse effects (e.g.,, impacted threatened/endangered species or caused critical reduction, extinction, behavioral changes including modified spawning behavior) on one or more native populations	6
Yes, and it has caused some noticeable stress to (e.g.,, decrease in growth, survival, fecundity) or decline of at least one native population	1
Not significantly	0
Unknown	U
Score	
if unknown enter a 1 below the score	

32 Does it alter predator-prey relationships?

Yes, and it has resulted in significant adverse effects (e.g.,, impacted threatened/endangered species, caused significant reduction or extinction of one or more native populations, creation of a dead end or any other significant alteration in the food web)	6
Yes, and it has resulted in some noticeable stress to (e.g.,, decrease in growth, survival, fecundity) or decline of at least one native population AND/OR Yes, and it has resulted in some alteration of the food web structure or processes, the effects of which have not been widespread or severe	1
Not significantly	0
Unknown	U
Score	
if unknown enter a 1 below the score	

33 Has it affected any native populations genetically (e.g.,, through hybridization, selective pressure, introgression)?

Yes, and it has caused a loss or alteration of genes that may be irreversible or has led to the decline of one or more native species (or added pressure to threatened/endangered species)	6
Yes, some genetic effects have been observed, but consequences have been limited to the individual level	1
Not significantly	0
Unknown	U
Score	
if unknown enter a 1 below the score	

34 Does it negatively affect water quality (e.g.,, increased turbidity or clarity, altered nutrient, oxygen, or other chemical levels/cycles)?

Yes, and it has had a widespread, long-term, or severe negative effect on water quality AND/OR Yes, and it has resulted in significant negative consequences for at least one native species	6
Yes, it has affected water quality to some extent, but the alterations and resulting adverse effects have been limited or inconsistent (as compared with above statement)	1
Not significantly	0
Unknown	U
Score	
if unknown enter a 1 below the score	

35 Does it alter physical components of the ecosystem in some way (e.g.,, facilitated erosion/siltation, altered hydrology, altered macrophyte/phytoplankton communities, physical or chemical changes to substrate)?

Yes, and it has had a widespread, long term, or severe negative effect on the physical ecosystem AND/OR Yes, and it has resulted in significant negative consequences for at least one native species	6
Yes, it has affected the physical ecosystem to some extent, but the alterations and resulting adverse effects have been mild	1
Not significantly	0
Unknown	U
Score	
if unknown enter a 1 below the score	

Scoring		
Score	**# U**	**Impact**
>5	Any	**High**
2 to 5	Any	**Moderate**
0	0-1	**Low**
1	0	
0	≥2	**Unknown**
1	≥1	

Environmental Impact Total Score	**0**
Total Unknowns (U)	**0**
Impact (based on score) - if the total number of unknowns is greater than one (1) when the score is 0-1 then please *manually* adjust the impact rating to unknown.	**Low**

APPENDIX 5 – NOTRE DAME STATISTICAL RISK ASSESSMENT TOOL

Based on the premise that invasive species have a specific set of ecological traits that make them successful, ecological trait-based models have been developed to predict potential AIS (e.g.,, Mandrak 1989; Kolar and Lodge 2002). To develop trait-based models to predict potential AIS to several regions in North America, including the Great Lakes, a group of experts attended a workshop at the University of Notre Dame in June 2011. At that workshop, 18 traits (ecological, life-history, phylogenetic) were identified as potentially important predictors of invasiveness in freshwater fishes (Table A1). Test datasets of establishment and impact were developed for each region. For the Great Lakes region, 37 established and 28 failed NIS were in the establishment test dataset (Mandrak and Cudmore 2010). Impact was determined using a fish ecological impact questionnaire disseminated to Great Lakes academics, scientists, and managers (Howeth et al. unpubl. data). For each established NIS in the region, the experts were asked to rank the ecological impact (in the categories Unknown, None-low, Moderate, High, Very High) and their confidence in the response (Low or High) (Table 1). Experts were also asked to provide additional information about species that had failed to establish in the region. Twenty-seven experts provided responses (Figure 1).

The trait and test datasets were used to develop trait-based classification trees using CART (Classification and Regression Tree) software (CART, California Statistical Software, Inc.) for establishment and impact. A preliminary CART tree indicates that climate match is the most important trait predicting establishment (Figure A1). An AUC of 0.8507 indicates that this model is good at distinguishing established and failed invaders with this trait (Table 4). AUC values of ≥0.7 are considered acceptable (Hosmer and Lemeshow 2000). A preliminary CART tree indicates that trophic guild and fecundity are the best predictors of impact (Figure A2), with an AUC >0.7 indicating a good model fit (Table 4).

Table A1. Eighteen fish traits compared in the CART Establishment and Impact models.

Life-history	***Habitat preference***	***Phylogenetic***
Body size	Macrohabitat preference	Phylogeny
Egg size	Salinity tolerance	Relatedness
Fecundity	Temperature tolerance	
Larval size		***Trophic ecology***
Longevity	***Invasion risk***	Diet breadth
Maturation size	Climate similarity	Trophic guild
Reproductive guild	Prior invasion success	
Spawning frequency		***Native range***
		Size of range

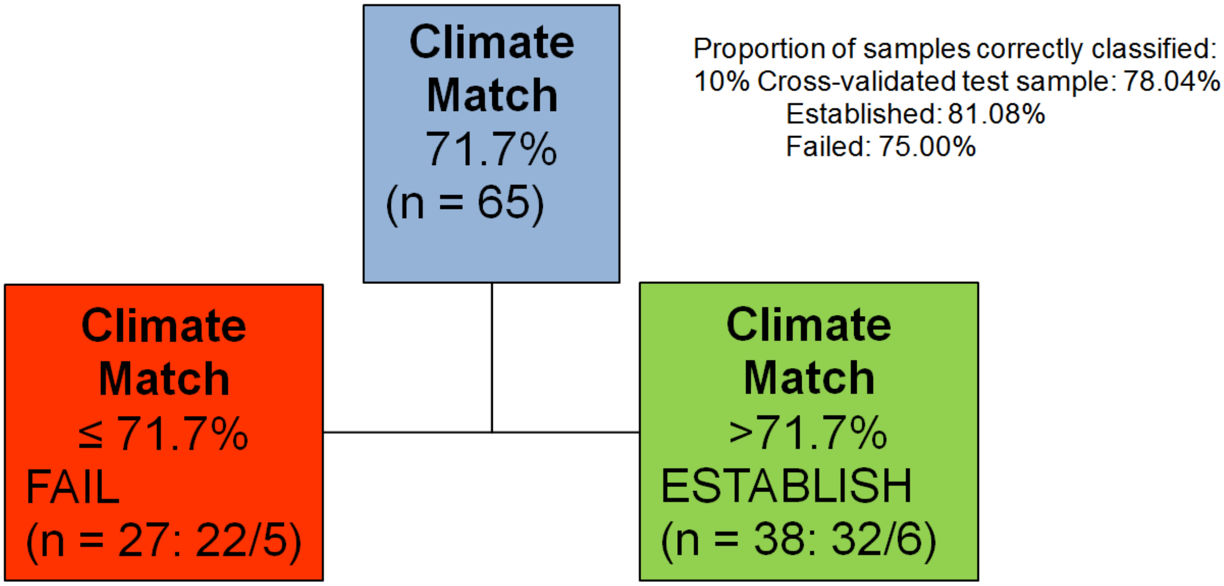

Figure A1. Trait-based classification tree for Great Lakes non-indigenous fish: establishment.

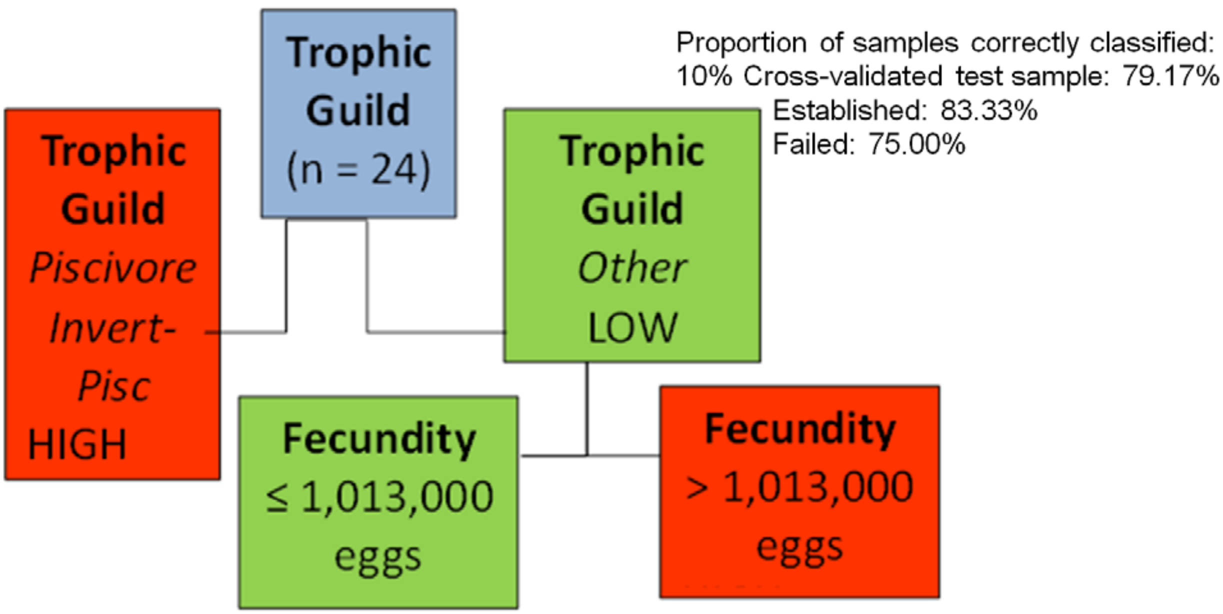

Figure A2. Trait-based classification tree for Great Lakes non-indigenous fish: ecological impact.

APPENDIX 6 – MASTER LIST OF FISHES IN TRADE IN CANADA

Master list of fishes in live trade in Canada (see text for sources). Family and species habitat match: E – Euryhaline; F – Freshwater; M – Marine. Family and species climate match: 0 – no match with Canada; 1 – match with Canada (see text for criteria). Status of establishment in Canada: 0 – species not in Canada; 1 – species in Canada. * indicates species with import trade volumes of live specimens (Romagosa, unpubl. data) that are not assigned to either Aquarium or Live Food trade. List sorted hierarchically: (a) species in Canada (0-1); (b) species-level climate-match (1-0); (c) family name (A-Z); and (d) scientific name (A-Z). The first 12 species in the master list represent those selected for screening.

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Cobitidae	*Cobitis taenia*	156		F	F	1	1	0
Cobitidae	*Misgurnus anguillicaudatus*	10385		F	F	1	1	0
Cobitidae	*Misgurnus fossilis*	139		F	F	1	1	0
Cyprinidae	*Carassius carassius*		340*	F	F	1	1	0
Cyprinidae	*Ctenopharyngodon idella*		46347	F	F	1	1	0
Cyprinidae	*Cyprinella lutrensis*	120		F	F	1	1	0
Cyprinidae	*Danio albolineatus*	8878		F	F	1	1	0
Cyprinidae	*Leuciscus idus*	50		F	F	1	1	0
Ictaluridae	*Ictalurus furcatus*			F	F	1	1	0
Moronidae	*Morone saxatilis x chrysops*		78593	E	E	1	1	0
Percichthyidae	*Siniperca chuatsi*	18442*		F	F	1	1	0
Siluridae	*Silurus glanis*	20		F	F	1	1	0
Achiridae	*Trinectes maculatus*	1230		F	F	1	0	0
Ambassidae	*Parambassis pulcinella*	29		F	F	1	0	0
Ambassidae	*Parambassis ranga*	4935		F	F	1	0	0
Ambassidae	*Parambassis siamensis*	920		F	F	1	0	0
Ambassidae	*Parambassis wolffii*	18		F	F	1	0	0
Ambassidae	*Pseudambassis baculis*	300		F	F	1	0	0
Anguillidae	*Anguilla australis*	15	7510	F	F	1	0	0
Anguillidae	*Anguilla bicolor*			F	F	1	0	0

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Anguillidae	*Anguilla japonica*			F	F	1	0	0
Anostomidae	*Abramites hypselonotus*	220		F	F	1	0	0
Anostomidae	*Anostomus anostomus*	288		F	F	1	0	0
Anostomidae	*Leporinus fasciatus*	501		F	F	1	0	0
Anostomidae	*Leporinus octofasciatus*	296		F	F	1	0	0
Bagridae	*Hemibagrus nemurus*	240		F	F	1	0	0
Bagridae	*Horabagrus brachysoma*	28		F	F	1	0	0
Bagridae	*Hyalobagrus ornatus*	183		F	F	1	0	0
Bagridae	*Mystus leucophasis*	18		F	F	1	0	0
Bagridae	*Mystus micracanthus*	283		F	F	1	0	0
Bagridae	*Pseudomystus siamensis*	360		F	F	1	0	0
Balitoridae	*Acanthocobitis botia*	630		F	F	1	0	0
Balitoridae	*Beaufortia kweichowensis*	55		F	F	1	0	0
Balitoridae	*Beaufortia leveretti*	1049		F	F	1	0	0
Balitoridae	*Gastromyzon borneensis*	316		F	F	1	0	0
Balitoridae	*Homaloptera ophiolepis*	10		F	F	1	0	0
Balitoridae	*Nemacheilus fasciatus*	100		F	F	1	0	0
Balitoridae	*Pseudogastromyzon fasciatus*	65		F	F	1	0	0
Balitoridae	*Pseudogastromyzon myersi*	3082		F	F	1	0	0
Balitoridae	*Schistura mahnerti*	56		F	F	1	0	0
Balitoridae	*Sewellia lineolata*	70		F	F	1	0	0
Belonidae	*Xenentodon cancila*	201		E	F	1	0	0
Catostomidae	*Myxocyprinus asiaticus*	510		F	F	1	0	0
Cobitidae	*Acantopsis choirorhynchos*	1374		F	F	1	0	0
Cobitidae	*Botia dario*	269		F	F	1	0	0
Cobitidae	*Botia histrionica*	437		F	F	1	0	0
Cobitidae	*Botia kubotai*	386		F	F	1	0	0

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Cobitidae	*Botia lohachata*	1963		F	F	1	0	0
Cobitidae	*Botia pulchripinnis*	40		F	F	1	0	0
Cobitidae	*Botia striata*	839		F	F	1	0	0
Cobitidae	*Chromobotia macracanthus*	16336		F	F	1	0	0
Cobitidae	*Lepidocephalichthys guntea*	72		F	F	1	0	0
Cobitidae	*Lepidocephalus thermalis*	125		F	F	1	0	0
Cobitidae	*Leptobotia guilinensis*	70		F	F	1	0	0
Cobitidae	*Pangio kuhlii*	14358		F	F	1	0	0
Cobitidae	*Pangio myersi*	4660		F	F	1	0	0
Cobitidae	*Pangio oblonga*	951		F	F	1	0	0
Cobitidae	*Pangio semicincta*	976		F	F	1	0	0
Cobitidae	*Pangio shelfordii*	300		F	F	1	0	0
Cobitidae	*Syncrossus hymenophysa*	501		F	F	1	0	0
Cobitidae	*Yasuhikotakia lecontei*	160		F	F	1	0	0
Cobitidae	*Yasuhikotakia modesta*	546		F	F	1	0	0
Cobitidae	*Yasuhikotakia morleti*	1584		F	F	1	0	0
Cobitidae	*Yasuhikotakia sidthimunki*	140		F	F	1	0	0
Crenuchidae	*Characidium fasciatum*	220		F	F	1	0	0
Crenuchidae	*Crenuchus spilurus*	40		F	F	1	0	0
Cynoglossidae	*Cynoglossus microlepis*	40		F	F	1	0	0
Cyprinidae	*Balantiocheilos melanopterus*	20194		F	F	1	0	0
Cyprinidae	*Barbonymus altus*	145		F	F	1	0	0
Cyprinidae	*Barbonymus schwanenfeldii*	3854		F	F	1	0	0
Cyprinidae	*Boraras maculatus*	1200		F	F	1	0	0
Cyprinidae	*Cirrhina molitorella*			F	F	1	0	0
Cyprinidae	*Crossocheilus latius*	188		F	F	1	0	0
Cyprinidae	*Crossocheilus siamensis*	4907		F	F	1	0	0

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Cyprinidae	*Cyclocheilichthys apogon*	41		F	F	1	0	0
Cyprinidae	*Danio choprai*	388		F	F	1	0	0
Cyprinidae	*Danio dangila*	42		F	F	1	0	0
Cyprinidae	*Danio kerri*	600		F	F	1	0	0
Cyprinidae	*Danio kyathit*	290		F	F	1	0	0
Cyprinidae	*Danio rerio*	227772		F	F	1	0	0
Cyprinidae	*Devario aequipinnatus*	7908		F	F	1	0	0
Cyprinidae	*Devario malabaricus*	1998		F	F	1	0	0
Cyprinidae	*Devario shanensis*	130		F	F	1	0	0
Cyprinidae	*Epalzeorhynchos bicolor*	15710		F	F	1	0	0
Cyprinidae	*Epalzeorhynchos frenatum*	4243		F	F	1	0	0
Cyprinidae	*Epalzeorhynchos kalopterus*	2932		F	F	1	0	0
Cyprinidae	*Epalzeorhynchos munense*	10511		F	F	1	0	0
Cyprinidae	*Garra bicornuta*	30		F	F	1	0	0
Cyprinidae	*Garra cambodgiensis*	30		F	F	1	0	0
Cyprinidae	*Garra ceylonensis*	100		F	F	1	0	0
Cyprinidae	*Hypophthalmichthys nobilis*		326618	F	F	1	0	0
Cyprinidae	*Hypsibarbus vernayi*	80		F	F	1	0	0
Cyprinidae	*Hypsibarbus wetmorei*	412		F	F	1	0	0
Cyprinidae	*Labeo chrysophekadion*	1801		F	F	1	0	0
Cyprinidae	*Labiobarbus festivus*	75		F	F	1	0	0
Cyprinidae	*Leptobarbus hoevenii*	505		F	F	1	0	0
Cyprinidae	*Luciosoma setigerum*	374		F	F	1	0	0
Cyprinidae	*Luciosoma spilopleura*	15		F	F	1	0	0
Cyprinidae	*Microrasbora erythromicron*	696		F	F	1	0	0
Cyprinidae	*Microrasbora kubotai*	150		F	F	1	0	0
Cyprinidae	*Oreichthys cosuatis*	180		F	F	1	0	0

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Cyprinidae	*Paracheilognathus himantegus*			F	F	1	0	0
Cyprinidae	*Puntius arulius*	387		F	F	1	0	0
Cyprinidae	*Puntius asoka*	102		F	F	1	0	0
Cyprinidae	*Puntius chola*	30		F	F	1	0	0
Cyprinidae	*Puntius conchonius*	24092		F	F	1	0	0
Cyprinidae	*Puntius denisonii*	947		F	F	1	0	0
Cyprinidae	*Puntius everetti*	1188		F	F	1	0	0
Cyprinidae	*Puntius filamentosus*	174		F	F	1	0	0
Cyprinidae	*Puntius gelius*	1387		F	F	1	0	0
Cyprinidae	*Puntius hexazona*	292		F	F	1	0	0
Cyprinidae	*Puntius johorensis*	10		F	F	1	0	0
Cyprinidae	*Puntius lateristriga*	1144		F	F	1	0	0
Cyprinidae	*Puntius lineatus*	284		F	F	1	0	0
Cyprinidae	*Puntius melanampyx*	620		F	F	1	0	0
Cyprinidae	*Puntius nigrofasciatus*	4385		F	F	1	0	0
Cyprinidae	*Puntius oligolepis*	4185		F	F	1	0	0
Cyprinidae	*Puntius partipentazona*	1390		F	F	1	0	0
Cyprinidae	*Puntius pentazona*	216		F	F	1	0	0
Cyprinidae	*Puntius rhomboocellatus*	339		F	F	1	0	0
Cyprinidae	*Puntius sachsii*	8341		F	F	1	0	0
Cyprinidae	*Puntius semifasciolatus*	60		F	F	1	0	0
Cyprinidae	*Puntius tetrazona*	101115		F	F	1	0	0
Cyprinidae	*Puntius ticto*	1125		F	F	1	0	0
Cyprinidae	*Puntius titteya*	32873		F	F	1	0	0
Cyprinidae	*Puntius vittatus*	75		F	F	1	0	0
Cyprinidae	*Rasbora borapetensis*	1172		F	F	1	0	0
Cyprinidae	*Rasbora dorsiocellata*	1424		F	F	1	0	0

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Cyprinidae	*Rasbora einthovenii*	4615		F	F	1	0	0
Cyprinidae	*Rasbora elegans*	185		F	F	1	0	0
Cyprinidae	*Rasbora kalochroma*	252		F	F	1	0	0
Cyprinidae	*Rasbora meinkeni*	110		F	F	1	0	0
Cyprinidae	*Rasbora pauciperforata*	6070		F	F	1	0	0
Cyprinidae	*Rasbora trilineata*	9363		F	F	1	0	0
Cyprinidae	*Rasbora vaterifloris*	150		F	F	1	0	0
Cyprinidae	*Sawbwa resplendens*	200		F	F	1	0	0
Cyprinidae	*Sundadanio axelrodi*	160		F	F	1	0	0
Cyprinidae	*Tanichthys albonubes*	104539		F	F	1	0	0
Cyprinidae	*Trigonostigma espei*	100		F	F	1	0	0
Cyprinidae	*Trigonostigma hengeli*	2005		F	F	1	0	0
Cyprinidae	*Trigonostigma heteromorpha*	38101		F	F	1	0	0
Cyprinodontidae	*Jordanella floridae*	1124		E	F	1	0	0
Elassomatidae	*Elassoma evergladei*	40		F	F	1	0	0
Eleotridae	*Dormitator latifrons*			E	E	1	0	0
Eleotridae	*Kribia kribensis*			E	F	1	0	0
Eleotridae	*Mogurnda adspersa*	18		E	F	1	0	0
Eleotridae	*Mogurnda mogurnda*	30		E	F	1	0	0
Eleotridae	*Oxyeleotris marmorata*		1212	E	F	1	0	0
Eleotridae	*Tateurndina ocellicauda*	104		E	F	1	0	0
Gobiidae	*Amblyeleotris gymnocephala*	4		E	E	1	0	0
Gobiidae	*Awaous bustamantei*	100		E	F	1	0	0
Gobiidae	*Brachygobius doriae*	3140		E	F	1	0	0
Gobiidae	*Brachygobius xanthozonus*	1253		E	F	1	0	0
Gobiidae	*Gobiodon rivulatus*	42		E	E	1	0	0
Gobiidae	*Gobioides broussonnetii*	713		E	E	1	0	0

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Gobiidae	*Odontamblyopus rubicundus*	230		E	E	1	0	0
Gobiidae	*Periophthalmus barbarus*	62		E	E	1	0	0
Gobiidae	*Stigmatogobius sadanundio*	80		E	E	1	0	0
Gobiidae	*Stiphodon ornatus*	32		E	F	1	0	0
Hemiramphidae	*Dermogenys pusilla*	514		E	E	1	0	0
Hemiramphidae	*Nomorhamphus liemi*	68		E	F	1	0	0
Lepisosteidae	*Atractosteus spatula*	3		F	F	1	0	0
Lepisosteidae	*Lepisosteus platyrhincus*	25		F	F	1	0	0
Petromyzontidae	*Icthyomyzon gagei*	100		E	F	1	0	0
Poeciliidae	*Aplocheilichthys myersi*			F	F	1	0	0
Poeciliidae	*Aplocheilichthys normani*	1570		F	F	1	0	0
Poeciliidae	*Gambusia affinis*	3630		F	F	1	0	0
Poeciliidae	*Gambusia holbrooki*			F	F	1	0	0
Poeciliidae	*Heterandria formosa*			F	F	1	0	0
Poeciliidae	*Poecilia latipinna*	52033		F	F	1	0	0
Poeciliidae	*Poecilia petenensis*			F	F	1	0	0
Poeciliidae	*Poecilia reticulata*	197181		F	F	1	0	0
Poeciliidae	*Poecilia sphenops*	46543		F	F	1	0	0
Poeciliidae	*Poecilia velifera*	36080		F	F	1	0	0
Poeciliidae	*Priapella intermedia*	20		F	F	1	0	0
Poeciliidae	*Procatopus aberrans*	20		F	F	1	0	0
Poeciliidae	*Xiphophorus birchmanni*			F	F	1	0	0
Poeciliidae	*Xiphophorus hellerii*	140778		F	F	1	0	0
Poeciliidae	*Xiphophorus maculatus*	193979		F	F	1	0	0
Poeciliidae	*Xiphophorus variatus*	15256		F	F	1	0	0
Siluridae	*Kryptopterus bicirrhis*	5414		F	F	1	0	0
Siluridae	*Kryptopterus cryptopterus*	126		F	F	1	0	0

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Synbranchidae	*Monopterus albus*		632	F	F	1	0	0
Syngnathidae	*Doryichthys boaja*	10		E	F	1	0	0
Siluridae	*Kryptopterus macrocephalus*	416		F	F	1	0	0
Siluridae	*Kryptopterus minor*	12		F	F	1	0	0
Anguillidae	*Anguilla rostrata*		86185	F	F	1	1	1
Catostomidae	*Ictiobus cyprinellus*	2	30533	F	F	1	1	1
Centrarchidae	*Lepomis macrochirus*	20		F	F	1	1	1
Centrarchidae	*Lepomis megalotis*	4		F	F	1	1	1
Centrarchidae	*Micropterus salmoides*	18	185973	F	F	1	1	1
Centrarchidae	*Pomoxis nigromaculatus*	24		F	F	1	1	1
Cyprinidae	*Carassius auratus*	4571600	297	F	F	1	1	1
Cyprinidae	*Cyprinus carpio*	27123	153908	F	F	1	1	1
Cyprinidae	*Phoxinus neogaeus*	5550		F	F	1	1	1
Cyprinidae	*Pimephales promelas*	248050		F	F	1	1	1
Ictaluridae	*Ameiurus nebulosus*			F	F	1	1	1
Ictaluridae	*Ictalurus punctatus*	788	105331	F	F	1	1	1
Lepisosteidae	*Lepisosteus oculatus*	248		F	F	1	1	1
Lepisosteidae	*Lepisosteus osseus*	4		F	F	1	1	1
Moronidae	*Morone saxatilis*		117947	E	E	1	1	1
Salmonidae	*Oncorhynchus keta*			E	E	1	1	1
Salmonidae	*Oncorhynchus mykiss*		950000	E	F	1	1	1
Salmonidae	*Salmo salar*		565990	E	E	1	1	1
Acanthuridae	*Acanthurus achilles*	71		M	M			
Acanthuridae	*Acanthurus bariene*	1		M	M			
Acanthuridae	*Acanthurus chirurgus*	3		M	M			
Acanthuridae	*Acanthurus coeruleus*	112		M	M			
Acanthuridae	*Acanthurus guttatus*	8		M	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Acanthuridae	*Acanthurus japonicus*	133		M	M			
Acanthuridae	*Acanthurus leucopareius*			M	M			
Acanthuridae	*Acanthurus leucosternon*	314		M	M			
Acanthuridae	*Acanthurus lineatus*	74		M	M			
Acanthuridae	*Acanthurus maculiceps*	1		M	M			
Acanthuridae	*Acanthurus nigricans*	45		M	M			
Acanthuridae	*Acanthurus nigricauda*	18		M	M			
Acanthuridae	*Acanthurus nigrofuscus*	7		M	M			
Acanthuridae	*Acanthurus nigroris*	2		M	M			
Acanthuridae	*Acanthurus olivaceus*	49		M	M			
Acanthuridae	*Acanthurus pyroferus*	56		M	M			
Acanthuridae	*Acanthurus sohal*	124		M	M			
Acanthuridae	*Acanthurus tennentii*	8		M	M			
Acanthuridae	*Acanthurus triostegus*	34		M	M			
Acanthuridae	*Acanthurus xanthopterus*	8		M	M			
Acanthuridae	*Ctenochaetus binotatus*	4		M	M			
Acanthuridae	*Ctenochaetus hawaiiensis*	35		M	M			
Acanthuridae	*Ctenochaetus marginatus*	52		M	M			
Acanthuridae	*Ctenochaetus striatus*	35		M	M			
Acanthuridae	*Ctenochaetus strigosus*	118		M	M			
Acanthuridae	*Ctenochaetus tominiensis*	1		M	M			
Acanthuridae	*Naso brevirostris*	13		M	M			
Acanthuridae	*Naso elegans*	10		M	M			
Acanthuridae	*Naso hexacanthus*	2		M	M			
Acanthuridae	*Naso lituratus*	434		M	M			
Acanthuridae	*Naso lopezi*	12		M	M			
Acanthuridae	*Naso unicornis*	7		M	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Acanthuridae	*Naso vlamingii*	8		M	M			
Acanthuridae	*Paracanthurus hepatus*	1303		M	M			
Acanthuridae	*Zebrasoma desjardinii*	130		M	M			
Acanthuridae	*Zebrasoma flavescens*	1420		M	M			
Acanthuridae	*Zebrasoma scopas*	182		M	M			
Acanthuridae	*Zebrasoma veliferum*	224		M	M			
Acanthuridae	*Zebrasoma xanthurum*	374		M	M			
Acestrorhynchidae	*Acestrorhynchus falcatus*	118		F	F	0		
Acipenseridae	*Acipenser baerii*			M	M			
Acipenseridae	*Acipenser gueldenstaedtii*			M	M			
Acipenseridae	*Acipenser naccarii*			M	M			
Acipenseridae	*Acipenser oxyrhynchus*			M	M			
Acipenseridae	*Acipenser ruthenus*	37		M	M			
Acipenseridae	*Acipenser sinensis*			M	M			
Acipenseridae	*Acipenser stellatus*			M	M			
Acipenseridae	*Acipenser transmontanus*			M	M			
Acipenseridae	*Huso huso*			M	M			
Agonidae	*Agonopsis vulsa*			M	M			
Alestidae	*Alestopetersius caudalis*	277		F	F	0		
Alestidae	*Alestopetersius smykalai*			F	F	0		
Alestidae	*Arnoldichthys spilopterus*			F	F	0		
Alestidae	*Brycinus longipinnis*	18		F	F	0		
Alestidae	*Ladigesia roloffi*			F	F	0		
Alestidae	*Lepidarchus adonis*			F	F	0		
Alestidae	*Phenacogrammus aurantiacus*	170		F	F	0		
Alestidae	*Phenacogrammus interruptus*	3398		F	F	0		
Anabantidae	*Anabas testudineus*	80		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Anabantidae	*Ctenopoma acutirostre*	441		F	F	0		
Anarhichadidae	*Anarhichthys ocellatus*			M	M			
Anomalopidae	*Anomalops katoptron*	7		M	M			
Antennariidae	*Antennarius avalonis*	4		M	M			
Antennariidae	*Antennarius biocellatus*	14		M	M			
Antennariidae	*Antennarius hispidus*	11		M	M			
Antennariidae	*Antennarius indicus*	4		M	M			
Antennariidae	*Antennarius maculatus*	3		M	M			
Antennariidae	*Antennarius nummifer*	4		M	M			
Antennariidae	*Antennarius striatus*	9		M	M			
Antennariidae	*Antennatus tuberosus*	7		M	M			
Antennariidae	*Histrio histrio*	5		M	M			
Aplocheilidae	*Aphyosemion australe*	115		F	F	0		
Aplocheilidae	*Aphyosemion filamentosum*			F	F	0		
Aplocheilidae	*Aphyosemion gabunense*	30		F	F	0		
Aplocheilidae	*Aphyosemion striatum*	30		F	F	0		
Aplocheilidae	*Aplocheilus dayi*	25		F	F	0		
Aplocheilidae	*Aplocheilus lineatus*	964		F	F	0		
Aplocheilidae	*Aplocheilus panchax*	632		F	F	0		
Aplocheilidae	*Epiplatys annulatus*	80		F	F	0		
Aplocheilidae	*Fundulopanchax filamentosus*	40		F	F	0		
Aplocheilidae	*Fundulopanchax gardneri*	30		F	F	0		
Aplocheilidae	*Fundulopanchax puerzli*	30		F	F	0		
Aplocheilidae	*Fundulopanchax sjostedti*	25		F	F	0		
Aplocheilidae	*Fundulopanchax walkeri*	20		F	F	0		
Aplocheilidae	*Nothobranchius guentheri*	61		F	F	0		
Aplocheilidae	*Nothobranchius rachovii*	60		F	F	0		

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Aplocheilidae	*Nothobranchius rubripinnis*	60		F	F	0		
Apogonidae	*Apogon fasciatus*	9		E	M			
Apogonidae	*Apogon ishigakiensis*	4		E	M			
Apogonidae	*Apogon maculatus*	27		E	M			
Apogonidae	*Apogon pseudomaculatus*	4		E	M			
Apogonidae	*Ostorhinchus fasciatus*	30		E	M			
Apogonidae	*Ostorhinchus nigrofasciatus*	10		E	M			
Apogonidae	*Ostorhincus angustatus*	16		E	M			
Apogonidae	*Pterapogon kauderni*	808		E	M			
Apogonidae	*Sphaeramia nematoptera*	311		E	M			
Apogonidae	*Sphaeramia orbicularis*	29		E	M			
Apogonidae	*Zoramia leptacantha*	2		E	M			
Apteronotidae	*Apteronotus albifrons*	2960		F	F	0		
Apteronotidae	*Apteronotus leptorhynchus*	525		F	F	0		
Ariidae	*Arius seemanni*	5065		M	M			
Aspredinidae	*Bunocephalus coracoideus*	701		F	F	0		
Aspredinidae	*Bunocephalus knerii*	40		F	F	0		
Atherinopsidae	*Menidia menidia*			E	M			
Auchenipteridae	*Auchenipterichthys thoracatus*	90		F	F	0		
Auchenipteridae	*Centromochlus reticulatus*	15		F	F	0		
Aulostomidae	*Aulostomus chinensis*	2		M	M			
Balistidae	*Abalistes stellaris*			M	M			
Balistidae	*Abalistes stellatus*	2		M	M			
Balistidae	*Balistapus undulatus*	16		M	M			
Balistidae	*Balistes vetula*	7		M	M			
Balistidae	*Balistoides conspicillum*	74		M	M			
Balistidae	*Balistoides viridescens*			M	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Balistidae	*Melichthys niger*	4		M	M			
Balistidae	*Melichthys vidua*	14		M	M			
Balistidae	*Odonus niger*	165		M	M			
Balistidae	*Pseudobalistes fuscus*	11		M	M			
Balistidae	*Rhinecanthus aculeatus*	72		M	M			
Balistidae	*Rhinecanthus assasi*	8		M	M			
Balistidae	*Rhinecanthus rectangulus*	23		M	M			
Balistidae	*Rhinecanthus verrucosus*	15		M	M			
Balistidae	*Sufflamen albicaudatum*	1		M	M			
Balistidae	*Sufflamen chrysopterum*	1		M	M			
Balistidae	*Xanthichthys auromarginatus*	15		M	M			
Balistidae	*Xanthichthys ringens*	11		M	M			
Bathymasteridae	*Ronquilus jordani*			M	M			
Batrachoididae	*Opsanus pardus*	1		E	M			
Batrachoididae	*Opsanus tau*		406	E	M			
Batrachoididae	*Porichthys notatus*			E	M			
Bedotiidae	*Bedotia gaeyi*	746		F	F	0		
Blenniidae	*Atrosalarias fuscus*	5		E	M			
Blenniidae	*Blenniella chrysospilos*	26		E	M			
Blenniidae	*Blenniella periophthalmus*	20		E	M			
Blenniidae	*Cirripectes castaneus*	3		E	M			
Blenniidae	*Cirripectes obscurus*	6		E	M			
Blenniidae	*Cirripectes stigmaticus*	3		E	M			
Blenniidae	*Cirripectes variolosus*	12		E	M			
Blenniidae	*Ecsenius aroni*	20		E	M			
Blenniidae	*Ecsenius bicolor*	330		E	M			
Blenniidae	*Ecsenius bimaculatus*	18		E	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Blenniidae	*Ecsenius frontalis*	36		E	M			
Blenniidae	*Ecsenius gravieri*	21		E	M			
Blenniidae	*Ecsenius lineatus*	36		E	M			
Blenniidae	*Ecsenius lividanalis*	1		E	M			
Blenniidae	*Ecsenius midas*	102		E	M			
Blenniidae	*Ecsenius namiyei*	8		E	M			
Blenniidae	*Ecsenius stigmatura*	1		E	M			
Blenniidae	*Exallias brevis*	14		E	M			
Blenniidae	*Hypsoblennius gentilis*	2		E	M			
Blenniidae	*Meiacanthus atrodorsalis*	34		E	M			
Blenniidae	*Meiacanthus bundoon*	1		E	M			
Blenniidae	*Meiacanthus grammistes*	40		E	M			
Blenniidae	*Meiacanthus mossambicus*	1		E	M			
Blenniidae	*Meiacanthus nigrolineatus*	1		E	M			
Blenniidae	*Meiacanthus oualanensis*	55		E	M			
Blenniidae	*Meiacanthus smithi*	65		E	M			
Blenniidae	*Ophioblennius atlanticus*	58		E	M			
Blenniidae	*Ophioblennius macclurei*	13		E	M			
Blenniidae	*Ophioblennius steindachneri*	11		E	M			
Blenniidae	*Parablennius marmoreus*	16		E	M			
Blenniidae	*Plagiotremus rhinorhynchos*	3		E	M			
Blenniidae	*Salarias fasciatus*	421		E	M			
Blenniidae	*Salarias segmentatus*	1		E	M			
Bothidae	*Bothus mancus*	10		M	M			
Bothidae	*Bothus ocellatus*	12		M	M			
Bythitidae	*Brotulina fusca*	13		E	M	0		
Bythitidae	*Dinematichthys riukiuensis*	28		E	M	0		

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Caesionidae	*Caesio cuning*	22		M	M			
Callichthyidae	*Brochis britskii*	100		F	F	0		
Callichthyidae	*Brochis multiradiatus*	17		F	F	0		
Callichthyidae	*Brochis splendens*	4749		F	F	0		
Callichthyidae	*Callichthys callichthys*			F	F	0		
Callichthyidae	*Corydoras adolfoi*	90		F	F	0		
Callichthyidae	*Corydoras aeneus*	20592		F	F	0		
Callichthyidae	*Corydoras agassizii*	1080		F	F	0		
Callichthyidae	*Corydoras arcuatus*	861		F	F	0		
Callichthyidae	*Corydoras atropersonatus*	70		F	F	0		
Callichthyidae	*Corydoras axelrodi*	260		F	F	0		
Callichthyidae	*Corydoras blochi*	100		F	F	0		
Callichthyidae	*Corydoras concolor*	120		F	F	0		
Callichthyidae	*Corydoras delphax*	100		F	F	0		
Callichthyidae	*Corydoras duplicareus*	10		F	F	0		
Callichthyidae	*Corydoras elegans*	885		F	F	0		
Callichthyidae	*Corydoras eques*	20		F	F	0		
Callichthyidae	*Corydoras habrosus*	700		F	F	0		
Callichthyidae	*Corydoras hastatus*	2950		F	F	0		
Callichthyidae	*Corydoras julii*	6268		F	F	0		
Callichthyidae	*Corydoras melanistius*	3630		F	F	0		
Callichthyidae	*Corydoras melanotaenia*	3800		F	F	0		
Callichthyidae	*Corydoras melini*	730		F	F	0		
Callichthyidae	*Corydoras metae*	1970		F	F	0		
Callichthyidae	*Corydoras nattereri*	600		F	F	0		
Callichthyidae	*Corydoras ornatus*	10		F	F	0		
Callichthyidae	*Corydoras paleatus*	15873		F	F	0		

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Callichthyidae	*Corydoras panda*	4193		F	F	0		
Callichthyidae	*Corydoras polystictus*	150		F	F	0		
Callichthyidae	*Corydoras punctatus*	5477		F	F	0		
Callichthyidae	*Corydoras pygmaeus*	2980		F	F	0		
Callichthyidae	*Corydoras rabauti*	1161		F	F	0		
Callichthyidae	*Corydoras reticulatus*	500		F	F	0		
Callichthyidae	*Corydoras schwartzi*	1492		F	F	0		
Callichthyidae	*Corydoras spilurus*	75		F	F	0		
Callichthyidae	*Corydoras sterbai*	1068		F	F	0		
Callichthyidae	*Corydoras trilineatus*	2115		F	F	0		
Callichthyidae	*Corydoras zygatus*	20		F	F	0		
Callichthyidae	*Dianema longibarbis*	110		F	F	0		
Callichthyidae	*Dianema urostriatum*	225		F	F	0		
Callichthyidae	*Hoplosternum littorale*	160		F	F	0		
Callichthyidae	*Hoplosternum thoracatum*			F	F	0		
Callichthyidae	*Megalechis thoracata*	495		F	F	0		
Callichthyidae	*Scleromystax barbatus*	50		F	F	0		
Callionymidae	*Callionymus beniteguri*	20		E	M			
Callionymidae	*Dactylopus dactylopus*	8		E	M			
Callionymidae	*Diplogrammus xenicus*	17		E	M			
Callionymidae	*Synchiropus ijimae*	47		E	M			
Callionymidae	*Synchiropus marmoratus*	56		E	M			
Callionymidae	*Synchiropus ocellatus*	289		E	M			
Callionymidae	*Synchiropus picturatus*	231		E	M			
Callionymidae	*Synchiropus splendidus*	1017		E	M			
Caracanthidae	*Caracanthus maculatus*	6		M	M			
Carangidae	*Gnathanodon speciosus*	5		M	M			

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Carangidae	*Selene vomer*	20		M	M			
Carcharhinidae	*Carcharhinus melanopterus*	2		M	M			
Carcharhinidae	*Galeocerdo cuvieri*			M	M			
Carcharhinidae	*Prionace glauca*			M	M			
Centriscidae	*Aeoliscus strigatus*			M	M			
Centropomidae	*Lates calcarifer*		4530	E	E	0		
Ceratodontidae	*Neoceratodus forsteri*			F	F	0		
Chacidae	*Chaca chaca*	265		F	F	0		
Chaenopsidae	*Acanthemblemaria crockeri*	1		M	M			
Chaenopsidae	*Acanthemblemaria macrospilus*	4		M	M			
Chaenopsidae	*Emblemaria pandionis*	33		M	M			
Chaetodontidae	*Chaetodon argentatus*	4		M	M			
Chaetodontidae	*Chaetodon auriga*	174		M	M			
Chaetodontidae	*Chaetodon austriacus*	11		M	M			
Chaetodontidae	*Chaetodon bennetti*	7		M	M			
Chaetodontidae	*Chaetodon capistratus*	10		M	M			
Chaetodontidae	*Chaetodon citrinellus*	7		M	M			
Chaetodontidae	*Chaetodon collare*	46		M	M			
Chaetodontidae	*Chaetodon decussatus*	11		M	M			
Chaetodontidae	*Chaetodon ephippium*	44		M	M			
Chaetodontidae	*Chaetodon falcula*	8		M	M			
Chaetodontidae	*Chaetodon fasciatus*	53		M	M			
Chaetodontidae	*Chaetodon guttatissimus*	2		M	M			
Chaetodontidae	*Chaetodon humeralis*	6		M	M			
Chaetodontidae	*Chaetodon kleinii*	35		M	M			
Chaetodontidae	*Chaetodon larvatus*	7		M	M			
Chaetodontidae	*Chaetodon lineolatus*	1		M	M			

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Chaetodontidae	*Chaetodon lunula*	138		M	M			
Chaetodontidae	*Chaetodon madagaskariensis*	3		M	M			
Chaetodontidae	*Chaetodon melannotus*	1		M	M			
Chaetodontidae	*Chaetodon mertensii*	1		M	M			
Chaetodontidae	*Chaetodon mesoleucos*	3		M	M			
Chaetodontidae	*Chaetodon meyeri*	12		M	M			
Chaetodontidae	*Chaetodon mitratus*	1		M	M			
Chaetodontidae	*Chaetodon multicinctus*	1		M	M			
Chaetodontidae	*Chaetodon ocellatus*	4		M	M			
Chaetodontidae	*Chaetodon octofasciatus*	5		M	M			
Chaetodontidae	*Chaetodon ornatissimus*	16		M	M			
Chaetodontidae	*Chaetodon paucifasciatus*	26		M	M			
Chaetodontidae	*Chaetodon plebeius*	1		M	M			
Chaetodontidae	*Chaetodon punctatofasciatus*	37		M	M			
Chaetodontidae	*Chaetodon quadrimaculatus*	1		M	M			
Chaetodontidae	*Chaetodon rafflesii*	12		M	M			
Chaetodontidae	*Chaetodon rainfordi*	5		M	M			
Chaetodontidae	*Chaetodon reticulatus*	1		M	M			
Chaetodontidae	*Chaetodon sedentarius*	2		M	M			
Chaetodontidae	*Chaetodon semilarvatus*	145		M	M			
Chaetodontidae	*Chaetodon speculum*	9		M	M			
Chaetodontidae	*Chaetodon striatus*	10		M	M			
Chaetodontidae	*Chaetodon trifasciatus*	11		M	M			
Chaetodontidae	*Chaetodon ulietensis*	2		M	M			
Chaetodontidae	*Chaetodon unimaculatus*	32		M	M			
Chaetodontidae	*Chaetodon vagabundus*	55		M	M			
Chaetodontidae	*Chaetodon wiebeli*	1		M	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Chaetodontidae	*Chaetodon xanthocephalus*	4		M	M			
Chaetodontidae	*Chaetodon xanthurus*	84		M	M			
Chaetodontidae	*Chelmon rostratus*	407		M	M			
Chaetodontidae	*Forcipiger flavissimus*	114		M	M			
Chaetodontidae	*Forcipiger longirostris*	29		M	M			
Chaetodontidae	*Hemitaurichthys polylepis*	2		M	M			
Chaetodontidae	*Hemitaurichthys zoster*	6		M	M			
Chaetodontidae	*Heniochus acuminatus*	231		M	M			
Chaetodontidae	*Heniochus chrysostomus*	9		M	M			
Chaetodontidae	*Heniochus intermedius*	15		M	M			
Chaetodontidae	*Heniochus monoceros*	49		M	M			
Chaetodontidae	*Heniochus singularius*	3		M	M			
Chaetodontidae	*Heniochus varius*	50		M	M			
Chaetodontidae	*Johnrandallia nigrirostris*	5		M	M			
Chaetodontidae	*Prognathodes aculeatus*	3		M	M			
Channidae	*Channa asiatica*		1355	F	F	0		
Channidae	*Channa gachua*			F	F	0		
Channidae	*Channa lucius*	120		F	F	0		
Channidae	*Channa maculata*		3816	F	F	0		
Channidae	*Channa micropeltes*	657	5	F	F	0		
Channidae	*Channa punctata*	80		F	F	0		
Channidae	*Channa striata*	150		F	F	0		
Characidae	*Aphyocharax anisitsi*	9969		F	F	0		
Characidae	*Aphyocharax paraguayensis*	845		F	F	0		
Characidae	*Aphyocharax rathbuni*	738		F	F	0		
Characidae	*Astyanax fasciatus*	374		F	F	0		
Characidae	*Astyanax jordani*	50		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Characidae	*Astyanax mexicanus*	1334		F	F	0		
Characidae	*Boehikee fredcochui*	14746		F	F	0		
Characidae	*Chalceus macrolepidotus*	250		F	F	0		
Characidae	*Colossoma macropomum*	255		F	F	0		
Characidae	*Ctenobrycon hauxwellianus*	12		F	F	0		
Characidae	*Ctenobrycon spilurus*	80		F	F	0		
Characidae	*Exodon paradoxus*	365		F	F	0		
Characidae	*Gymnocorymbus ternetzi*	42058		F	F	0		
Characidae	*Hasemania nana*	12726		F	F	0		
Characidae	*Hemigrammus bleheri*	11106		F	F	0		
Characidae	*Hemigrammus erythrozonus*	25517		F	F	0		
Characidae	*Hemigrammus gracilis*	2030		F	F	0		
Characidae	*Hemigrammus hyanuary*	670		F	F	0		
Characidae	*Hemigrammus ocellifer*	17265		F	F	0		
Characidae	*Hemigrammus pulcher*	4205		F	F	0		
Characidae	*Hemigrammus rhodostomus*	15075		F	F	0		
Characidae	*Hemigrammus rodwayi*	8810		F	F	0		
Characidae	*Hemigrammus ulreyi*	150		F	F	0		
Characidae	*Hoplocharax goethei*			F	F	0		
Characidae	*Hyphessobrycon amandae*	400		F	F	0		
Characidae	*Hyphessobrycon anisitsi*	5991		F	F	0		
Characidae	*Hyphessobrycon axelrodi*	60		F	F	0		
Characidae	*Hyphessobrycon bentosi*	3636		F	F	0		
Characidae	*Hyphessobrycon columbianus*	2305		F	F	0		
Characidae	*Hyphessobrycon ecuadoriensis*	936		F	F	0		
Characidae	*Hyphessobrycon eos*	250		F	F	0		
Characidae	*Hyphessobrycon eques*	43309		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Characidae	*Hyphessobrycon erythrostigma*	8783		F	F	0		
Characidae	*Hyphessobrycon flammeus*	12101		F	F	0		
Characidae	*Hyphessobrycon herbertaxelrodi*	28375		F	F	0		
Characidae	*Hyphessobrycon loretoensis*	950		F	F	0		
Characidae	*Hyphessobrycon megalopterus*	11591		F	F	0		
Characidae	*Hyphessobrycon metae*	580		F	F	0		
Characidae	*Hyphessobrycon pulchripinnis*	20981		F	F	0		
Characidae	*Hyphessobrycon pyrrhonotus*	200		F	F	0		
Characidae	*Hyphessobrycon rosaceus*	870		F	F	0		
Characidae	*Hyphessobrycon roseus*	740		F	F	0		
Characidae	*Hyphessobrycon scholzei*	150		F	F	0		
Characidae	*Hyphessobrycon serpae*	80		F	F	0		
Characidae	*Hyphessobrycon socolofi*	1550		F	F	0		
Characidae	*Hyphessobrycon sweglesi*	5468		F	F	0		
Characidae	*Inpaichthys kerri*	3229		F	F	0		
Characidae	*Metynnis argenteus*	1061		F	F	0		
Characidae	*Metynnis hypsauchen*	1909		F	F	0		
Characidae	*Metynnis lippincottianus*	20		F	F	0		
Characidae	*Metynnis maculatus*	100		F	F	0		
Characidae	*Moenkhausia oligolepis*	5869		F	F	0		
Characidae	*Moenkhausia pittieri*	4007		F	F	0		
Characidae	*Moenkhausia sanctaefilomenae*	11459		F	F	0		
Characidae	*Moenkhausia*	100		F	F	0		
Characidae	*Myleus schomburgkii*	110		F	F	0		
Characidae	*Myloplus rubripinnis*	188		F	F	0		
Characidae	*Mylossoma aureum*	1533		F	F	0		
Characidae	*Nematobrycon lacortei*	580		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Characidae	*Nematobrycon palmeri*	8862		F	F	0		
Characidae	*Paracheirodon axelrodi*	44514		F	F	0		
Characidae	*Paracheirodon innesi*	540990		F	F	0		
Characidae	*Paracheirodon simulans*	11345		F	F	0		
Characidae	*Petitella georgiae*	2879		F	F	0		
Characidae	*Piaractus brachypomus*	565		F	F	0		
Characidae	*Prionobrama filigera*	2210		F	F	0		
Characidae	*Pristella maxillaris*	13738		F	F	0		
Characidae	*Pristobrycon striolatus*	330		F	F	0		
Characidae	*Pygocentrus cariba*	30		F	F	0		
Characidae	*Pygocentrus nattereri*	10293		F	F	0		
Characidae	*Pygocentrus piraya*			F	F	0		
Characidae	*Serrasalmus brandti*			F	F	0		
Characidae	*Serrasalmus elongatus*	1		F	F	0		
Characidae	*Serrasalmus manueli*	4		F	F	0		
Characidae	*Serrasalmus niger*			F	F	0		
Characidae	*Serrasalmus rhombeus*	4		F	F	0		
Characidae	*Serrasalmus striolatus*			F	F	0		
Characidae	*Serrasalmus ternetzi*			F	F	0		
Characidae	*Thayeria boehlkei*	9363		F	F	0		
Characidae	*Thayeria obliqua*	4573		F	F	0		
Characidae	*Tyttocharax cochui*	520		F	F	0		
Chilodontidae	*Chilodus punctatus*	261		F	F	0		
Chlamydoselachidae	*Chlamydoselachus anguineus*			M	M			
Cichlidae	*Acarichthys heckelii*	117		F	F	0		
Cichlidae	*Aequidens latifrons*	50		F	F	0		
Cichlidae	*Aequidens pulcher*	627		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Cichlidae	*Aequidens rivulatus*	1353		F	F	0		
Cichlidae	*Alcolapia alcalicus*	35		F	F	0		
Cichlidae	*Altolamprologus calvus*	517		F	F	0		
Cichlidae	*Altolamprologus compressiceps*	720		F	F	0		
Cichlidae	*Amatitlania nigrofasciata*	1266		F	F	0		
Cichlidae	*Amphilophus citrinellus*	1689		F	F	0		
Cichlidae	*Amphilophus labiatus*	707	1387	F	F	0		
Cichlidae	*Anomalochromis thomasi*	84		F	F	0		
Cichlidae	*Apistogramma agassizii*	1239		F	F	0		
Cichlidae	*Apistogramma atahualpa*	50		F	F	0		
Cichlidae	*Apistogramma bitaeniata*	180		F	F	0		
Cichlidae	*Apistogramma borellii*	325		F	F	0		
Cichlidae	*Apistogramma cacatuoides*	1079		F	F	0		
Cichlidae	*Apistogramma commbrae*	20		F	F	0		
Cichlidae	*Apistogramma cruzi*	80		F	F	0		
Cichlidae	*Apistogramma eunotus*	80		F	F	0		
Cichlidae	*Apistogramma gibbiceps*	25		F	F	0		
Cichlidae	*Apistogramma hongsloi*	194		F	F	0		
Cichlidae	*Apistogramma linkei*	20		F	F	0		
Cichlidae	*Apistogramma macmasteri*	500		F	F	0		
Cichlidae	*Apistogramma nijsseni*	65		F	F	0		
Cichlidae	*Apistogramma panduro*	120		F	F	0		
Cichlidae	*Apistogramma piauiensis*	25		F	F	0		
Cichlidae	*Apistogramma trifasciata*	60		F	F	0		
Cichlidae	*Apistogramma tucurui*	8		F	F	0		
Cichlidae	*Apistogramma viejita*	138		F	F	0		
Cichlidae	*Archocentrus myrnae*	30		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Cichlidae	*Archocentrus sajica*	35		F	F	0		
Cichlidae	*Aristochromis christyi*	36		F	F	0		
Cichlidae	*Astronotus ocellatus*	13692		F	F	0		
Cichlidae	*Aulonocara baenschi*	235		F	F	0		
Cichlidae	*Aulonocara hansbaenschi*	10		F	F	0		
Cichlidae	*Aulonocara jacobfreibergi*	272		F	F	0		
Cichlidae	*Aulonocara korneliae*	20		F	F	0		
Cichlidae	*Aulonocara maylandi*	89		F	F	0		
Cichlidae	*Aulonocara nyassae*	1244		F	F	0		
Cichlidae	*Aulonocara rostratum*	80		F	F	0		
Cichlidae	*Aulonocara steveni*	136		F	F	0		
Cichlidae	*Aulonocara stuartgranti*	227		F	F	0		
Cichlidae	*Benthochromis tricoti*			F	F	0		
Cichlidae	*Biotodoma cupido*	250		F	F	0		
Cichlidae	*Boulengerochromis microlepis*			F	F	0		
Cichlidae	*Buccochromis nototaenia*	30		F	F	0		
Cichlidae	*Buccochromis rhoadesii*	50		F	F	0		
Cichlidae	*Cheilochromis euchilus*	60		F	F	0		
Cichlidae	*Cichla ocellaris*	195		F	F	0		
Cichlidae	*Cichla temensis*	125		F	F	0		
Cichlidae	*Cichlasoma citrinellum*			F	F	0		
Cichlidae	*Cichlasoma festae*	312		F	F	0		
Cichlidae	*Cichlasoma grammodes*	15		F	F	0		
Cichlidae	*Cichlasoma octofasciatum*	1564		F	F	0		
Cichlidae	*Cichlasoma salvini*	525		F	F	0		
Cichlidae	*Cichlasoma trimaculatum*	113		F	F	0		
Cichlidae	*Cleithracara maronii*	782		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Cichlidae	*Copadichromis boadzulu*	7		F	F	0		
Cichlidae	*Copadichromis borleyi*	770		F	F	0		
Cichlidae	*Copadichromis chrysonotus*	864		F	F	0		
Cichlidae	*Copadichromis jacksoni*	30		F	F	0		
Cichlidae	*Copadichromis mloto*	6		F	F	0		
Cichlidae	*Copadichromis virginalis*	58		F	F	0		
Cichlidae	*Crenicara punctulatum*	130		F	F	0		
Cichlidae	*Crenicichla compressiceps*	65		F	F	0		
Cichlidae	*Crenicichla lepidota*	167		F	F	0		
Cichlidae	*Crenicichla marmorata*	17		F	F	0		
Cichlidae	*Crenicichla saxatilis*	33		F	F	0		
Cichlidae	*Cunningtonia longiventralis*	15		F	F	0		
Cichlidae	*Cyathopharynx furcifer*	89		F	F	0		
Cichlidae	*Cynotilapia afra*	857		F	F	0		
Cichlidae	*Cyphotilapia frontosa*	578		F	F	0		
Cichlidae	*Cyprichromis leptosoma*	226		F	F	0		
Cichlidae	*Cyprichromis microlepidotus*	36		F	F	0		
Cichlidae	*Cyrtocara moorii*	1395		F	F	0		
Cichlidae	*Dicrossus maculatus*	75		F	F	0		
Cichlidae	*Dimidiochromis compressiceps*	595		F	F	0		
Cichlidae	*Dimidiochromis strigatus*	95		F	F	0		
Cichlidae	*Eclectochromis ornatus*	24		F	F	0		
Cichlidae	*Ectodus descampsii*			F	F	0		
Cichlidae	*Enantiopus melanogenys*			F	F	0		
Cichlidae	*Etroplus maculatus*	198		F	F	0		
Cichlidae	*Fossorochromis rostratus*	83		F	F	0		
Cichlidae	*Geophagus altifrons*	16		F	F	0		

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Cichlidae	*Geophagus brasiliensis*	100		F	F	0		
Cichlidae	*Geophagus steindachneri*	35		F	F	0		
Cichlidae	*Geophagus surinamensis*	330		F	F	0		
Cichlidae	*Gephyrochromis moorii*	90		F	F	0		
Cichlidae	*Gymnogeophagus australis*	5		F	F	0		
Cichlidae	*Gymnogeophagus balzanii*	16		F	F	0		
Cichlidae	*Haplochromis burtoni*	20		F	F	0		
Cichlidae	*Haplochromis latifasciatus*	40		F	F	0		
Cichlidae	*Haplochromis nubilus*	68		F	F	0		
Cichlidae	*Haplochromis obliquidens*	309		F	F	0		
Cichlidae	*Haplochromis phenochilus*	44		F	F	0		
Cichlidae	*Hemichromis bimaculatus*	2308		F	F	0		
Cichlidae	*Hemichromis lifalili*	245		F	F	0		
Cichlidae	*Herichthys carpintis*	914		F	F	0		
Cichlidae	*Herichthys cyanoguttatus*	791		F	F	0		
Cichlidae	*Herichthys pearsei*	20		F	F	0		
Cichlidae	*Heros severus*	2526		F	F	0		
Cichlidae	*Herotilapia multispinosa*	128		F	F	0		
Cichlidae	*Hypselecara temporalis*	44		F	F	0		
Cichlidae	*Hypsophrys nicaraguensis*	12		F	F	0		
Cichlidae	*Iodotropheus sprengerae*	435		F	F	0		
Cichlidae	*Julidochromis dickfeldi*	30		F	F	0		
Cichlidae	*Julidochromis marlieri*	66		F	F	0		
Cichlidae	*Julidochromis ornatus*	184		F	F	0		
Cichlidae	*Julidochromis regani*	50		F	F	0		
Cichlidae	*Julidochromis transcriptus*	115		F	F	0		
Cichlidae	*Labeotropheus fuelleborni*	147		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Cichlidae	*Labeotropheus trewavasae*	248		F	F	0		
Cichlidae	*Labidochromis caeruleus*	3141		F	F	0		
Cichlidae	*Labidochromis chisumulae*	40		F	F	0		
Cichlidae	*Labidochromis freibergi*	25		F	F	0		
Cichlidae	*Labidochromis mbenjii*	25		F	F	0		
Cichlidae	*Labidochromis textilis*	14		F	F	0		
Cichlidae	*Labidochromis zebroides*	95		F	F	0		
Cichlidae	*Laetacara curviceps*	623		F	F	0		
Cichlidae	*Laetacara dorsigera*	45		F	F	0		
Cichlidae	*Lamprologus congoensis*	17		F	F	0		
Cichlidae	*Lamprologus ocellatus*	103		F	F	0		
Cichlidae	*Lamprologus werneri*	8		F	F	0		
Cichlidae	*Lepidiolamprologus attenuatus*	19		F	F	0		
Cichlidae	*Lepidiolamprologus kendalli*	2		F	F	0		
Cichlidae	*Lepidiolamprologus nkambae*	26		F	F	0		
Cichlidae	*Limnochromis auritus*	22		F	F	0		
Cichlidae	*Maylandia callainos*	69		F	F	0		
Cichlidae	*Maylandia greshakei*	714		F	F	0		
Cichlidae	*Maylandia hajomaylandi*	40		F	F	0		
Cichlidae	*Maylandia zebra*	6093		F	F	0		
Cichlidae	*Melanochromis auratus*	3728		F	F	0		
Cichlidae	*Melanochromis chipokae*	373		F	F	0		
Cichlidae	*Melanochromis cyaneorhabdos*	271		F	F	0		
Cichlidae	*Melanochromis joanjohnsonae*	168		F	F	0		
Cichlidae	*Melanochromis johannii*	2243		F	F	0		
Cichlidae	*Melanochromis labrosus*	60		F	F	0		
Cichlidae	*Melanochromis parallelus*	50		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Cichlidae	*Melanochromis vermivorus*	96		F	F	0		
Cichlidae	*Mesonauta festivus*	296		F	F	0		
Cichlidae	*Mikrogeophagus altispinosus*	859		F	F	0		
Cichlidae	*Mikrogeophagus ramirezi*	11424		F	F	0		
Cichlidae	*Nandopsis haitiensis*	30		F	F	0		
Cichlidae	*Nannacara anomala*	80		F	F	0		
Cichlidae	*Nannacara taenia*	25		F	F	0		
Cichlidae	*Nanochromis dimidiatus*	16		F	F	0		
Cichlidae	*Nanochromis nudiceps*	50		F	F	0		
Cichlidae	*Nanochromis parilus*	10		F	F	0		
Cichlidae	*Nanochromis transvestitus*	67		F	F	0		
Cichlidae	*Neolamprologus boulengeri*	29		F	F	0		
Cichlidae	*Neolamprologus brevis*	76		F	F	0		
Cichlidae	*Neolamprologus brichardi*	1206		F	F	0		
Cichlidae	*Neolamprologus buescheri*	10		F	F	0		
Cichlidae	*Neolamprologus christyi*	15		F	F	0		
Cichlidae	*Neolamprologus cylindricus*	141		F	F	0		
Cichlidae	*Neolamprologus falcicula*	12		F	F	0		
Cichlidae	*Neolamprologus gracilis*	8		F	F	0		
Cichlidae	*Neolamprologus helianthus*	20		F	F	0		
Cichlidae	*Neolamprologus leleupi*	883		F	F	0		
Cichlidae	*Neolamprologus longior*	60		F	F	0		
Cichlidae	*Neolamprologus modestus*	12		F	F	0		
Cichlidae	*Neolamprologus multifasciatus*	40		F	F	0		
Cichlidae	*Neolamprologus mustax*	35		F	F	0		
Cichlidae	*Neolamprologus olivaceous*	10		F	F	0		
Cichlidae	*Neolamprologus pulcher*	27		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Cichlidae	*Neolamprologus sexfasciatus*	108		F	F	0		
Cichlidae	*Neolamprologus similis*	25		F	F	0		
Cichlidae	*Neolamprologus tetracanthus*	30		F	F	0		
Cichlidae	*Neolamprologus tretocephalus*	376		F	F	0		
Cichlidae	*Nimbochromis fuscotaeniatus*	179		F	F	0		
Cichlidae	*Nimbochromis livingstonii*	816		F	F	0		
Cichlidae	*Nimbochromis polystigma*	132		F	F	0		
Cichlidae	*Nimbochromis venustus*	3406		F	F	0		
Cichlidae	*Nyassachromis purpurans*	15		F	F	0		
Cichlidae	*Ophthalmotilapia boops*	2		F	F	0		
Cichlidae	*Ophthalmotilapia nasuta*	20		F	F	0		
Cichlidae	*Ophthalmotilapia ventralis*	16		F	F	0		
Cichlidae	*Oreochromis niloticus*		939229	F	F	0		
Cichlidae	*Oreochromis niloticus × aureus*		19151	F	F	0		
Cichlidae	*Oreochromis niloticus × aureus ×*		131846	F	F	0		
Cichlidae	*Otopharynx lithobates*	35		F	F	0		
Cichlidae	*Otopharynx ovatus*	298		F	F	0		
Cichlidae	*Parachromis dovii*	5		F	F	0		
Cichlidae	*Parachromis friedrichsthalii*	29		F	F	0		
Cichlidae	*Parachromis managuensis*	338		F	F	0		
Cichlidae	*Paracyprichromis nigripinnis*	94		F	F	0		
Cichlidae	*Paratilapia polleni*	232		F	F	0		
Cichlidae	*Paretroplus maculatus*	60		F	F	0		
Cichlidae	*Pelvicachromis pulcher*	3018		F	F	0		
Cichlidae	*Pelvicachromis taeniatus*	615		F	F	0		
Cichlidae	*Petrotilapia tridentiger*	62		F	F	0		
Cichlidae	*Placidochromis electra*	149		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Cichlidae	*Placidochromis johnstoni*	40		F	F	0		
Cichlidae	*Protomelas fenestratus*	118		F	F	0		
Cichlidae	*Protomelas insignis*	50		F	F	0		
Cichlidae	*Protomelas spilonotus*	20		F	F	0		
Cichlidae	*Protomelas taeniolatus*	24		F	F	0		
Cichlidae	*Pseudocrenilabrus nicholsi*	30		F	F	0		
Cichlidae	*Pseudocrenilabrus sp. philander*	40		F	F	0		
Cichlidae	*Pseudotropheus aurora*	206		F	F	0		
Cichlidae	*Pseudotropheus crabro*	430		F	F	0		
Cichlidae	*Pseudotropheus demasoni*	1653		F	F	0		
Cichlidae	*Pseudotropheus elongatus*	1045		F	F	0		
Cichlidae	*Pseudotropheus flavus*	95		F	F	0		
Cichlidae	*Pseudotropheus lombardoi*	3386		F	F	0		
Cichlidae	*Pseudotropheus macrophthalmus*	318		F	F	0		
Cichlidae	*Pseudotropheus saulosi*	654		F	F	0		
Cichlidae	*Pseudotropheus socolofi*	910		F	F	0		
Cichlidae	*Pseudotropheus tropheops*	34		F	F	0		
Cichlidae	*Pseudotropheus zebra*	25		F	F	0		
Cichlidae	*Pterophyllum altum*	209		F	F	0		
Cichlidae	*Pterophyllum scalare*	34929		F	F	0		
Cichlidae	*Ptychochromis oligacanthus*	12		F	F	0		
Cichlidae	*Pundamilia nyererei*	10		F	F	0		
Cichlidae	*Sarotherodon galilaeus*		164357	F	F	0		
Cichlidae	*Satanoperca daemon*	185		F	F	0		
Cichlidae	*Satanoperca jurupari*	824		F	F	0		
Cichlidae	*Satanoperca leucosticta*	116		F	F	0		
Cichlidae	*Sciaenochromis ahli*	1391		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Cichlidae	*Sciaenochromis fryeri*	11		F	F	0		
Cichlidae	*Spathodus erythrodon*	20		F	F	0		
Cichlidae	*Steatocranus casuarius*	271		F	F	0		
Cichlidae	*Steatocranus tinanti*	19		F	F	0		
Cichlidae	*Symphysodon aequifasciatus*	2716		F	F	0		
Cichlidae	*Symphysodon discus*	3122		F	F	0		
Cichlidae	*Telmatochromis bifrenatus*	10		F	F	0		
Cichlidae	*Theraps irregularis*	12		F	F	0		
Cichlidae	*Thorichthys aureus*	20		F	F	0		
Cichlidae	*Thorichthys meeki*	2020		F	F	0		
Cichlidae	*Tilapia buttikoferi*	502		F	F	0		
Cichlidae	*Tilapia mariae*	35		F	F	0		
Cichlidae	*Tomocichla tuba*	2		F	F	0		
Cichlidae	*Triglachromis otostigma*	12		F	F	0		
Cichlidae	*Tropheus duboisi*	613		F	F	0		
Cichlidae	*Tropheus moorii*	433		F	F	0		
Cichlidae	*Tropheus polli*	5		F	F	0		
Cichlidae	*Uaru amphiacanthoides*	52		F	F	0		
Cichlidae	*Variabilichromis moorii*	41		F	F	0		
Cichlidae	*Vieja godmanni*	40		F	F	0		
Cichlidae	*Vieja maculicauda*	6		F	F	0		
Cichlidae	*Vieja synspila*	255		F	F	0		
Cichlidae	*Vieja zonata*	20		F	F	0		
Cichlidae	*Xenotilapia flavipinnis*			F	F	0		
Cichlidae	*Xenotilapia melanogenys*	38		F	F	0		
Cichlidae	*Xenotilapia papilio*			F	F	0		
Cirrhitidae	*Amblycirrhitus pinos*	14		M	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Cirrhitidae	*Cirrhitichthys aprinus*	7		M	M			
Cirrhitidae	*Cirrhitichthys aureus*	4		M	M			
Cirrhitidae	*Cirrhitichthys falco*	10		M	M			
Cirrhitidae	*Cirrhitichthys oxycephalus*	25		M	M			
Cirrhitidae	*Cirrhitops fasciatus*	2		M	M			
Cirrhitidae	*Cirrhitus pinnulatus*	1		M	M			
Cirrhitidae	*Cyprinocirrhites polyactis*	3		M	M			
Cirrhitidae	*Neocirrhites armatus*	89		M	M			
Cirrhitidae	*Oxycirrhites typus*	168		M	M			
Cirrhitidae	*Paracirrhites arcatus*	2		M	M			
Cirrhitidae	*Paracirrhites forsteri*	27		M	M			
Clariidae	*Clarias angolensis*	135		F	F	0		
Clariidae	*Clarias batrachus*	1134	5	F	F	0		
Claroteidae	*Clarotes laticeps*	344		F	F	0		
Clupeidae	*Clupea harengus*			E	M	1		
Coiidae	*Datnioides campbelli*	4		F	F	0		
Coiidae	*Datnioides polota*	21		F	F	0		
Coiidae	*Datnioides undecimradiatus*	5		F	F	0		
Congridae	*Conger conger*			M	M			
Congridae	*Conger myriaster*		3520	M	M			
Congridae	*Conger oceanicus*		385	M	M			
Congridae	*Heteroconger longissimus*	5		M	M			
Cottidae	*Enophrys bison*			E	M	1		
Cottidae	*Hemilepidotus hemilepidotus*			E	M	1		
Cottidae	*Jordania zonope*			E	M	1		
Cottidae	*Scorpaenichthys marmoratus*		349	E	M	1		
Ctenoluciidae	*Boulengerella maculata*	164		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Ctenoluciidae	*Ctenolucius hujeta*	486		F	F	0		
Cynodontidae	*Hydrolycus scomberoides*	23		F	F	0		
Dactylopteridae	*Dactyloptena orientalis*	43		M	M			
Dactylopteridae	*Dactylopterus volitans*	10		M	M			
Dasyatidae	*Dasyatis akajei*	3		E	M			
Dasyatidae	*Dasyatis sabina*	12		E	M			
Dasyatidae	*Himantura bleekeri*			E	M			
Dasyatidae	*Pastinachus sephen*			E	M			
Dasyatidae	*Taeniura lymma*	21		E	M			
Diodontidae	*Chilomycterus antennatus*	1		M	M			
Diodontidae	*Chilomycterus antillarum*	3		M	M			
Diodontidae	*Chilomycterus schoepfii*	7		M	M			
Diodontidae	*Diodon holocanthus*	47		M	M			
Diodontidae	*Diodon hystrix*	84		M	M			
Diodontidae	*Diodon liturosus*	4		M	M			
Diodontidae	*Diodon maculatus*	1		M	M			
Distichodontidae	*Distichodus affinis*	60		F	F	0		
Distichodontidae	*Distichodus lusosso*			F	F	0		
Distichodontidae	*Distichodus sexfasciatus*	24		F	F	0		
Doradidae	*Acanthodoras spinosissimus*	135		F	F	0		
Doradidae	*Agamyxis pectinifrons*	407		F	F	0		
Doradidae	*Platydoras costatus*	911		F	F	0		
Echeneidae	*Echeneis naucrates*	1		M	M			
Embiotocidae	*Brachyistius frenatus*			M	M			
Embiotocidae	*Cymatogaster aggregata*			M	M			
Embiotocidae	*Embiotoca lateralis*			M	M			
Ephippidae	*Platax orbicularis*	107		M	M			

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Ephippidae	*Platax pinnatus*	11		M	M			
Ephippidae	*Platax teira*	12		M	M			
Erethistidae	*Hara jerdoni*	80		F	F	0		
Gadidae	*Gadus morhua*		45	E	M	1		
Gasteropelecidae	*Carnegiella marthae*	1055		F	F	0		
Gasteropelecidae	*Carnegiella myersi*	530		F	F	0		
Gasteropelecidae	*Carnegiella strigata*	7473		F	F	0		
Gasteropelecidae	*Gasteropelecus levis*	275		F	F	0		
Gasteropelecidae	*Gasteropelecus sternicla*	1805		F	F	0		
Gasteropelecidae	*Thoracocharax stellatus*	5396		F	F	0		
Ginglymostomatidae	*Ginglymostoma cirratum*	3		M	M			
Gobiesocidae	*Gobiesox punctulatus*	1		E	M			
Gobiidae	*Amblyeleotris aurora*	7		E	M	1		
Gobiidae	*Amblyeleotris diagonalis*	17		E	M	1		
Gobiidae	*Amblyeleotris fasciata*	4		E	M	1		
Gobiidae	*Amblyeleotris guttata*	55		E	M	1		
Gobiidae	*Amblyeleotris randalli*	4		E	M	1		
Gobiidae	*Amblyeleotris steinitzi*	5		E	M	1		
Gobiidae	*Amblyeleotris wheeleri*	153		E	M	1		
Gobiidae	*Amblygobius albimaculatus*	2		E	M	1		
Gobiidae	*Amblygobius bynoensis*	28		E	M	1		
Gobiidae	*Amblygobius decussatus*	3		E	M	1		
Gobiidae	*Amblygobius nocturnus*	22		E	M	1		
Gobiidae	*Amblygobius phalaena*	53		E	M	1		
Gobiidae	*Bathygobius fuscus*	22		E	M	1		
Gobiidae	*Bryaninops amplus*	24		E	M	1		
Gobiidae	*Coryphopterus glaucofraenum*	5		E	M	1		

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Gobiidae	*Coryphopterus personatus*	1		E	M	1		
Gobiidae	*Cryptocentrus cinctus*	395		E	M	1		
Gobiidae	*Cryptocentrus cryptocentrus*	6		E	M	1		
Gobiidae	*Cryptocentrus fasciatus*	7		E	M	1		
Gobiidae	*Cryptocentrus leptocephalus*	64		E	M	1		
Gobiidae	*Cryptocentrus lutheri*	43		E	M	1		
Gobiidae	*Cryptocentrus strigilliceps*	10		E	M	1		
Gobiidae	*Ctenogobiops tangaroai*	2		E	M	1		
Gobiidae	*Elacatinus atronasus*	116		E	M	1		
Gobiidae	*Elacatinus evelynae*	64		E	M	1		
Gobiidae	*Elacatinus horsti*	19		E	M	1		
Gobiidae	*Elacatinus illecebrosus*	16		E	M	1		
Gobiidae	*Elacatinus multifasciatus*	8		E	M	1		
Gobiidae	*Elacatinus oceanops*	339		E	M	1		
Gobiidae	*Elacatinus prochilos*	4		E	M	1		
Gobiidae	*Elacatinus puncticulatus*	11		E	M	1		
Gobiidae	*Eviota pellucida*	9		E	M	1		
Gobiidae	*Exyrias puntang*	210		E	M	1		
Gobiidae	*Gobiodon atrangulatus*	249		E	M	1		
Gobiidae	*Gobiodon citrinus*	181		E	M	1		
Gobiidae	*Gobiodon histrio*	134		E	M	1		
Gobiidae	*Gobiodon okinawae*	272		E	M	1		
Gobiidae	*Gobiodon quinquestrigatus*	47		E	M	1		
Gobiidae	*Gobius auratus*	4		E	M	1		
Gobiidae	*Koumansetta hectori*	43		E	M	1		
Gobiidae	*Koumansetta rainfordi*	57		E	M	1		
Gobiidae	*Lythrypnus dalli*	27		E	M	1		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Gobiidae	*Paragobiodon lacunicolus*	2		E	M	1		
Gobiidae	*Signigobius biocellatus*	40		E	M	1		
Gobiidae	*Stonogobiops nematodes*	5		E	M	1		
Gobiidae	*Stonogobiops xanthorhinica*	82		E	M	1		
Gobiidae	*Trimma striata*	2		E	M	1		
Gobiidae	*Valenciennea helsdingenii*	12		E	M	1		
Gobiidae	*Valenciennea longipinnis*	64		E	M	1		
Gobiidae	*Valenciennea puellaris*	427		E	M	1		
Gobiidae	*Valenciennea sexguttata*	55		E	M	1		
Gobiidae	*Valenciennea strigata*	471		E	M	1		
Gobiidae	*Valenciennea wardii*	87		E	M	1		
Grammatidae	*Gramma loreto*	915		M	M			
Grammatidae	*Gramma melacara*	58		M	M			
Gymnarchidae	*Gymnarchus niloticus*	40		F	F	0		
Gymnotidae	*Electrophorus electricus*			F	F	0		
Gyrinocheilidae	*Gyrinocheilus aymonieri*	33126		F	F	0		
Gyrinocheilidae	*Gyrinocheilus pennocki*	28		F	F	0		
Haemulidae	*Anisotremus taeniatus*	7		E	M			
Haemulidae	*Anisotremus virginicus*	32		E	M			
Haemulidae	*Haemulon flavolineatum*	14		E	M			
Haemulidae	*Plectorhinchus albovittatus*	11		E	M			
Haemulidae	*Plectorhinchus chaetodonoides*	46		E	M			
Haemulidae	*Plectorhinchus diagrammus*	3		E	M			
Haemulidae	*Plectorhinchus gaterinus*	2		E	M			
Haemulidae	*Plectorhinchus lineatus*	1		E	M			
Haemulidae	*Plectorhinchus orientalis*	7		E	M			
Haemulidae	*Plectorhinchus picus*	2		E	M			

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Haemulidae	*Plectorhinchus polytaenia*	2		E	M			
Helostomatidae	*Helostoma temminkii*	10979		F	F	0		
Hemiodontidae	*Hemiodus gracilis*	60		F	F	0		
Hemiodontidae	*Hemiodus semitaeniatus*	30		F	F	0		
Hemiscylliidae	*Chiloscyllium indicum*	5		M	M			
Hemiscylliidae	*Chiloscyllium plagiosum*	4		M	M			
Hemiscylliidae	*Chiloscyllium punctatum*	28		M	M			
Hemiscylliidae	*Chiloscyllium punctatum*	28		M	M			
Hemiscylliidae	*Hemiscyllium ocellatum*	1		M	M			
Hemitripteridae	*Hemitripterus americanus*		1959	M	M			
Hemitripteridae	*Nautichthys oculofasciatus*			M	M			
Heterodontidae	*Heterodontus francisci*	1		M	M			
Heterodontidae	*Heterodontus japanicus*			M	M			
Hexagrammidae	*Hexagrammos decagrammus*			M	M			
Hexagrammidae	*Ophiodon elongatus*			M	M			
Hexagrammidae	*Oxylebius pictus*			M	M			
Holocentridae	*Myripristis jacobus*	4		M	M			
Holocentridae	*Neoniphon sammara*	8		M	M			
Holocentridae	*Sargocentron caudimaculatum*	3		M	M			
Holocentridae	*Sargocentron diadema*	2		M	M			
Holocentridae	*Sargocentron vexillarium*	11		M	M			
Hypopomidae	*Hypopygus lepturus*	50		F	F	0		
Labridae	*Anampses caeruleopunctatus*	49		M	M			
Labridae	*Anampses chrysocephalus*	3		M	M			
Labridae	*Anampses cuvier*	1		M	M			
Labridae	*Anampses lineatus*	5		M	M			
Labridae	*Anampses meleagrides*	18		M	M			

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Labridae	*Anampses twistii*	1		M	M			
Labridae	*Bodianus anthioides*	6		M	M			
Labridae	*Bodianus axillaris*	5		M	M			
Labridae	*Bodianus bimaculatus*	4		M	M			
Labridae	*Bodianus diana*	18		M	M			
Labridae	*Bodianus diplotaenia*	2		M	M			
Labridae	*Bodianus hirsutus*	2		M	M			
Labridae	*Bodianus mesothorax*	9		M	M			
Labridae	*Bodianus opercularis*	4		M	M			
Labridae	*Bodianus pulchellus*	44		M	M			
Labridae	*Bodianus rufus*	31		M	M			
Labridae	*Cheilinus fasciatus*	5		M	M			
Labridae	*Cheilinus trilobatus*	1		M	M			
Labridae	*Cheilinus undulatus*			M	M			
Labridae	*Choerodon fasciatus*	22		M	M			
Labridae	*Cirrhilabrus adornatus*	5		M	M			
Labridae	*Cirrhilabrus aurantidorsalis*	43		M	M			
Labridae	*Cirrhilabrus condei*	1		M	M			
Labridae	*Cirrhilabrus cyanopleura*	18		M	M			
Labridae	*Cirrhilabrus exquisitus*	40		M	M			
Labridae	*Cirrhilabrus filamentosus*	7		M	M			
Labridae	*Cirrhilabrus flavidorsalis*	10		M	M			
Labridae	*Cirrhilabrus jordani*	1		M	M			
Labridae	*Cirrhilabrus lineatus*	1		M	M			
Labridae	*Cirrhilabrus lubbocki*	55		M	M			
Labridae	*Cirrhilabrus luteovittatus*	1		M	M			
Labridae	*Cirrhilabrus punctatus*	1		M	M			

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Labridae	*Cirrhilabrus rubrimarginatus*	2		M	M			
Labridae	*Cirrhilabrus rubripinnis*	2		M	M			
Labridae	*Cirrhilabrus rubriventralis*	90		M	M			
Labridae	*Cirrhilabrus scottorum*	26		M	M			
Labridae	*Cirrhilabrus solorensis*	71		M	M			
Labridae	*Cirrhilabrus temminckii*	1		M	M			
Labridae	*Cirrhilabrus tonozukai*	2		M	M			
Labridae	*Coris aygula*	3		M	M			
Labridae	*Coris cuvieri*	5		M	M			
Labridae	*Coris flavovittata*	3		M	M			
Labridae	*Coris formosa*	53		M	M			
Labridae	*Coris gaimard*	73		M	M			
Labridae	*Epibulus insidiator*	1		M	M			
Labridae	*Gomphosus caeruleus*	29		M	M			
Labridae	*Gomphosus varius*	16		M	M			
Labridae	*Halichoeres chierchiae*	3		M	M			
Labridae	*Halichoeres chloropterus*	25		M	M			
Labridae	*Halichoeres chrysus*	304		M	M			
Labridae	*Halichoeres garnoti*	8		M	M			
Labridae	*Halichoeres hortulanus*	49		M	M			
Labridae	*Halichoeres iridis*	4		M	M			
Labridae	*Halichoeres marginatus*	43		M	M			
Labridae	*Halichoeres melanochir*	1		M	M			
Labridae	*Halichoeres melanurus*	17		M	M			
Labridae	*Halichoeres nebulosus*	1		M	M			
Labridae	*Halichoeres ornatissimus*	28		M	M			
Labridae	*Halichoeres timorensis*	1		M	M			

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Labridae	*Halichoeres trispilus*	75		M	M			
Labridae	*Hemigymnus fasciatus*	1		M	M			
Labridae	*Labroides bicolor*	10		M	M			
Labridae	*Labroides dimidiatus*	923		M	M			
Labridae	*Labroides pectoralis*	3		M	M			
Labridae	*Labroides phthirophagus*	5		M	M			
Labridae	*Larabicus quadrilineatus*	20		M	M			
Labridae	*Macropharyngodon choati*	2		M	M			
Labridae	*Macropharyngodon geoffroy*	17		M	M			
Labridae	*Macropharyngodon meleagris*	48		M	M			
Labridae	*Macropharyngodon ornatus*	23		M	M			
Labridae	*Notolabrus fucicola*	1		M	M			
Labridae	*Novaculichthys taeniourus*	47		M	M			
Labridae	*Oxycheilinus bimaculatus*	1		M	M			
Labridae	*Paracheilinus angulatus*	22		M	M			
Labridae	*Paracheilinus carpenteri*	12		M	M			
Labridae	*Paracheilinus cyaneus*	20		M	M			
Labridae	*Paracheilinus filamentosus*	128		M	M			
Labridae	*Paracheilinus lineopunctatus*	3		M	M			
Labridae	*Paracheilinus mccoskeri*	7		M	M			
Labridae	*Paracheilinus octotaenia*	46		M	M			
Labridae	*Pseudocheilinus evanidus*	3		M	M			
Labridae	*Pseudocheilinus hexataenia*	488		M	M			
Labridae	*Pseudocheilinus octotaenia*	21		M	M			
Labridae	*Pseudocheilinus tetrataenia*	2		M	M			
Labridae	*Pseudocoris yamashiroi*	2		M	M			
Labridae	*Pseudojuloides cerasinus*	8		M	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Labridae	*Stethojulis balteata*	5		M	M			
Labridae	*Stethojulis trilineata*	2		M	M			
Labridae	*Tautoga onitis*		17562	M	M			
Labridae	*Thalassoma bifasciatum*	83		M	M			
Labridae	*Thalassoma hardwicke*	12		M	M			
Labridae	*Thalassoma lucasanum*	20		M	M			
Labridae	*Thalassoma lunare*	46		M	M			
Labridae	*Thalassoma lutescens*	13		M	M			
Labridae	*Thalassoma rueppellii*	10		M	M			
Labridae	*Thalassoma trilobatum*	4		M	M			
Labridae	*Wetmorella nigropinnata*	2		M	M			
Labrisomidae	*Labrisomus filamentosus*	2		M	M			
Lamnidae	*Isurus oxyrhinchus*			M	M			
Lebiasinidae	*Copella arnoldi*	25		F	F	0		
Lebiasinidae	*Nannostomus beckfordi*	7586		F	F	0		
Lebiasinidae	*Nannostomus eques*	1640		F	F	0		
Lebiasinidae	*Nannostomus harrisoni*	150		F	F	0		
Lebiasinidae	*Nannostomus unifasciatus*	100		F	F	0		
Lebiasinidae	*Poecilobrycon eques*	200		F	F	0		
Loricariidae	*Acanthicus adonis*	16		F	F	0		
Loricariidae	*Acanthicus hystrix*	83		F	F	0		
Loricariidae	*Ancistrus dolichopterus*	4106		F	F	0		
Loricariidae	*Ancistrus hoplogenys*	5		F	F	0		
Loricariidae	*Ancistrus ranunculus*	123		F	F	0		
Loricariidae	*Ancistrus tamboensis*	302		F	F	0		
Loricariidae	*Ancistrus temminckii*	235		F	F	0		
Loricariidae	*Chaetostoma greeni*	100		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Loricariidae	*Chaetostoma thomsoni*	3176		F	F	0		
Loricariidae	*Dasyloricaria filamentosa*	30		F	F	0		
Loricariidae	*Dekeyseria pulcher*	89		F	F	0		
Loricariidae	*Farlowella acus*	2378		F	F	0		
Loricariidae	*Glyptoperichthys gibbiceps*	4413		F	F	0		
Loricariidae	*Glyptoperichthys joselimaianus*	150		F	F	0		
Loricariidae	*Hypancistrus inspector*	25		F	F	0		
Loricariidae	*Hypancistrus zebra*	1		F	F	0		
Loricariidae	*Hypostomus plecostomus*	76434		F	F	0		
Loricariidae	*Hypostomus punctatus*	2907		F	F	0		
Loricariidae	*Leporacanthicus joselimai*	21		F	F	0		
Loricariidae	*Loricaria parnahybae*	50		F	F	0		
Loricariidae	*Otocinclus affinis*	26458		F	F	0		
Loricariidae	*Otocinclus flexilis*	2550		F	F	0		
Loricariidae	*Otocinclus mariae*	3080		F	F	0		
Loricariidae	*Otocinclus vestitus*	442		F	F	0		
Loricariidae	*Otocinclus vittatus*	12775		F	F	0		
Loricariidae	*Panaque nigrolineatus*	562		F	F	0		
Loricariidae	*Parancistrus aurantiacus*	40		F	F	0		
Loricariidae	*Pareiorhina rudolphi*	100		F	F	0		
Loricariidae	*Parotocinclus jumbo*	700		F	F	0		
Loricariidae	*Parotocinclus maculicauda*	50		F	F	0		
Loricariidae	*Peckoltia vermiculata*	5		F	F	0		
Loricariidae	*Peckoltia vittata*	2001		F	F	0		
Loricariidae	*Pseudacanthicus leopardus*	5		F	F	0		
Loricariidae	*Pterygoplichthys anisitsi*	1953		F	F	0		
Loricariidae	*Pterygoplichthys gibbiceps*	100		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Loricariidae	*Pterygoplichthys multiradiatus*	25		F	F	0		
Loricariidae	*Rineloricaria fallax*	3		F	F	0		
Loricariidae	*Rineloricaria hasemani*	480		F	F	0		
Loricariidae	*Rineloricaria parva*	790		F	F	0		
Loricariidae	*Scobinancistrus aureatus*	30		F	F	0		
Loricariidae	*Sturisoma aureum*	21		F	F	0		
Lutjanidae	*Lutjanus erythropterus*	2		M	M			
Lutjanidae	*Lutjanus kasmira*	1		M	M			
Lutjanidae	*Lutjanus sebae*	5		M	M			
Lutjanidae	*Macolor niger*	4		M	M			
Lutjanidae	*Symphorichthys spilurus*	6		M	M			
Malacanthidae	*Hoplolatilus fronticinctus*	10		M	M			
Malacanthidae	*Hoplolatilus luteus*	3		M	M			
Malacanthidae	*Hoplolatilus marcosi*	10		M	M			
Malacanthidae	*Hoplolatilus purpureus*	22		M	M			
Malacanthidae	*Hoplolatilus starcki*	4		M	M			
Malacanthidae	*Malacanthus latovittatus*	6		M	M			
Malapteruridae	*Malapterurus electricus*	25		F	F	0		
Mastacembelidae	*Macrognathus aral*	91		F	F	0		
Mastacembelidae	*Macrognathus circumcinctus*	216		F	F	0		
Mastacembelidae	*Macrognathus pancalus*	30		F	F	0		
Mastacembelidae	*Macrognathus siamensis*	1099		F	F	0		
Mastacembelidae	*Macrognathus zebrinus*	30		F	F	0		
Mastacembelidae	*Mastacembalus armatus*	1366		F	F	0		
Mastacembelidae	*Mastacembelus erythrotaenia*	279		F	F	0		
Mastacembelidae	*Mastacembelus favus*	75		F	F	0		
Megalopidae	*Megalops atlanticus*			M	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Melanotaeniidae	*Chilatherina bleheri*	13		F	F	0		
Melanotaeniidae	*Glossolepis incisus*	1801		F	F	0		
Melanotaeniidae	*Iriatherina werneri*	2213		F	F	0		
Melanotaeniidae	*Melanotaenia affinis*	500		F	F	0		
Melanotaeniidae	*Melanotaenia australis*	25		F	F	0		
Melanotaeniidae	*Melanotaenia boesemani*	2458		F	F	0		
Melanotaeniidae	*Melanotaenia gracilis*	40		F	F	0		
Melanotaeniidae	*Melanotaenia herbertaxelrodi*	357		F	F	0		
Melanotaeniidae	*Melanotaenia lacustris*	1173		F	F	0		
Melanotaeniidae	*Melanotaenia maccullochi*	476		F	F	0		
Melanotaeniidae	*Melanotaenia nigrans*	1600		F	F	0		
Melanotaeniidae	*Melanotaenia parkinsoni*	35		F	F	0		
Melanotaeniidae	*Melanotaenia parva*	20		F	F	0		
Melanotaeniidae	*Melanotaenia praecox*	4688		F	F	0		
Melanotaeniidae	*Melanotaenia splendida*	1938		F	F	0		
Melanotaeniidae	*Melanotaenia trifasciata*	232		F	F	0		
Microdesmidae	*Gunnellichthys curiosus*	6		E	M			
Microdesmidae	*Nemateleotris decora*	126		E	M			
Microdesmidae	*Nemateleotris magnifica*	683		E	M			
Microdesmidae	*Ptereleotris evides*	157		E	M			
Microdesmidae	*Ptereleotris heteroptera*	11		E	M			
Microdesmidae	*Ptereleotris microlepis*	18		E	M			
Microdesmidae	*Ptereleotris zebra*	105		E	M			
Mochokidae	*Synodontis batensoda*	250		F	F	0		
Mochokidae	*Synodontis clarias*	40		F	F	0		
Mochokidae	*Synodontis decorus*	15		F	F	0		
Mochokidae	*Synodontis eupterus*	526		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Mochokidae	*Synodontis multipunctatus*	204		F	F	0		
Mochokidae	*Synodontis nigrita*	10		F	F	0		
Mochokidae	*Synodontis nigriventris*	1894		F	F	0		
Mochokidae	*Synodontis njassae*	70		F	F	0		
Mochokidae	*Synodontis ocellifer*	10		F	F	0		
Mochokidae	*Synodontis petricola*	100		F	F	0		
Mochokidae	*Synodontis schall*	15		F	F	0		
Mochokidae	*Synodontis schoutedeni*	15		F	F	0		
Monacanthidae	*Acreichthys tomentosus*	4		M	M			
Monacanthidae	*Cantherhines dumerilii*	1		M	M			
Monacanthidae	*Oxymonacanthus longirostris*	22		M	M			
Monacanthidae	*Paraluteres prionurus*	4		M	M			
Monacanthidae	*Pervagor janthinosoma*	1		M	M			
Monacanthidae	*Pervagor melanocephalus*	28		M	M			
Monacanthidae	*Stephanolepis hispidus*	2		M	M			
Monodactylidae	*Monodactylus argenteus*	901		M	F			
Monodactylidae	*Monodactylus sebae*	490		M	M			
Mormyridae	*Brienomyrus brachyistius*	700		F	F	0		
Mormyridae	*Gnathonemus petersii*	1989		F	F	0		
Mormyridae	*Marcusenius macrolepidotus*	150		F	F	0		
Mormyridae	*Pollimyrus castelnaui*	40		F	F	0		
Moronidae	*Lateolabrax japonicus*			E	M	1		
Mullidae	*Parupeneus barberinoides*	14		M	M			
Mullidae	*Parupeneus cyclostomus*	4		M	M			
Mullidae	*Parupeneus macronemus*	5		M	M			
Mullidae	*Pseudupeneus maculatus*	1		M	M			
Mullidae	*Upeneichthys lineatus*	1		M	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Muraenidae	*Echidna catenata*	2		M	M			
Muraenidae	*Echidna nebulosa*	49		M	M			
Muraenidae	*Echidna polyzona*	1		M	M			
Muraenidae	*Gymnomuraena zebra*	6		M	M			
Muraenidae	*Gymnothorax favagineus*	2		M	M			
Muraenidae	*Gymnothorax fimbriatus*	2		M	M			
Muraenidae	*Gymnothorax miliaris*	2		M	M			
Muraenidae	*Gymnothorax tile*	30		M	M			
Muraenidae	*Gymnothorax undulatus*	16		M	M			
Muraenidae	*Muraena lentiginosa*	1		M	M			
Muraenidae	*Pseudechidna brummeri*	2		M	M			
Muraenidae	*Rhinomuraena quaesita*	20		M	M			
Muraenidae	*Uropterygius concolor*	3		M	M			
Myliobatidae	*Myliobatis californiacas*			M	M			
Nandidae	*Badis badis*	1691		F	F	0		
Nandidae	*Nandus nandus*	15		F	F	0		
Nemipteridae	*Scolopsis bilineata*	8		M	M			
Notopteridae	*Chitala blanci*	16		F	F	0		
Notopteridae	*Chitala borneensis*	4		F	F	0		
Notopteridae	*Chitala chitala*	591		F	F	0		
Notopteridae	*Chitala ornata*	50		F	F	0		
Notopteridae	*Notopterus notopterus*	15		F	F	0		
Notopteridae	*Papyrocranus afer*			F	F	0		
Notopteridae	*Xenomystus nigri*	670		F	F	0		
Ophichthidae	*Myrichthys colubrinus*	5		M	M			
Ophichthidae	*Pisodonophis boro*	100		M	M			
Opistognathidae	*Opistognathus aurifrons*	296		M	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Opistognathidae	*Opistognathus gilberti*	12		M	M			
Opistognathidae	*Opistognathus lonchurus*	1		M	M			
Opistognathidae	*Opistognathus macrognathus*	9		M	M			
Opistognathidae	*Opistognathus whitehursti*	11		M	M			
Oplegnathidae	*Oplegnathus fasciatus*	4		M	M			
Osmeridae	*Osmerus eperlanus*			E	M			
Osphronemidae	*Belontia signata*	40		F	F	0		
Osphronemidae	*Betta coccina*	88		F	F	0		
Osphronemidae	*Betta imbellis*	112		F	F	0		
Osphronemidae	*Betta pugnax*	32		F	F	0		
Osphronemidae	*Betta splendens*	49303		F	F	0		
Osphronemidae	*Colisa chuna*	484		F	F	0		
Osphronemidae	*Colisa fasciata*	817		F	F	0		
Osphronemidae	*Colisa labiosus*	1894		F	F	0		
Osphronemidae	*Colisa lalia*	32277		F	F	0		
Osphronemidae	*Ctenops nobilis*	16		F	F	0		
Osphronemidae	*Macropodus opercularis*	4880		F	F	0		
Osphronemidae	*Macropodus spechti*	153		F	F	0		
Osphronemidae	*Osphronemus goramy*	954		F	F	0		
Osphronemidae	*Parasphaerichthys lineatus*	120		F	F	0		
Osphronemidae	*Parasphaerichthys ocellatus*	6		F	F	0		
Osphronemidae	*Parosphromenus deissneri*	64		F	F	0		
Osphronemidae	*Polyacanthus fasciatus*	60		F	F	0		
Osphronemidae	*Pseudosphromenus cupanus*	149		F	F	0		
Osphronemidae	*Pseudosphromenus dayi*			F	F	0		
Osphronemidae	*Sphaerichthys osphromenoides*	955		F	F	0		
Osphronemidae	*Trichogaster chuna*	5444		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Osphronemidae	*Trichogaster labiosus*	245		F	F	0		
Osphronemidae	*Trichogaster leerii*	10229		F	F	0		
Osphronemidae	*Trichogaster microlepis*	2868		F	F	0		
Osphronemidae	*Trichogaster pectoralis*	1100		F	F	0		
Osphronemidae	*Trichopodus trichopterus*	26220		F	F	0		
Osphronemidae	*Trichopsis pumila*	1660		F	F	0		
Osphronemidae	*Trichopsis vittata*	449		F	F	0		
Osteoglossidae	*Arapaima gigas*			F	F	0		
Osteoglossidae	*Osteoglossum bicirrhosum*	1182		F	F	0		
Osteoglossidae	*Osteoglossum ferreirai*	20		F	F	0		
Osteoglossidae	*Scleropages formosus*	89		F	F	0		
Osteoglossidae	*Scleropages jardinii*	118		F	F	0		
Ostraciidae	*Acanthostracion quadricornis*	21		M	M			
Ostraciidae	*Lactoria cornuta*	133		M	M			
Ostraciidae	*Ostracion cubicus*	74		M	M			
Ostraciidae	*Ostracion meleagris*	19		M	M			
Ostraciidae	*Tetrosomus gibbosus*	4		M	M			
Pangasiidae	*Pangasius bocourti*	10		F	F	0		
Pangasiidae	*0*	13370		F	F	0		
Pangasiidae	*Pangasius sanitwongsei*	355		F	F	0		
Pantodontidae	*Pantodon buchholzi*	2225		F	F	0		
Pegasidae	*Pegasus volitans*	3		M	M			
Pholidichthyidae	*Pholidichthys leucotaenia*	129		M	M			
Pimelodidae	*Brachyrhamdia imitator*	12		F	F	0		
Pimelodidae	*Microglanis iheringi*	6		F	F	0		
Pimelodidae	*Microglanis poecilus*	1335		F	F	0		
Pimelodidae	*Phractocephalus hemioliopterus*	185		F	F	0		

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Pimelodidae	*Pimelodus blochii*	6		F	F	0		
Pimelodidae	*Pimelodus pictus*	4703		F	F	0		
Pimelodidae	*Pseudoplatystoma fasciatum*	243		F	F	0		
Pimelodidae	*Sorubim lima*	150		F	F	0		
Pimelodidae	*Sorubimichthys planiceps*	50		F	F	0		
Pimelodidae	*Zungaro zungaro*	35		F	F	0		
Pinguipedidae	*Parapercis punctulata*	6		M	M			
Pinguipedidae	*Parapercis schauinslandii*	3		M	M			
Pinguipedidae	*Parapercis snyderi*	9		M	M			
Pinguipedidae	*Parapercis tetracantha*	5		M	M			
Platycephalidae	*Platycephalus indicus*	8		M	M			
Plesiopidae	*Assessor macneilli*	1		M	M			
Plesiopidae	*Calloplesiops altivelis*	51		M	M			
Plesiopidae	*Plesiops coeruleolineatus*	6		M	M			
Plesiopidae	*Plesiops corallicola*	5		M	M			
Pleuronectidae	*Hippoglossus hippoglossus*			E	M			
Pleuronectidae	*Hippoglossus stenolepis*		99	E	M			
Pleuronectidae	*Lepidopsetta bilineata*			E	M			
Pleuronectidae	*Parophrys vetulus*			E	M			
Pleuronectidae	*Psettichthys melanostictus*	2		E	M			
Plotosidae	*Plotosus lineatus*	126		E	M	1		
Polycentridae	*Monocirrhus polyacanthus*	71		F	F	0		
Polycentridae	*Polycentrus schomburgkii*	20		F	F	0		
Polynemidae	*Polynemus octonemus*			E	M	0		
Polypteridae	*Erpetoichthys calabaricus*	1117		F	F	0		
Polypteridae	*Polypterus ornatipinnis*	20		F	F	0		
Polypteridae	*Polypterus senegalus*	584		F	F	0		

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Pomacanthidae	*Apolemichthys trimaculatus*	96		M	M			
Pomacanthidae	*Apolemichthys xanthopunctatus*	8		M	M			
Pomacanthidae	*Apolemichthys xanthurus*	27		M	M			
Pomacanthidae	*Centropyge acanthops*	17		M	M			
Pomacanthidae	*Centropyge argi*	175		M	M			
Pomacanthidae	*Centropyge aurantia*	19		M	M			
Pomacanthidae	*Centropyge aurantonotus*	67		M	M			
Pomacanthidae	*Centropyge bicolor*	334		M	M			
Pomacanthidae	*Centropyge bispinosa*	646		M	M			
Pomacanthidae	*Centropyge colini*	1		M	M			
Pomacanthidae	*Centropyge eibli*	113		M	M			
Pomacanthidae	*Centropyge ferrugata*	114		M	M			
Pomacanthidae	*Centropyge fisheri*	16		M	M			
Pomacanthidae	*Centropyge flavicauda*	53		M	M			
Pomacanthidae	*Centropyge flavipectoralis*	11		M	M			
Pomacanthidae	*Centropyge flavissima*	122		M	M			
Pomacanthidae	*Centropyge heraldi*	132		M	M			
Pomacanthidae	*Centropyge loricula*	341		M	M			
Pomacanthidae	*Centropyge multifasciata*	7		M	M			
Pomacanthidae	*Centropyge multispinis*	24		M	M			
Pomacanthidae	*Centropyge nox*	41		M	M			
Pomacanthidae	*Centropyge potteri*	46		M	M			
Pomacanthidae	*Centropyge tibicen*	100		M	M			
Pomacanthidae	*Centropyge venustus*	3		M	M			
Pomacanthidae	*Centropyge vrolikii*	151		M	M			
Pomacanthidae	*Chaetodontoplus caeruleopunctatus*	11		M	M			
Pomacanthidae	*Chaetodontoplus chrysocephalus*	1		M	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Pomacanthidae	*Chaetodontoplus duboulayi*	14		M	M			
Pomacanthidae	*Chaetodontoplus melanosoma*	23		M	M			
Pomacanthidae	*Chaetodontoplus meredithi*	15		M	M			
Pomacanthidae	*Chaetodontoplus mesoleucus*	61		M	M			
Pomacanthidae	*Chaetodontoplus septentrionalis*	12		M	M			
Pomacanthidae	*Genicanthus bellus*	12		M	M			
Pomacanthidae	*Genicanthus caudovittatus*	7		M	M			
Pomacanthidae	*Genicanthus lamarck*	45		M	M			
Pomacanthidae	*Genicanthus melanospilos*	56		M	M			
Pomacanthidae	*Genicanthus semifasciatus*	7		M	M			
Pomacanthidae	*Genicanthus watanabei*	7		M	M			
Pomacanthidae	*Holacanthus bermudensis*	42		M	M			
Pomacanthidae	*Holacanthus ciliaris*	101		M	M			
Pomacanthidae	*Holacanthus passer*	71		M	M			
Pomacanthidae	*Holacanthus tricolor*	86		M	M			
Pomacanthidae	*Pomacanthus annularis*	82		M	M			
Pomacanthidae	*Pomacanthus arcuatus*	48		M	M			
Pomacanthidae	*Pomacanthus asfur*	62		M	M			
Pomacanthidae	*Pomacanthus chrysurus*	6		M	M			
Pomacanthidae	*Pomacanthus imperator*	259		M	M			
Pomacanthidae	*Pomacanthus maculosus*	63		M	M			
Pomacanthidae	*Pomacanthus navarchus*	82		M	M			
Pomacanthidae	*Pomacanthus paru*	98		M	M			
Pomacanthidae	*Pomacanthus semicirculatus*	199		M	M			
Pomacanthidae	*Pomacanthus sexstriatus*	17		M	M			
Pomacanthidae	*Pomacanthus xanthometopon*	57		M	M			
Pomacanthidae	*Pomacanthus zonipectus*	25		M	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Pomacanthidae	*Pygoplites diacanthus*	119		M	M			
Pomacentridae	*Abudefduf saxatilis*	62		M	M			
Pomacentridae	*Amblyglyphidodon aureus*	20		M	M			
Pomacentridae	*Amblyglyphidodon flavilatus*	12		M	M			
Pomacentridae	*Amphiprion akallopisos*	215		M	M			
Pomacentridae	*Amphiprion akindynos*	6		M	M			
Pomacentridae	*Amphiprion bicinctus*	48		M	M			
Pomacentridae	*Amphiprion chrysopterus*	68		M	M			
Pomacentridae	*Amphiprion clarkii*	664		M	M			
Pomacentridae	*Amphiprion ephippium*	84		M	M			
Pomacentridae	*Amphiprion frenatus*	956		M	M			
Pomacentridae	*Amphiprion latezonatus*	14		M	M			
Pomacentridae	*Amphiprion melanopus*	226		M	M			
Pomacentridae	*Amphiprion nigripes*	18		M	M			
Pomacentridae	*Amphiprion ocellaris*	3327		M	M			
Pomacentridae	*Amphiprion percula*	1238		M	M			
Pomacentridae	*Amphiprion perideraion*	125		M	M			
Pomacentridae	*Amphiprion polymnus*	149		M	M			
Pomacentridae	*Amphiprion sandaracinos*	104		M	M			
Pomacentridae	*Amphiprion sebae*	539		M	M			
Pomacentridae	*Chromis analis*	20		M	M			
Pomacentridae	*Chromis atripectoralis*	857		M	M			
Pomacentridae	*Chromis caerulea*	686		M	M			
Pomacentridae	*Chromis cyanea*	87		M	M			
Pomacentridae	*Chromis dimidiata*	20		M	M			
Pomacentridae	*Chromis fumea*	6		M	M			
Pomacentridae	*Chromis insolata*	20		M	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Pomacentridae	*Chromis iomelas*	1		M	M			
Pomacentridae	*Chromis margaritifer*	4		M	M			
Pomacentridae	*Chromis ovalis*	5		M	M			
Pomacentridae	*Chromis retrofasciata*	29		M	M			
Pomacentridae	*Chromis scotti*	5		M	M			
Pomacentridae	*Chromis vanderbilti*	9		M	M			
Pomacentridae	*Chromis viridis*	1556		M	M			
Pomacentridae	*Chromis xanthurus*	33		M	M			
Pomacentridae	*Chrysiptera brownriggii*	4		M	M			
Pomacentridae	*Chrysiptera cyanea*	1604		M	M			
Pomacentridae	*Chrysiptera hemicyanea*	1155		M	M			
Pomacentridae	*Chrysiptera parasema*	723		M	M			
Pomacentridae	*Chrysiptera rollandi*	8		M	M			
Pomacentridae	*Chrysiptera springeri*	5		M	M			
Pomacentridae	*Chrysiptera starcki*	11		M	M			
Pomacentridae	*Chrysiptera talboti*	166		M	M			
Pomacentridae	*Chrysiptera taupou*	165		M	M			
Pomacentridae	*Chrysiptera tricincta*	12		M	M			
Pomacentridae	*Dascyllus albisella*	507		M	M			
Pomacentridae	*Dascyllus aruanus*	363		M	M			
Pomacentridae	*Dascyllus carneus*	54		M	M			
Pomacentridae	*Dascyllus marginatus*	97		M	M			
Pomacentridae	*Dascyllus melanurus*	844		M	M			
Pomacentridae	*Dascyllus reticulatus*	16		M	M			
Pomacentridae	*Dascyllus trimaculatus*	828		M	M			
Pomacentridae	*Dischistodus fasciatus*	2		M	M			
Pomacentridae	*Hypsypops rubicundus*	8		M	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Pomacentridae	*Microspathodon chrysurus*	76		M	M			
Pomacentridae	*Microspathodon dorsalis*	12		M	M			
Pomacentridae	*Neoglyphidodon melas*	289		M	M			
Pomacentridae	*Neoglyphidodon nigroris*	16		M	M			
Pomacentridae	*Neoglyphidodon oxyodon*	46		M	M			
Pomacentridae	*Neopomacentrus azysron*	66		M	M			
Pomacentridae	*Neopomacentrus filamentosus*	100		M	M			
Pomacentridae	*Neopomacentrus nemurus*	120		M	M			
Pomacentridae	*Parma bicolor*	40		M	M			
Pomacentridae	*Parma microlepis*	12		M	M			
Pomacentridae	*Plectroglyphidodon dickii*	20		M	M			
Pomacentridae	*Plectroglyphidodon lacrymatus*	14		M	M			
Pomacentridae	*Plectroglyphidodon leucozonus*	20		M	M			
Pomacentridae	*Pomacentrus alleni*	45		M	M			
Pomacentridae	*Pomacentrus amboinensis*	21		M	M			
Pomacentridae	*Pomacentrus auriventris*	59		M	M			
Pomacentridae	*Pomacentrus bankanensis*	72		M	M			
Pomacentridae	*Pomacentrus caeruleus*	530		M	M			
Pomacentridae	*Pomacentrus coelestis*	192		M	M			
Pomacentridae	*Pomacentrus melanochir*	10		M	M			
Pomacentridae	*Pomacentrus milleri*	3		M	M			
Pomacentridae	*Pomacentrus moluccensis*	71		M	M			
Pomacentridae	*Pomacentrus pikei*	18		M	M			
Pomacentridae	*Pomacentrus smithi*	15		M	M			
Pomacentridae	*Pomacentrus sulfureus*	2		M	M			
Pomacentridae	*Pomacentrus tripunctatus*	32		M	M			
Pomacentridae	*Premnas biaculeatus*	939		M	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Pomacentridae	*Stegastes adustus*	10		M	M			
Pomacentridae	*Stegastes leucostictus*	38		M	M			
Pomacentridae	*Stegastes partitus*	28		M	M			
Pomacentridae	*Stegastes planifrons*	10		M	M			
Potamotrygonidae	*Potamotrygon hystrix*	7		F	F	0		
Potamotrygonidae	*Potamotrygon leopoldi*	3		F	F	0		
Potamotrygonidae	*Potamotrygon motoro*	119		F	F	0		
Potamotrygonidae	*Potamotrygon orbignyi*	62		F	F	0		
Priacanthidae	*Heteropriacanthus cruentatus*	12		M	M			
Pristidae	*Pristis pristis*			M	M			
Prochilodontidae	*Semaprochilodus insignis*	50		F	F	0		
Prochilodontidae	*Semaprochilodus taeniurus*	35		F	F	0		
Protopteridae	*Protopterus aethiopicus*			F	F	0		
Pseudochromidae	*Congrogadus subducens*	5		M	M			
Pseudochromidae	*Pseudochromis aldabraensis*	85		M	M			
Pseudochromidae	*Pseudochromis bitaeniatus*	6		M	M			
Pseudochromidae	*Pseudochromis cyanotaenia*	15		M	M			
Pseudochromidae	*Pseudochromis diadema*	169		M	M			
Pseudochromidae	*Pseudochromis dilectus*	13		M	M			
Pseudochromidae	*Pseudochromis flavivertex*	95		M	M			
Pseudochromidae	*Pseudochromis fridmani*	184		M	M			
Pseudochromidae	*Pseudochromis fuscus*	33		M	M			
Pseudochromidae	*Pseudochromis olivaceus*	1		M	M			
Pseudochromidae	*Pseudochromis paccagnellae*	152		M	M			
Pseudochromidae	*Pseudochromis polynemus*	2		M	M			
Pseudochromidae	*Pseudochromis porphyreus*	220		M	M			
Pseudochromidae	*Pseudochromis sankeyi*	17		M	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Pseudochromidae	*Pseudochromis splendens*	18		M	M			
Pseudochromidae	*Pseudochromis springeri*	19		M	M			
Pseudochromidae	*Pseudochromis steenei*	10		M	M			
Pseudochromidae	*Pseudochromis tapeinosoma*	5		M	M			
Pseudomugilidae	*Pseudomugil furcatus*	518		F	F	0		
Pseudomugilidae	*Pseudomugil gertrudae*	1100		F	F	0		
Pseudomugilidae	*Pseudomugil paludicola*	985		F	F	0		
Pseudomugilidae	*Pseudomugil signifer*	90		F	F	0		
Rhamphocottidae	*Rhamphocottus richardsoni*			M	M			
Rhincodontidae	*Rhincodon typus*			M	M			
Rhinobatidae	*Rhinobatos typus*	1		M	M			
Rhinobatidae	*Rhynchobatus australiae*			M	M			
Rivulidae	*Austrolebias nigripinnis*	30		F	F	0		
Scaridae	*Cetoscarus bicolor*	15		M	M			
Scaridae	*Chlorurus bleekeri*	1		M	M			
Scaridae	*Chlorurus gibbus*	7		M	M			
Scaridae	*Scarus taeniopterus*	7		M	M			
Scaridae	*Sparisoma viride*	2		M	M			
Scatophagidae	*Scatophagus argus*	229		M	M			
Scatophagidae	*Scatophagus tetracanthus*	60		M	M			
Scatophagidae	*Selenotoca multifasciata*	111		M	M			
Schilbeidae	*Pareutropius debauwi*	943		F	F	0		
Schilbeidae	*Pseudeutropius moolenburghae*	80		F	F	0		
Sciaenidae	*Pareques acuminatus*	13		E	M	1		
Scomberesocidae	*Cololabis saira*			M	M			
Scombridae	*Scomber scombrus*			M	M			
Scombridae	*Thunnus alalunga*			M	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Scophthalmidae	*Psetta maxima*		4566	M	M			
Scophthalmidae	*Scophthalmus maximus*			M	M			
Scorpaenidae	*Amblyapistus taenionotus*	1		E	M			
Scorpaenidae	*Dendrochirus barberi*	1		E	M			
Scorpaenidae	*Dendrochirus biocellatus*	39		E	M			
Scorpaenidae	*Dendrochirus brachypterus*	62		E	M			
Scorpaenidae	*Dendrochirus zebra*	104		E	M			
Scorpaenidae	*Pterois antennata*	18		E	M			
Scorpaenidae	*Pterois lunulata*	2		E	M			
Scorpaenidae	*Pterois miles*	50		E	M			
Scorpaenidae	*Pterois radiata*	14		E	M			
Scorpaenidae	*Pterois volitans*	273		E	M			
Scorpaenidae	*Rhinopias aphanes*	3		E	M			
Scorpaenidae	*Rhinopias eschmeyeri*	1		E	M			
Scorpaenidae	*Rhinopias frondosa*	2		E	M			
Scorpaenidae	*Scorpaenodes xyris*	2		E	M			
Scorpaenidae	*Scorpaenopsis venosa*	2		E	M			
Scorpaenidae	*Sebastapistes cyanostigma*	7		E	M			
Scorpaenidae	*Taenianotus triacanthus*	5		E	M			
Scyliorhinidae	*Atelomycterus macleayi*	1		M	M			
Scyliorhinidae	*Atelomycterus marmoratus*	3		M	M			
Sebastidae	*Sebastes caurinus*		939	M	M			
Sebastidae	*Sebastes maliger*			M	M			
Sebastidae	*Sebastes nebulosus*			M	M			
Sebastidae	*Sebastes nigrocinctus*			M	M			
Sebastidae	*Sebastes ruberrimus*			M	M			
Serranidae	*Centropristis striata*		1135	E	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Serranidae	*Cephalopholis boenak*	1		E	M			
Serranidae	*Cephalopholis miniata*	20		E	M			
Serranidae	*Cephalopholis panamensis*	2		E	M			
Serranidae	*Cromileptes altivelis*	56		E	M			
Serranidae	*Diploprion bifasciatum*	1		E	M			
Serranidae	*Epinephelus akaara*		50	E	M			
Serranidae	*Epinephelus fuscoguttatus*			E	M			
Serranidae	*Grammistes sexlineatus*	1		E	M			
Serranidae	*Hypoplectrus indigo*	12		E	M			
Serranidae	*Hypoplectrus unicolor*	6		E	M			
Serranidae	*Liopropoma rubre*	13		E	M			
Serranidae	*Paranthias colonus*	5		E	M			
Serranidae	*Plectranthias inermis*	1		E	M			
Serranidae	*Plectropomus laevis*	4		E	M			
Serranidae	*Plectropomus leopardus*			E	M			
Serranidae	*Pogonoperca punctata*	1		E	M			
Serranidae	*Pseudanthias bartlettorum*	6		E	M			
Serranidae	*Pseudanthias bicolor*	2		E	M			
Serranidae	*Pseudanthias dispar*	218		E	M			
Serranidae	*Pseudanthias engelhardi*	4		E	M			
Serranidae	*Pseudanthias evansi*	50		E	M			
Serranidae	*Pseudanthias huchtii*	11		E	M			
Serranidae	*Pseudanthias hypselosoma*	3		E	M			
Serranidae	*Pseudanthias kashiwae*	30		E	M			
Serranidae	*Pseudanthias lori*	14		E	M			
Serranidae	*Pseudanthias parvirostris*	2		E	M			
Serranidae	*Pseudanthias pascalus*	6		E	M			

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Serranidae	*Pseudanthias pictilis*	43		E	M			
Serranidae	*Pseudanthias pleurotaenia*	189		E	M			
Serranidae	*Pseudanthias randalli*	11		E	M			
Serranidae	*Pseudanthias rubrizonatus*	5		E	M			
Serranidae	*Pseudanthias smithvanizi*	132		E	M			
Serranidae	*Pseudanthias squamipinnis*	568		E	M			
Serranidae	*Pseudanthias thompsoni*	1		E	M			
Serranidae	*Pseudanthias truncatus*	2		E	M			
Serranidae	*Pseudanthias tuka*	140		E	M			
Serranidae	*Serranocirrhitus latus*	10		E	M			
Serranidae	*Serranus baldwini*	16		E	M			
Serranidae	*Serranus tabacarius*	7		E	M			
Serranidae	*Serranus tigrinus*	22		E	M			
Serranidae	*Serranus tortugarum*	65		E	M			
Siganidae	*Siganus corallinus*	17		M	M			
Siganidae	*Siganus magnificus*	14		M	M			
Siganidae	*Siganus puellus*	3		M	M			
Siganidae	*Siganus punctatus*	2		M	M			
Siganidae	*Siganus stellatus*	12		M	M			
Siganidae	*Siganus uspi*	1		M	M			
Siganidae	*Siganus virgatus*	5		M	M			
Siganidae	*Siganus vulpinus*	177		M	M			
Sphyraenidae	*Sphyraena barracuda*	18		M	M			
Sphyrnidae	*Sphyrna zygaena*			M	M			
Squalidae	*Squalus acanthias*			M	M			
Stegostomatidae	*Stegostoma fasciatum*	2		M	M			
Sternopygidae	*Eigenmannia virescens*	1170		F	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Synanceiidae	*Synanceia horrida*			E	M			
Synanceiidae	*Synanceia verrucosa*		768	E	M			
Syngnathidae	*Corythoichthys intestinalis*	7		E	M	1		
Syngnathidae	*Doryrhamphus dactyliophorus*	12		E	M	1		
Syngnathidae	*Doryrhamphus excisus*	3		E	M	1		
Syngnathidae	*Doryrhamphus multiannulatus*	2		E	M	1		
Syngnathidae	*Hippocampus abdominalis*			E	M	1		
Syngnathidae	*Hippocampus angustus*			E	M	1		
Syngnathidae	*Hippocampus barbouri*			E	M	1		
Syngnathidae	*Hippocampus breviceps*			E	M	1		
Syngnathidae	*Hippocampus comes*			E	M	1		
Syngnathidae	*Hippocampus coronatus*			E	M	1		
Syngnathidae	*Hippocampus denise*			E	M	1		
Syngnathidae	*Hippocampus erectus*			E	M	1		
Syngnathidae	*Hippocampus fuscus*			E	M	1		
Syngnathidae	*Hippocampus hippocampus*	3		E	M	1		
Syngnathidae	*Hippocampus histrix*			E	M	1		
Syngnathidae	*Hippocampus ingens*			E	M	1		
Syngnathidae	*Hippocampus kelloggi*			E	M	1		
Syngnathidae	*Hippocampus kuda*			E	M	1		
Syngnathidae	*Hippocampus kuda subsp. multiannularis*			E	M	1		
Syngnathidae	*Hippocampus reidi*			E	M	1		
Syngnathidae	*Hippocampus spinosissimus*			E	M	1		
Syngnathidae	*Hippocampus trimaculatus*			E	M	1		
Syngnathidae	*Phycodurus eques*			E	M	1		
Syngnathidae	*Phyllopteryx taeniolatus*			E	M	1		
Telmatherinidae	*Marosatherina ladigesi*	2350		E	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Tetraodontidae	*Arothron diadematus*	12		E	M	0		
Tetraodontidae	*Arothron hispidus*	3		E	M	0		
Tetraodontidae	*Arothron manilensis*	4		E	M	0		
Tetraodontidae	*Arothron mappa*	7		E	M	0		
Tetraodontidae	*Arothron meleagris*	8		E	M	0		
Tetraodontidae	*Arothron nigropunctatus*	35		E	M	0		
Tetraodontidae	*Arothron stellatus*	3		E	M	0		
Tetraodontidae	*Canthigaster amboinensis*	5		E	M	0		
Tetraodontidae	*Canthigaster bennetti*	3		E	M	0		
Tetraodontidae	*Canthigaster epilampra*	1		E	M	0		
Tetraodontidae	*Canthigaster jactator*	7		E	M	0		
Tetraodontidae	*Canthigaster janthinoptera*	3		E	M	0		
Tetraodontidae	*Canthigaster margaritata*	16		E	M	0		
Tetraodontidae	*Canthigaster rostrata*	4		E	M	0		
Tetraodontidae	*Canthigaster solandri*	17		E	M	0		
Tetraodontidae	*Canthigaster valentini*	80		E	M	0		
Tetraodontidae	*Carinotetraodon lorteti*	40		E	F	0		
Tetraodontidae	*Carinotetraodon travancoricus*	5086		E	F	0		
Tetraodontidae	*Chelonodon laticeps*	2		E	M	0		
Tetraodontidae	*Colomesus asellus*	424		E	F	0		
Tetraodontidae	*Tetraodon biocellatus*	455		E	F	0		
Tetraodontidae	*Tetraodon fluviatilis*	3097		E	F	0		
Tetraodontidae	*Tetraodon leiurus*	15		E	F	0		
Tetraodontidae	*Tetraodon lineatus*	6		E	F	0		
Tetraodontidae	*Tetraodon miurus*			E	F	0		
Tetraodontidae	*Tetraodon nigroviridis*	411		E	F	0		
Tetraodontidae	*Tetraodon palembangensis*	1612		E	F	0		

Family name	Scientific name	Aquarium Trade Volume (#)	Live Food Trade Volume (kg)	Family Habitat Match	Species Habitat Match	Family Climate Match	Species Climate Match	Species in Canada
Tetraodontidae	*Tetraodon suvattii*	12		E	F	0		
Toxotidae	*Toxotes jaculatrix*	376		F	F	0		
Triakidae	*Mustelus mustelus*			M	M			
Trichonotidae	*Trichonotus setiger*	1		M	M			
Triglidae	*Prionotus ophryas*	3		M	M			
Urolophidae	*Urobatis halleri*	2		M	M			
Urolophidae	*Urobatis jamaicensis*	4		M	M			
Zanclidae	*Zanclus cornutus*	112		M	M			