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ASSESSMENT OF THE VULNERABILITY OF THE BIOLOGICAL COMPONENTS OF THE ST. LAWRENCE TO SHIP-SOURCE OIL SPILLS

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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.

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ABSTRACT

In Canada, assessing and mitigating the impacts of marine-transport-related oil spills is a major concern, driven by the increase in oil tanker size and in the density of marine traffic. The Government of Canada therefore reviewed and updated Canada's Ship-source Oil Spill Response and Preparedness Regime to address this concern. This Canadian government need led to the implementation of the Area Response Planning Initiative (ARPI) by Transport Canada (TC) and the Canadian Coast Guard (CCG) in four pilot areas of the country. DFO National Capital Region was mandated to develop a methodology to assess the vulnerabilities of the biological components of the aquatic environment (the National Framework). This framework (Thornborough et al. 2017) was implemented regionally by DFO Quebec Region in the St. Lawrence Area Response Plan (ARP) pilot area.

This document aims to assess the vulnerability of biological components in the St. Lawrence—including marine and estuarine algae and plants; marine and estuarine invertebrates; marine, estuarine and diadromous fish; and marine mammals—to ship-source oil spills, as well as to assess the appropriateness and applicability of the changes made by the Quebec Region to the National Framework for the St. Lawrence ARP pilot area. The vulnerability assessment was performed using four criteria related to exposure potential and four criteria related to resilience in the juvenile and adult stages of the various taxa or taxa groups under evaluation.

The vulnerability assessment made it possible to identify 136 taxa groups (among the 323 taxa groups assessed) with a high level of vulnerability to oil spills. These highly vulnerable groups represent 42% of all taxa assessed, and include 28% of algae and plants, 56% of invertebrates, 23% of fish, and 23% of marine mammals. An overall uncertainty level of 25% was associated with the assessment: 20% for algae and plants, 34% for invertebrates, 9% for fish, and none for marine mammals. These uncertainties, which affected the accuracy of scoring, are mainly attributable to the population status criterion. The regional adaptation of the National Framework made it possible to fulfill the mandate and ensured that the methodology was applicable to the biological realities of the St. Lawrence ARP. This methodology could be used in other areas or regions.

Évaluation de la vulnérabilité de composantes biologiques du Saint-Laurent aux déversements d'hydrocarbures provenant de navires

RÉSUMÉ

Au Canada, l'évaluation et l'atténuation des impacts des déversements d'hydrocarbures issus du transport maritime constituent une préoccupation importante alimentée par l'augmentation de la taille des pétroliers et de la densité du trafic maritime. Le gouvernement du Canada a donc entrepris la révision et la mise à jour du Régime canadien d'intervention en cas de déversement pour répondre à cette préoccupation. Ce besoin du gouvernement canadien a mené à la mise sur pied de l'Initiative de planification d'intervention localisée (IPIL) par Transports Canada (TC) et la Garde côtière canadienne (GCC) dans quatre zones pilotes au pays. Le MPO de la région de la capitale nationale a été mandaté pour élaborer une méthodologie d'évaluation des vulnérabilités biologiques du milieu aquatique (Cadre national). L'application régionale de ce cadre a été faite par la région du Québec dans la zone pilote du Plan d'intervention localisé (PIL) Saint-Laurent.

Ce document vise à évaluer la vulnérabilité de composantes biologiques : algues et plantes marines et estuariennes, invertébrés marins et estuariens, poissons marins, estuariens et diadromes, et mammifères marins du Saint-Laurent aux déversements d'hydrocarbures provenant de navires, mais aussi à évaluer l'adéquation et l'applicabilité des changements apportés au Cadre national par la région du Québec pour la zone pilote du PIL Saint-Laurent. L'évaluation de la vulnérabilité a été effectuée à partir de quatre critères portant sur le potentiel d'exposition et de quatre critères portant sur la résilience des stades juvéniles et adultes des différents taxons ou groupes de taxons évalués.

L'évaluation de la vulnérabilité a permis d'identifier 136 groupes de taxons à vulnérabilité élevée en cas de déversement sur 323 groupes évalués. Cela représente 42 % de tous les taxons évalués dont 28 % des algues et plantes, 56 % des invertébrés, 23 % des poissons et 23 % des mammifères marins. L'incertitude totale liée à l'évaluation est de 25 %, soit : 20 % pour les algues et plantes, 34 % pour les invertébrés, 9 % pour les poissons et aucune pour les mammifères marins. Ces incertitudes ont affecté le niveau de précision de la cotation. Elles sont dues principalement au critère de statut de la population. L'adaptation régionale du Cadre national a permis de répondre au mandat et de rendre la méthodologie applicable aux réalités biologiques du PIL Saint-Laurent. Celle-ci pourrait être utilisée dans d'autres secteurs ou régions.

1. INTRODUCTION

1.1. BACKGROUND

1.1.1. Area Response Planning Initiative

Assessing and managing the risks associated with shipping-related oil spills is a worldwide concern. In Canada, these concerns are driven by the increasing density of marine traffic, as well as ever-larger oil tankers (Tanker Safety Expert Panel Secretariat 2013; WSP 2014). Although Canada has not experienced any major oil spills to date, examples from elsewhere in the world suggest that we need to be more cautious and better prepared. Consequently, following the Tanker Safety Expert Panel Secretariat's 2013 report, the Government of Canada undertook to review and update some aspects of Canada's Marine Oil Spill Preparedness and Response Regime, which was implemented about 20 years ago.

One of the report's recommendations is that oil spill response plans should be adapted to regional realities and the specific characteristics of the environment where these plans will be implemented. In concrete terms, this means that response capacity, in terms of human and material resources, must be planned by taking into account realistic scenarios and the issues specific to the target area.

In response to this recommendation, Transport Canada (TC) and the Canadian Coast Guard (CCG) jointly established the Area Response Planning Initiative (ARPI),[1] which includes the development of Area Response Plans (ARPs) for four pilot areas in Canada. The findings and recommendations resulting from this initiative will be used to establish ARPs across Canada.

The St. Lawrence was targeted as an ARP pilot area because of the density and frequency of marine traffic and the multitude of associated human and environmental issues (WSP 2014; Transport Canada 2016). Environment and Climate Change Canada (ECCC) and Fisheries and Oceans Canada (DFO) are partners in the ARPI and provide expert environmental, data-related and scientific support for the project.

1.1.2. Response plan and biological vulnerabilities

In support of the ARPI, DFO Quebec Region was mandated to participate in the identification of the biological and ecological vulnerabilities of the aquatic environment in the St. Lawrence ARP pilot area. It is essential that stakeholders take these vulnerabilities[2] into account in selecting mitigation measures to limit the impact of a potential spill (Figure 1). This requirement, which is similar to those in the other pilot areas in Canada, highlights the necessity of better defining what a vulnerable component is and of developing a method for assessing the vulnerability of components in the face of a ship-source oil spill.

[1] Please refer to the glossary in Appendix 1 for more information on acronyms, for definitions of biological and oceanographic terms, and for information on the oil spill incidents mentioned in this document. This information is identified by a cross (†).

[2] Depending on the organization, the term "vulnerability" may be replaced by "sensitivity", "issue" or "resources at risk."

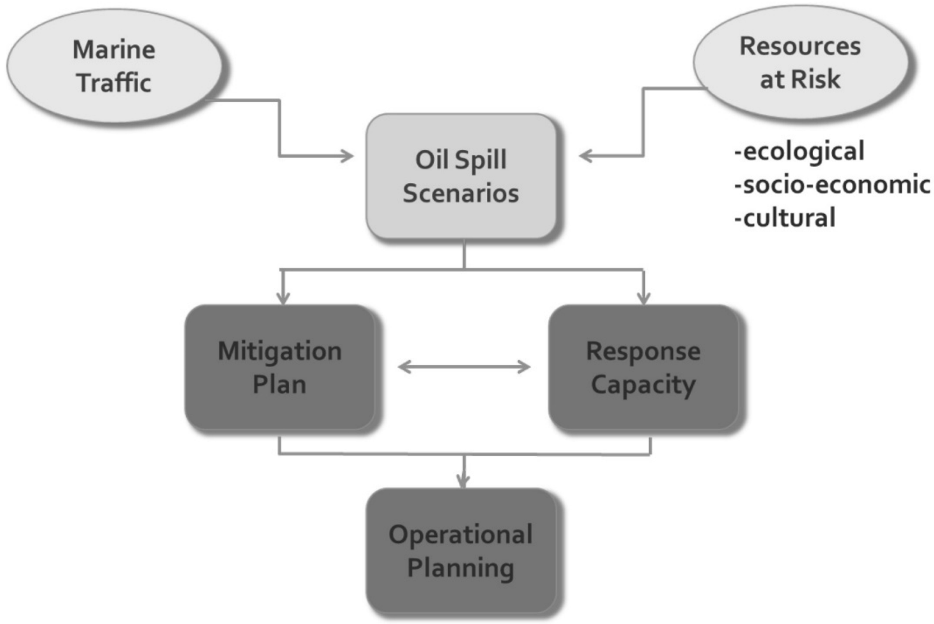

Figure 1. Oil spill response and planning model (Thornborough et al. 2017)

1.1.3. DFO's National Framework

In response to this mandate, DFO developed a theoretical framework (hereinafter referred to as the National Framework) for defining and assessing the vulnerability of the biological components of the marine environment to ship-source oil spills (Thornborough et al. 2017). This framework was developed so that it could be adapted and used in all pilot areas in Canada. However, since this is a pilot project, some flexibility was allowed in the application of the National Framework. Therefore, some modifications were made to improve the proposed method and to take specific regional characteristics into account.

1.2. OBJECTIVES

This research document describes how the National Framework was adapted and modified for the St. Lawrence ARP pilot area, in order to meet two objectives:

1. To assess the vulnerability of biological components of the St. Lawrence to ship-source oil spills;
2. To assess the appropriateness and applicability of the modifications made to the National Framework for the Quebec Region.

The first objective involves identifying the taxa that should be included in the oil spill response and planning process on a priority basis. Specifically, it entails identifying the DFO datasets that should be made available to ECCC, which is mandated to provide mapping products to stakeholders.

The second objective involves describing and justifying the changes made to the National Framework, which has been implemented in other DFO regions, and eventually comparing the various approaches.

2. OIL AND ITS IMPACTS ON THE AQUATIC ENVIRONMENT

An oil spill is an unpredictable, one-time occurrence with catastrophic consequences. A combination of factors determine the severity of a spill, as well as its impacts on ecosystems and aquatic plants and animals: the type of product spilled, spill characteristics (source, size and location), the time of year, the prevailing environmental conditions, the organisms present at the time of the spill and the mitigation measures put in place (O'Brien and Dixon 1976; NRC 2003; Fingas 2011).

2.1. BASIC CONCEPTS RELATED TO OIL

2.1.1. Definition and composition of oil

Crude oil is a natural product that is a mixture of thousands of hydrocarbon compounds, which are made up of carbon and hydrogen atoms (Fingas 2013). It is formed through the slow microbial degradation of organic matter—at low temperatures and high pressures, and in the absence of oxygen—in sedimentary layers deep underground. Refined petroleum is produced through the industrial refining process, whereby crude oil is separated into different components (fractions), which are refined into a variety of by-products (Lee et al. 2015). Gasoline and diesel are examples of refined petroleum products.

In Canada, there has been a lot of discussion about bitumen and diluted bitumen. Canadian bitumen occurs naturally in Alberta's oil sands. Bitumen may also be obtained as a residual fraction during the refining process (Yang et al. 2011). It is used mainly in asphalt for road paving. Diluted bitumen (dilbit) is a mixture of bitumen diluted with about 30% solvent, which makes it less viscous and easier to transport by pipeline. Although the impacts of other petroleum products are fairly well documented, much less is known about diluted bitumen (Fingas 2015a).

The composition of a particular petroleum product determines its properties and characteristics, which in turn influence its behaviour and fate in the aquatic environment (Dupuis and Ucan-Marin 2015). Each type of oil is composed of a large number of hydrocarbons. Hydrocarbons can be classified into two different categories—light and heavy—according to their molecular weight, which makes it easier to describe their respective properties and characteristics. Light hydrocarbons have a low molecular weight, while heavy hydrocarbons have a high molecular weight. A light, refined petroleum product, such as gasoline, is composed of a mixture of hydrocarbons with 5 to 10 carbon atoms, while a heavy oil, such as fuel oil, contains a higher percentage of high molecular weight hydrocarbons (Wang and Fingas 2003).

2.1.2. Behaviour and fate of oil spilled in the aquatic environment

An oil spill is a very dynamic event that evolves rapidly over time. The behaviour of the spilled oil in the water and the effects of the weathering processes on the oil vary according to the composition of the hydrocarbon compounds in the mixture, largely determining the distribution and fate of these compounds in the aquatic environment (NRC 2003; Fingas 2015b; Lee et al. 2015). For example, light hydrocarbons are more volatile, dissolve more readily in water and are more biodegradable than heavy hydrocarbons, and oil containing a higher proportion of light hydrocarbons than heavy hydrocarbons will therefore tend to behave in these ways.

Weathering processes (see Figures 2 and 3) occur at different spatial and temporal scales. The relative influence of each process varies with the hydrodynamic and environmental conditions prevailing at the time of the spill. The location of the spill, particularly its proximity to the coast, and the weather conditions during the spill can also influence these processes.

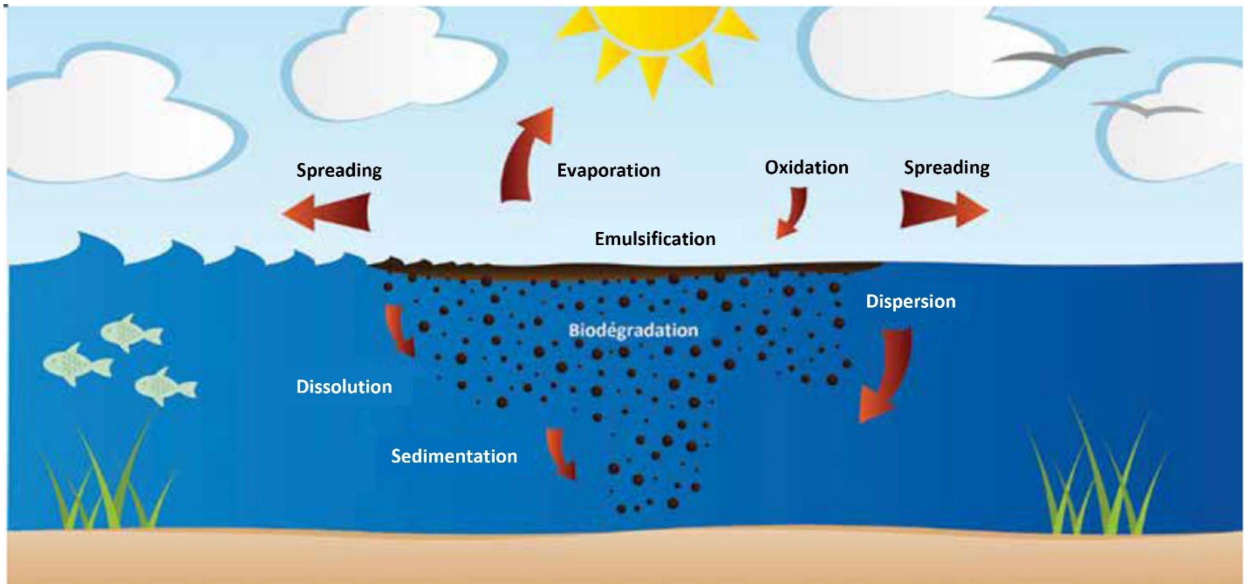

Figure 2. Main weathering processes acting on oil spilled in the aquatic environment (ITOPF 2012)

In the first few hours after a spill, the oil spreads and evaporates at the air-water interface, initiating a sequence of weathering processes. The oil starts spreading as soon as it comes into contact with the surface of the water. The slick spreads outward from the source, thinning and expanding at a rate that mainly depends on the viscosity of the oil, the volume spilled and environmental conditions (ITOPF 2012; Lee et al. 2015). Light hydrocarbons are lost as they evaporate from the slick into the atmosphere. Evaporation is the process that can result in the greatest net mass loss; light oils can lose up to 75% of their initial mass due to evaporation, compared with less than 10% for heavy oils (NRC 2003).

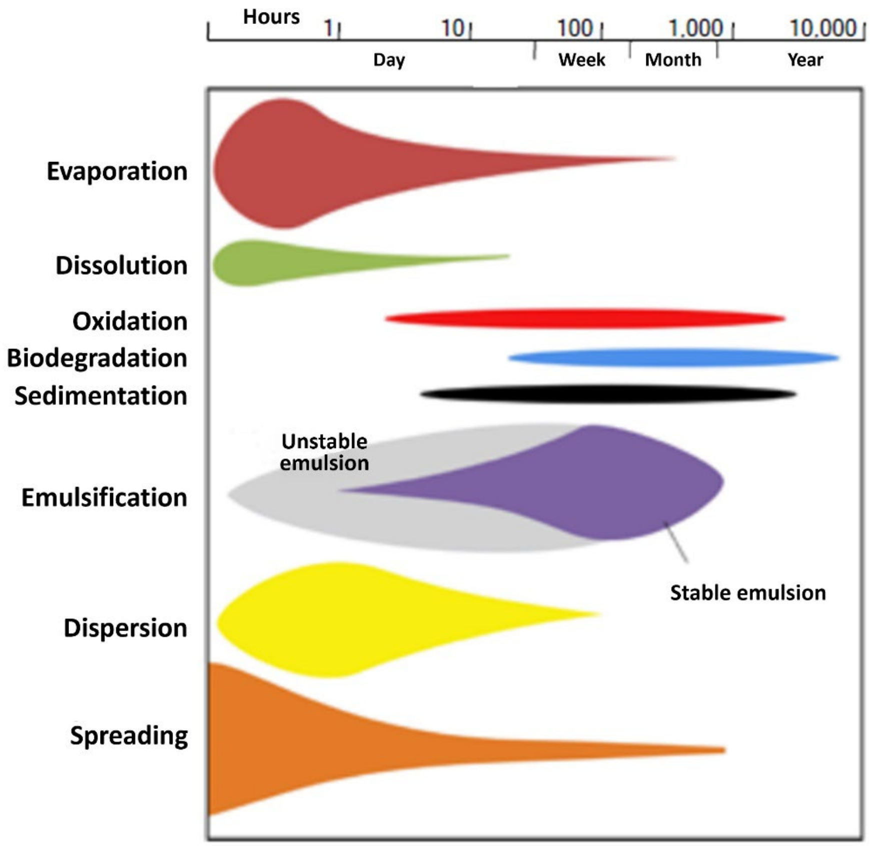

Figure 3. Oil weathering processes in the aquatic environment as a function of time (ITOPF 2012)

Dissolution and dispersion processes in the underlying water column are greatly influenced by environmental and hydrodynamic conditions at the spill site. Storm conditions and high-energy environments (e.g. waves and tidal action) promote the dissolution of light hydrocarbons, which are more soluble than heavy hydrocarbons. In fact, heavy hydrocarbons are virtually insoluble (ITOPF 2012). Dispersion is a process that involves the incorporation of the oil in the water column and its transport away from the spill site by currents. Although oil generally floats on the surface, it is dispersed in the water column when wave energy causes the slick to break up into fine droplets of oil or when oil is adsorbed onto suspended particles in the water column (Fingas 2013; Lee et al. 2015). As was the case for spreading, low viscosity oils disperse more readily than more viscous oils.

The emulsification process can start quickly and continue over the medium term before stabilizing. An emulsion forms when a liquid, in the form of microscopic droplets, is incorporated into another liquid with which it cannot mix. The most common type is a water-in-oil emulsion, often called “chocolate mousse” because of its appearance. The process requires considerable turbulence and can increase the effective volume of polluted water from three to five fold (*Lee et al.* 2015).

Sunlight promotes photo-oxidation, a process by which hydrocarbons react with oxygen. This phenomenon plays a minor role in the weathering of spilled oil, but it has two insidious effects. The reaction breaks the oil down into various by-products whose toxic effects are not well documented (Lee et al. 2015). In addition, contact with air creates a protective surface layer of oxidized hydrocarbons, which can lead to the formation of tar balls that may become stranded on shorelines or sink to the sea bottom. This protective layer slows down other weathering processes, and the oil trapped inside tar balls is protected from the air and therefore remains almost intact (ITOPF 2012).

Sedimentation occurs when oil is transferred from the water surface to the seabed through the adsorption of the hydrocarbons onto organic or inorganic particles suspended in the water column (Lee 2002). Shallow coastal waters and estuaries are often laden with suspended solids, which can bind with oil droplets and form oil-mineral aggregates, causing the oil to sink to the seabed or disperse into the water column (Bence et al. 1996; ITOPF 2012; Loh et al. 2014). Aquatic organisms also play a key role in sedimentation by ingesting oil, which is incorporated into their fecal pellets, which fall to the seabed, as do their tissues when they die (ITOPF 2012; Lee et al. 2015).

Biodegradation is the process in which microorganisms break down complex organic material into simpler chemical compounds. These organisms mineralize organic carbon, producing metabolites with a lower molecular weight. This process is more efficient in an oxygenated (aerobic) environment than in an anoxic (oxygen deficient) one (ITOPF 2012). In estuarine and marine environments, the biodegradability of a given oil depends on its composition, the prevailing environmental conditions and the presence of a microbial community capable of degrading hydrocarbons (Lemarchand and Desbiens 2015).

The different weathering processes are likely to influence one another. Evaporation of the volatile light hydrocarbons results in an increase in the proportion of heavy hydrocarbons in the slick, which increases the sedimentation potential of the residual oil and reduces its solubility. Biodegradation is promoted by any process that increases the surface-to-volume ratio of the oil mass, including spreading, dispersion and emulsification. Some processes, such as dispersion and emulsification, take place concurrently. Dispersion removes oil from the water surface, while emulsification causes an increase in the volume of polluted water and in its persistence (ITOPF 2012).

2.1.3. Influence of spill location and timing

The spill location, the prevailing weather conditions, and the season greatly influence the relative significance of the different weathering processes. This has a major effect on the type and magnitude of the impacts associated with a spill.

The persistence of the impacts of a spill is generally a function of its location. In the offshore environment, where there are no obstacles, oil may become diluted and disperse quickly. However, in coastal environments, there are more opportunities for stranding and confinement, which increase persistence. Oil washed up on a beach quickly loses its volatile compounds, leaving a layer of residual hydrocarbons that are more resistant to other weathering processes. Although rare, this phenomenon may also occur in connection with a spill far from the coast. Coastal environments are seldom spared even when a spill occurs several dozen kilometres offshore (Gundlach and Hayes 1978; Lee et al. 2015; Beyer et al. 2016). Winds and currents can play a major role in pushing an oil slick toward the shoreline (Beegle-Krause and Lehr 2015). There is little potential for dilution and dispersion of contaminated water masses in low-energy hydrodynamic environments, such as sheltered bays (Lee and Page 1997). Conversely, rocky environments characterized by high hydrodynamic energy are generally swept by significant waves and tidal currents, which tend to disperse contaminants (Cabioch et al. 1978; Bocquené et al. 2004).

In calm weather conditions, an oil slick remains stable and weathering processes are slowed while, in stormy conditions, the associated vigorous mixing energy will accelerate weathering. When dispersed droplets of oil form, the surface-to-volume ratio increases and dissolution is promoted. This causes a temporary increase in the concentrations of toxic compounds in the water column (Michel et al. 1997; Neff 2002; French McKay 2003). Temperature also affects the properties and behaviour of the spilled oil. Warmer temperatures promote evaporation and biodegradation, which in turn decrease the viscosity of the oil and increase spreading (Dupuis and Ucan-Marin 2015).

The behaviour and fate of oil are affected by winter conditions and the presence of ice (Dupuis and Ucan-Marin 2015). Oil can become trapped on, in, or under the ice (Figure 4) and will not be released until the ice melts in the spring. The main risk is that the oil-contaminated ice may be transported out of the spill area. An oil slick may also become concentrated in ice-free areas (CEAEQ 2015). Beneath the ice, the process of evaporation usually slows and the rates of dispersion and emulsification likewise decrease (Beegle-Krause and Lehr 2015). In addition, some weathering processes may not occur at all, such as photo-oxidation and tar ball formation, while other processes, such as sedimentation, are promoted by cold temperatures, which increase oil viscosity and density (Lee et al. 2015).

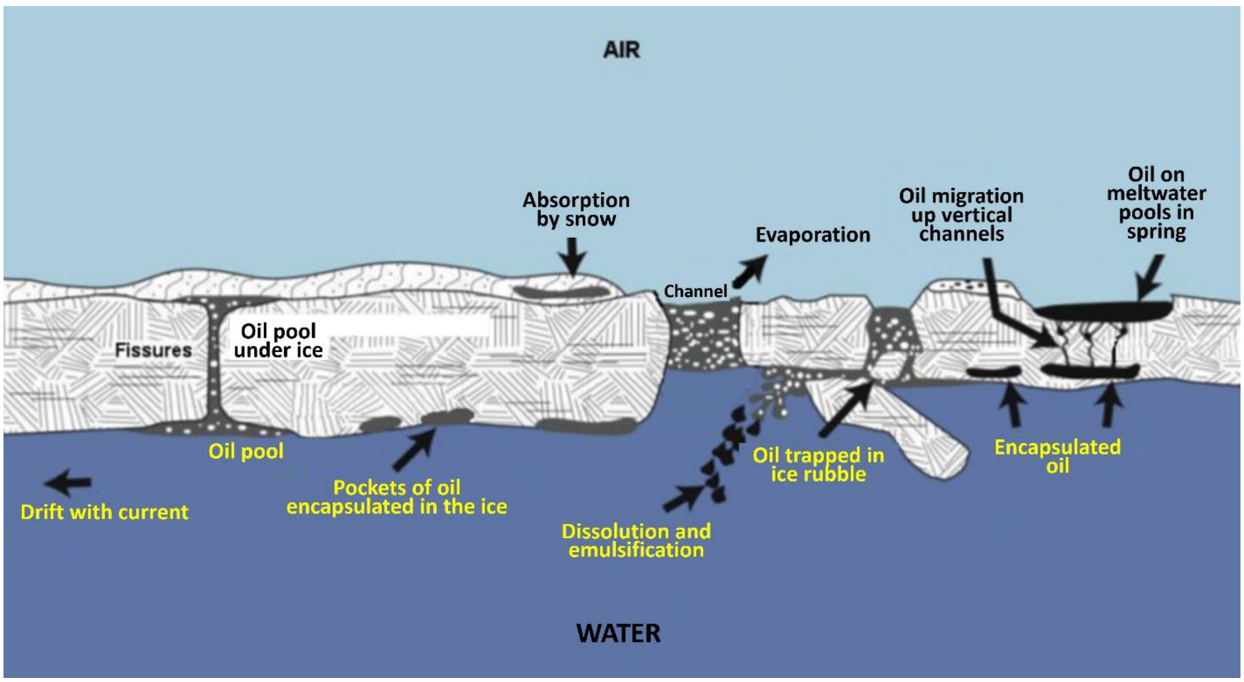

Figure 4. Fate of oil in the aquatic environment in areas with ice cover (modified from Potter et al. 2012 In CEAEQ 2015)

2.1.4. Types of impacts

Potential spill-related effects on the physical environment and on aquatic plants and animals can be divided into two broad categories: physical and toxicological. They can also be described according to the degree of harm experienced by organisms (lethal or sublethal effects) and the time scale involved (acute or chronic effects).

Physical impacts are caused by oiling, or the covering of habitat or organisms by an oil film of variable thickness. This can lead to smothering (suffocation), loss of swimming ability and insulation, habitat degradation, and so on. Oiling particularly affects organisms living in the midlittoral zone, which experiences the effects of the tides, and those occurring at the air-water interface, such as marine mammals. Oil fouling can cause instantaneous or delayed mortality as well as sublethal effects, such as the temporary inability to take in adequate food (Lee et al. 2015).

Toxicological effects result from the absorption of dissolved oil fractions, either directly from the surrounding water or through the ingestion of oil and the subsequent absorption of certain compounds in the intestinal tract. Exposure to dissolved fractions causes a form of narcosis, a general term for a range of effects produced by numerous biochemical reactions in the body that can be likened to anaesthesia (Campagna et al. 2003; Barron et al. 2004; Dupuis and Ucan-Marin 2015). The effects of narcosis, which can be short-lived or result in mortality, depend on the duration of exposure, the type of oil, the concentrations of toxic compounds in the oil and the bioavailability of the products (NRC 2003). Fatal effects are referred to as lethal. Non-fatal effects ranging from transient to chronic are referred to as sublethal.

Acute effects can be defined as the significant and immediate effects, whether lethal or sublethal, of a single exposure to a toxicant (NRC 2003). Chronic toxicity is defined as either the effects of long-term and continuous exposure to a toxicant (e.g. release of oil buried in sediment) or the long-term sublethal effects of acute exposure (Connell and Miller 1984).

2.1.5. Toxicity and sensitivity

Toxicity of oil

Toxicity is defined as all of the adverse effects on organisms caused by exposure to a substance or a chemical. The toxicity of a compound depends on its concentration and the duration of exposure as well as its bioavailability, that is, the existence of a mechanism through which the contaminant acts on the organism (Dupuis and Ucan-Marin 2015).

Crude oil is composed of four hydrocarbon groups: saturates, aromatics, resins and asphaltenes (Dupuis and Ucan-Marin 2015, Fingas 2015b). Aromatic compounds, which are primarily responsible for the toxicity of oil, can be divided into two groups: BTEX[†] and PAHs.[†] BTEX refers to six compounds: benzene, toluene, ethylbenzene and three xylene isomers. They belong to the group of aromatic hydrocarbons referred to as monocyclic because they have a single benzene ring (Lee et al. 2015). These low molecular weight compounds are fairly water soluble and volatile, and therefore not very persistent. Their concentration on the water surface rapidly decreases due to evaporation, dissolution and dispersion. Their toxicity is mitigated by their very short residence time in the water, ranging from 48 hours in calm conditions to a few hours in turbulent conditions (Neff 2002).

PAHs, or polycyclic aromatic hydrocarbons, are a larger group of hydrocarbons that have two or more benzene rings and a wider range of characteristics and properties than their monocyclic counterparts. They include low molecular weight compounds whose behaviour is similar to that of BTEX, as well as high molecular weight compounds such as benzo(a)pyrene, a known carcinogen. PAHs are much less water soluble than BTEX. They have a greater propensity to adsorb to suspended particulate matter and to sink (Neff 2002). They are also less affected by degradation processes, such as biodegradation and photo-oxidation. All of these characteristics contribute to the environmental persistence of PAHs (NRC 2003). PAHs can have long-term toxic effects on organisms that live in contact with contaminated sediments (Lee et al. 2015).

Sensitivity of organisms to dissolved petroleum compounds

The toxicological sensitivity of an organism to a contaminant is expressed as a toxicity threshold or value in relation to a specific endpoint (e.g. growth, survival, reproduction). This sensitivity is usually measured in individual organisms under controlled laboratory conditions, and the value obtained is generally specific to a given species (De Lange et al. 2010). For example, the median lethal concentration (LC_{50}), that is, the amount of a substance that causes the death of 50% of a group of organisms during exposures of 24, 48 or 96 hours, is routinely used to assess acute toxicity. Sublethal effects can also be measured on the basis of various physiological indicators such as lesions, developmental abnormalities or behavioural changes (Dupuis and Ucan-Marin 2015). Sensitivity values are only available for a handful of organisms and a small number of hydrocarbon molecules.

Since the characteristics of the receiving environment (water, soil, sediment, air) tend to affect the toxicity of hydrocarbons by influencing their bioavailability and since the composition of the mixture varies over time as a result of weathering, it is difficult to determine the toxicity of petroleum products in the aquatic environment and to predict their effects on aquatic organisms (Lee et al. 2015).

Field studies conducted during post-spill monitoring and mesocosm studies can aid in identifying the effects of oil on the biological components† of the aquatic environment (Dupuis and Ucan-Marin 2015). However, it is difficult to establish a direct relationship between an oil spill and its effects on the receiving environment and biological communities. In many cases, the lack of a pre-spill baseline characterization of the ecosystem makes it difficult to accurately determine the effects on organisms and/or predict the time to recovery (Dupuis and Ucan-Marin 2015; Lee et al. 2015).

2.2. CONCEPT OF VULNERABILITY

The effects of an oil spill in the aquatic environment cannot be determined solely on the basis of the toxicological sensitivity of the species† exposed to the different contaminants involved. That is why a number of authors use the concept of vulnerability to better characterize the response of different species to oil. Although vulnerability takes into account the toxicological sensitivity of individual organisms, it also considers potential for exposure to an oil spill and the level of resilience of the affected populations (De Lange et al. 2010).

Exposure potential is defined as the probability that a given taxon† will come into contact with an oil slick. This concept takes into account the location of the taxon's preferred habitat and its ability to move away from the oil. On the other hand, resilience relates to how quickly a population is able to recover following exposure to a stressor, in this case an oil spill (Pimm 1984; De Lange et al. 2009; De Lange et al. 2010).

Therefore, if there is no potential for exposure, an organism cannot be considered vulnerable even if it is highly sensitive to a given contaminant. Similarly, a group of sensitive individuals can be exposed to a contaminant without significant effects on the population, if the organism is highly resilient. The concept of vulnerability therefore represents a balance between these three concepts.

2.3. EXAMPLES OF OIL SPILL IMPACTS ON MARINE AND ESTUARINE ORGANISMS

The oil spills listed in Appendix 2 are incidents that have occurred in the Northern Hemisphere over the last 50 years. They were selected because they are described in post-spill studies that deal with the main effects of oil on marine and estuarine organisms. Below are some examples of oil spill effects on individual ecosystem components.

2.3.1. Marine and estuarine algae and plants

Coastal environments are rarely spared even when an oil spill occurs dozens of kilometres from the coast (Gundlach and Hayes 1978; Lee et al. 2015; Beyer et al. 2016). Algae and plants in the St. Lawrence River are likely to be exposed to spilled oil because they grow in the midlittoral and infralittoral zones and often form extensive grass beds, marshes and single-species stands (Chabot and Rossignol 2003; Tamigneaux and Johnson 2016). Their location puts them at risk of exposure to oiling and the toxicity of dissolved oil compounds (Foster et al. 1971; Zieman et al. 1984; Lobban and Harrison 1997; Lewis and Pryor 2013).

Midlittoral zone

Over the past 50 years, some oil spills have caused mass mortality followed by slow recovery among algal species in the family Fucaceae (order Fucales) that inhabit the midlittoral zone (Thomas 1978; Southward and Southward 1978; Jones et al. 1998; Driskell et al. 2001; Peterson et al. 2003), while other spills have had few impacts or indiscernible impacts that fall within the natural range of variability (Linden et al. 1979; Gundlach et al. 1983; Diez et al. 2009). As a possible explanation, Sjotun and Lein (1993) pointed out that stands of *Ascophyllum nodosum* form a dense canopy that protects new shoots growing underneath. Some affected sites exhibit remarkable post-spill growth after the first few weeks, during which mass mortalities are observed (Southward and Southward 1978; Moore et al. 1997; Crump et al. 1999; Peterson et al. 2003). The presence of a number of opportunistic† species appears to explain this rapid recovery. After the *Sea Empress*† ran aground, the affected area was quickly colonized by three opportunistic taxa in sequence, specifically *Ulva* spp. (Chlorophyceae), then *Porphyra* sp. (Rhodophyta), and *Fucus vesiculosus* (Phaeophyceae), a situation attributed to the decreased abundance of grazers, which had been severely impacted by the oil (Moore et al. 1997; Crump et al. 1999). In comparison, after other spills, some perennial† taxa, specifically those with slower growth rates, have shown much longer post-spill recovery times (Thomas 1978; Smith 1968 *in* Kaas 1980). For example, after the *Exxon Valdez*† oil spill, the biomass and percent cover of the algal species *Fucus spiralis* and *Fucus gardneri* failed to recover to their pre-spill values for many years (Driskell et al. 2001). This is similar to what has been observed following severe natural (e.g. denudation caused by ice abrasion) and anthropogenic disturbances in the midlittoral zone, with stands of mature algae composed of slow-growing perennial species often replaced by opportunistic species (Littler and Littler 1980; Archambault and Bourget 1983; Orfanidis et al. 2001; Wells et al. 2007). The main consequence of this shift from perennating algae with well-developed thalli to opportunistic algae (often Chlorophyceae) with simple thalli is a reduction in the amount of habitat available for a wide variety of fish and invertebrate species (Lobban and Harrison 1997; Bégin et al. 2004; Tamigneaux and Johnson 2016). The long-term consequences of oil spills cannot be assessed in terms of toxicity to algae; instead, the disruption of the ecological balance of natural communities as a whole must be considered (Thomas 1978).

Plants growing in the midlittoral zone, such as smooth cordgrass (*Spartina alterniflora*), are also directly affected by oil spills (Gundlach and Hayes 1978). While low concentrations of oil appear to have little effect on this marsh species, given that its growth quickly resumes within the same season (Alexander and Webb 1987; Siliman et al. 2012), high concentrations can cause a significant decrease in stem density, with long-term consequences for the marsh (Thomas 1973; Alexander and Webb 1987; Beyer et al. 2016). The suppression of growth and mortality have also been observed in common three-square bulrush (*Schoenoplectus pungens*) present in heavily oiled sediment (Longpré et al. 1999; Lee et al. 2001). Plant roots in a layer of contaminated sediment several centimetres thick come in contact with toxic dissolved oil compounds. The magnitude of the effects in such a case depends on the amount of oil spilled and its degree of penetration in the sediments. Oil penetration varies depending on the type of oil and its viscosity, sediment grain size, and the amount of time the oil remains present (Alexander and Webb 1987). The deep contamination of sediments can compromise the regrowth of plants for years by killing their roots. In the case of smooth cordgrass, it has been shown that the loss of root biomass can lead to shoreline erosion and weaken the entire ecosystem (Alexander and Webb 1987; Silliman et al. 2012).

Infralittoral zone

In the infralittoral environment, few major impacts have been observed in macroalgal and plant taxa. This has been attributed to the fact that oiling is less severe and less persistent in water below a depth of one metre (Kaas 1980). In addition, the toxicity of oil is rapidly reduced through its dilution and degradation in water (Lewis and Pryor 2013). The growth of seaweed species in the order Laminariales is generally not affected, and an increase in biomass has even been noted at some spill sites (Foster et al. 1971; Kaas 1980; Cross et al. 1987; Peterson 2001; Lobón et al. 2008). Their thick leathery thallus and their natural covering of mucus may prevent the adherence of oil and therefore the absorption of dissolved compounds that are harmful to other types of organisms (Foster et al. 1971). Marine plants, including common eelgrass (*Zostera marina*), also appear to experience relatively few effects (Den Hartog and Jacobs 1980; Durako et al. 1993; Kenworthy et al. 1993; Moore et al. 1997; Dean et al. 1998; Dean and Jewett 2001; Macinnis-Ng and Ralph 2003). In eelgrass beds, the canopy may have a protective effect by preventing the oil from reaching the sediments and thus the meristem tissue (specialized cells responsible for growth) of the leaves and the roots buried in the sediment (Den Hartog and Jacobs 1980; Zieman et al. 1984). However, heavily impacted eelgrass beds can take years to recover, especially if they are isolated from other, intact beds that could serve as a source of propagules (Zieman et al. 1984).

Epipelagic zone

The term "phytoplankton" refers to all microscopic algae living in the water column. In general, these algae seem to be fairly insensitive to the effects of oil (O'Brien and Dixon 1976). However, their responses may vary with the type of oil spilled and the species composition of the affected community (review by Lewis and Pryor 2013). While low concentrations of oil can stimulate phytoplankton growth, higher concentrations can have an adverse effect, by affecting cell size, cell division, chlorophyll-*a* concentration and photosynthetic activity (Johansson et al. 1980; Harrison et al. 1986; Siron et al. 1996; Sargian et al. 2005; Gilde and Pickney 2012; Parsons et al. 2015). Exposure to oil can also lead to drastic changes in community structure, as observed in nearshore macroalgae (Perhar and Arhonditsis 2014). However, functional redundancy, rapid reproductive rates, and recruitment of healthy organisms from adjacent areas thanks to the natural mixing of water masses are generally sufficient to enable affected populations to recover quickly (Lewis and Pryor 2013; Lee et al. 2015).

2.3.2. Marine and estuarine invertebrates

Oiling and exposure to dissolved compounds (mainly in the littoral zone) are the two main exposure pathways for invertebrates and can cause mass mortalities. In the midlittoral zone, several centimetres of oil, including water-in-oil emulsions (or "mousse"), can quickly smother and kill sessile[†] organisms. In the infralittoral zone, high concentrations of dissolved toxic compounds can cause mortality, and lower doses can induce narcosis. Narcotized organisms are disoriented and apathetic and become vulnerable to predation or to being swept ashore (Conan 1982; Suchanek 1993; Peterson 2001). Over the longer term, surviving organisms are likely to exhibit cytogenetic effects with repercussions on individual life expectancy, reproduction and recruitment. Furthermore, energy invested in survival in a suboptimal (contaminated) environment can alter behaviour, limit growth and reduce reproductive potential (Suchanek 1993).

Toxicological sensitivity

Toxicological sensitivity to hydrocarbons varies greatly among taxonomic groups of invertebrates. Among benthic macrofauna, crustaceans and polychaetes are at opposite ends of the sensitivity spectrum. Crustaceans, and especially amphipods, are definitely the most heavily impacted invertebrates. Their considerable sensitivity makes them good indicators of contamination. Although polychaetes are generally described as opportunistic species with low sensitivity, this is not the case for all species in the group (Linden 1976; Rossi et al. 1976; Cabioch et al. 1980; Den Hartog and Jacobs 1980; Dauvin 1982, 1987, 1998; Elmgren et al. 1983; Peterson et al. 1996; Gomez Gesteira and Dauvin 2000). Crustacean-dominated communities are generally more sensitive than other communities (Gomez Gesteira et al. 2003). Barnacles seem to be an exception, as they have shown a high level of tolerance to oil even when it accumulates around their shell (Suchanek 1993; Peterson 2001).

Molluscs exhibit short- and medium-term effects, which vary according to species and lifestyle. The fuel oil released from the wreck of the tanker *Erika*† did not cause mass mortality in exposed mussels (*Mytilus edulis*). The ability of mussels to close their shells is recognized as a characteristic that provides temporary protection from adverse conditions. Furthermore, mussels are generally known for their low sensitivity to chemical contaminants (Bocquené et al. 2004). After the *Tsesis*† oil spill, the clam species *Macoma balthica* showed considerable tolerance to the spilled oil, including low mortality and high recruitment, whereas amphipods of the genus *Pontoporeia* were virtually eliminated. A sublethal effect, specifically a lower than usual burrowing rate, was nonetheless observed in *Macoma balthica* (Elmgren et al. 1983). In sharp contrast, the clam species *Mya arenaria* appears to be very sensitive to hydrocarbons. Unlike mussels, these clams are unable to seal their shell valves completely (Gilfillan and Vandermeulen 1978).

Among meiofauna taxa, oligochaetes, polychaetes and halacarids generally appear to be resistant to oil pollution, while ostracods (crustaceans) appear to be more sensitive (Boucher 1980; Elmgren et al. 1983). Nematodes are definitely the most oil-resistant group in the meiofauna (Elmgren et al. 1983), with a tolerance comparable to that of polychaetes, which are part of the benthic macrofauna.

In general, zooplankton seem to be fairly resistant to petroleum hydrocarbons. Some species may even be able to ingest oil and excrete it in fecal pellets (Conover 1971).

Impact on communities

Few studies have reported the complete disappearance of an invertebrate community from a given site after an oil spill. However, reductions in abundance exceeding 50% and dramatic losses of biodiversity have often been reported (Cabioch et al. 1978, 1980; Conan 1982; Bodin and Boucher 1983; Elmgren et al. 1983; Michel et al. 1997; Gomez Gesteira and Dauvin 2000; de la Huz et al. 2005). In such cases, the community's full recovery depends on the life expectancy and fecundity of its constituent organisms and on the type of larvae (pelagic or benthic) they produce (Conan 1982).

Invertebrate communities typically go through a three-phase response following an oil spill. The first, or acute, phase is characterized by varying levels of mortality depending on the species present, the hydrodynamic conditions and the water depth at the site. Second, a reduction in recruitment (chronic effect) can be observed in some species, whether or not they suffered acute effects at the time of the spill. A proliferation of tolerant and opportunistic species is often observed at the same time. However, because these species do not compete for space and resources, the species making up the original community are able to gradually re-colonize the spill site and displace the opportunistic species as the habitat recovers. This return to normal is the third and final phase (Pearson and Rosenberg 1978; Dauvin 1982; Spies et al. 1988; Jewett et al. 1999).

Communities normally dominated by pericarid crustaceans (amphipods, isopods, tanaids and cumaceans), which are characterized by low fecundity and direct development†, generally take the longest time to recover to their former status (Conan 1982). Nearshore communities made up of long-lived species are also more likely than other communities to suffer long-term impacts from a substantial decrease in abundance (Suchanek 1993).

Circalittoral communities are unlikely to be affected by oil spills. For example, benthic communities around the Shetland Islands (Scotland) located at depths between 50 m and 146 m were not affected by the *Braer* spill† (Kingston et al. 1995). Similarly, 16 months after the *Exxon Valdez* spill, the benthic communities at depths between 40 m and 100 m in Prince William Sound, Alaska, showed no signs of disturbance from the spilled oil (Armstrong et al. 1995; Feder and Blanchard 1998).

Hydrodynamic conditions and sequestration of oil in sediments

Hydrodynamic conditions have a strong influence on the exposure potential and resilience of invertebrate benthic communities. For example, the *Exxon Valdez* spill resulted in extensive contamination of coastal ecosystems. Six years after the spill, about 80% of the affected groups of invertebrates in eelgrass beds (a low-energy hydrodynamic environment) still showed no clear signs of recovery, while most groups present in kelp beds (high-energy hydrodynamic environment) had fully recovered after two years. Even families with high abundance in both types of environment were more severely affected in eelgrass beds (higher mortality rates, lower recruitment, and longer recovery times for populations). Plant and algal communities appear not to have suffered significant effects. Habitat degradation is therefore not a factor that can account for the disparities between the two types of environments (Dean and Jewett 2001).

Coastal habitats with fine sand substrates, such as bays and estuaries, are often characterized by low hydrodynamic energy conditions and high levels of particulate matter. In these environments, petroleum hydrocarbons are likely to become concentrated and sequestered in sediments (Boehm et al. 1982; Lee and Page 1997). This explains why it took more than a decade for communities in low-energy environments to recover to their former status following the *Amoco Cadiz*† and *Florida*† spills (Sanders et al. 1980; Ibanez and Dauvin 1988; Dauvin and Gentil 1990; Warwick and Clarke 1993; Dauvin 1998). In the *Amoco Cadiz* spill incident, hydrocarbons penetrated deep into the sediments, causing adverse effects on the amphipod populations (particularly in the genus *Ampelisca*) that dominated the fine sediment community, while molluscs and polychaetes appear to have escaped harm (Cabioch et al. 1978, 1980). Because oil penetrated the deep sediment layers, the infralittoral benthic populations, which are usually exposed to a lesser extent, were affected as well (Cabioch et al. 1980; Jewett et al. 1999). The resulting disappearance of a variety of organisms benefited several oil-tolerant opportunistic polychaete species (Cabioch et al. 1980). The continuous leaching and resuspension of oil sequestered in sediments is likely to occur during rough seas or through the activity of bioturbating organisms (Bodin and Boucher 1983). This is likely to increase concentrations of dissolved toxic compounds that are bioavailable to filter-feeding benthic organisms and organisms living on the surface of bottom sediments, thereby slowing recovery (Christensen et al. 2002).

Geographic isolation†

Isolation is another factor that can influence a population’s rate of recovery. Following mass mortalities, the greater the distance between two similar communities, the lower the potential for recolonization of the affected site by the various species in the original community. This is especially true for invertebrates, given their generally low mobility. In species such as amphipods, which lack a pelagic larval phase that would enable their dispersal, immigration is very limited and recruitment is entirely dependent on the reproductive capacity of the females at a given site (Cabioch et al. 1980; Dauvin 1987).

2.3.3. Marine, estuarine and diadromous fish

Fish are quite mobile except during their early life stages. Unlike sessile organisms, their potential for exposure to oil therefore depends primarily on their presence at a spill site and their ability to move away from the oil.

Following the *Exxon Valdez* spill, Peterson (2001) grouped fish considered vulnerable in three categories: (1) fish that permanently live in coastal habitats; (2) fish that breed or spawn there; and (3) fish that feed there during a large part of their life cycle. These groups are considered to be at greater risk of acute effects, but they are also at risk of chronic effects from oil-contaminated nearshore substrates.

Acute exposure—short-term effects

Like all living organisms, fish are generally at risk of mortality during the first 24 to 48 hours after a spill. This acute exposure phase lasts only a short time because of the gradual decrease in toxicity resulting from weathering processes such as volatilization and dilution (NRC 2003; Lee *et* al. 2015). Mortalities are generally localized and mainly affect fish that swim in the first few metres of the water column (NRC 2003), including species that use the midlittoral zone and shallow-water demersal species (Peterson 2001).

The grounding of the *North Cape*† is an example of a spill incident that caused acute effects in aquatic organisms. This oil spill occurred during a storm and resulted in mass mortalities of invertebrates and fish despite the relatively small amount of oil that was released (Michel et al. 1997; French McKay 2003). Because of the intense wave action, the oil mixed into the water column quickly, thus reducing evaporation of the toxic compounds and increasing their dissolution. The *Amoco Cadiz* spill is another example of an incident where fish kills occurred due to the turbulent conditions (Chassé 1978).

However, in several other oil spills, few acute effects on fish were reported in inshore or offshore areas. The ability of fish to swim away from a spill site is the most plausible explanation given in most cases (Linden et al. 1979; Barber et al. 1995; SEEEC 1998; Beyer et al. 2016; Sanchez et al. 2006). Nonetheless, some authors have pointed out that it is much more difficult to obtain direct evidence of fish mortalities offshore than in coastal environments, where dead organisms can often be found on the shore. In the absence of direct evidence, some authors have sought to determine whether the impact of unreported spill-related mortalities could be observed at the population level. This issue is addressed in the “Impact on populations” section below.

Chronic exposure—long-term effects

Chronic exposure may occur after acute exposure, if exposure is prolonged through species’ use of a contaminated site or their ingestion of contaminated prey (NRC 2003; Dupuis and Ucan-Marin 2015). Fish are likely to experience long-term effects, especially if they come in close contact with sediment. Chronic exposure has a direct effect on the resilience of affected populations. Prolonged exposure occurred after the *Amoco Cadiz*† spill, with effects observed above all in flatfish, including fin rot disease, higher mortality rates, and decreased growth and reproduction rates, up to three years after the incident (Conan and Friha 1979; Conan 1982). These effects may be partly due to the mass mortalities of invertebrates that occurred at the time of the spill, which could have prompted flatfish to alter their diet by feeding on tolerant organisms occurring in abundance in the contaminated sediment (Friha and Conan 1981; Miossec 1981, 1982; Brule 1987). When oil reaches a confined, low-energy environment with high concentrations of particulate matter, as in the case of the *Amoco Cadiz* spill, favourable conditions exist for the concentration and sequestration of petroleum hydrocarbons. Owing to these conditions, the *Amoco Cadiz* spill zone remained contaminated for many years (Teal and Howarth 1984; Lee and Page 1997).

In many cases, the residual oil concentrations that are likely to cause long-term effects in fish are difficult to measure. One of the methods used to detect sublethal concentrations of oil in the environment involves measuring oil exposure biomarkers such as cytochrome P4501A (CYP1A) induction (Couillard 2009). These biomarkers can be used to determine whether an organism has come in contact with hydrocarbons that are bioavailable, that is, available in a form that can be assimilated by the organism (George et al. 1995). Biomarkers of this type have been detected in a number of fish species following oil spills; the responses varied in duration and intensity, but were generally limited to species that use the shallow littoral zone (George et al. 1995; Collier et al. 1996; Law and Kelly 2004; Sanchez et al. 2006).

In addition to measuring biomarkers, scientists can measure hydrocarbon concentrations directly in fish tissues, since concentrations are largely dependent on exposure duration. Law and Kelly (2004) compared levels of hydrocarbons in wild salmon flesh after the *Sea Empress* spill with the levels recorded in caged salmon following the *Braer* spill. The levels in wild salmon exposed to oil from the *Sea Empress* spill were more than 70 times lower than the levels found in caged salmon after the *Braer* spill. This finding can be explained by the fact that the wild salmon were able to avoid areas affected by high levels of petroleum hydrocarbons.

Impact on populations

It is difficult to assess the impacts of an oil spill on fish populations (Beyer et al. 2016). For example, following the *Exxon Valdez* spill, Barber et al. (1995) compared the effects on midlittoral fish populations from oil-impacted and reference sites. They found no significant differences in species diversity between the two site types. However, one year after the spill, the abundance of fish was lower at the oiled sites than at the reference sites. In contrast, Laur and Haldorson (1996) observed a significantly higher abundance of juvenile cod in eelgrass beds impacted by the *Exxon Valdez* spill. One of the hypotheses advanced to explain this finding is that young cod from outside the affected area may have been attracted to the eelgrass beds because of the availability of narcotized prey, which were easy to catch. In addition, following the *Deepwater Horizon*† spill, a study comparing oil-impacted and reference sites found no decrease in fish abundance or biodiversity (Fodrie and Heck 2011; Moody et al. 2013; Schaefer et al. 2016). An increase in catch per unit effort (CPUE) for all species combined was observed a year after the spill; the CPUE subsequently returned to a more normal level (Schaefer et al. 2016). The increase in CPUE could be attributable to fishery closures during the year of the spill (Fodrie and Heck 2011; Schaefer et al. 2016).

2.3.4. Marine mammals

As in the case of fish, it is difficult to provide a complete picture of the impacts on various marine mammal species, especially cetaceans. Despite the efforts made by a number of research teams following oil spills, it is very difficult to observe marine mammals in pelagic environments (Fair and Becker 2000), and the number of carcasses recovered is generally not representative of the actual number of oil-induced mortalities (Williams et al. 2011). It appears that, in general, marine mammals do not avoid oil slicks. They are therefore heavily exposed when a spill occurs in their habitat (Engelhardt 1983; Smith et al. 1983; Sorensen et al. 1984; Geraci and St. Aubin 1990; Smultea and Würsig 1995; Matkin et al. 2008; Ziccardi et al. 2015). Oil spills affect marine mammals through three different exposure pathways: exposure to toxic vapours, oiling, and ingestion.

Toxic vapours

The main threat to all marine mammals is the inhalation of toxic volatile compounds (Geraci and St. Aubin 1982, 1990; Neff 1990; Helm et al. 2015). These compounds can accumulate rapidly at the air-water interface and be inhaled in large quantities by cetaceans, which have a large lung capacity (Matkin et al. 2008; Ziccardi et al. 2015), and by pinnipeds, which spend much of their time at the surface (Peterson 2001). Inhalation of these toxic vapours can cause inflammation of the mucous membranes and lung problems, as well as increase the risk of developing bacterial or viral diseases such as pneumonia. The lungs also provide a route for toxic compounds to enter the bloodstream and affect the central nervous system (Geraci and St. Aubin 1982; Schwacke et al. 2014; Ziccardi et al. 2015). High concentrations of these compounds can accumulate in blood and tissues, causing liver damage and neurological disorders that can lead to death (Fair and Becker 2000; Helm et al. 2015). Winter ice cover also increases impact severity, as the oil concentrates in ice-free areas where marine mammals come to the surface to breathe (Engelhardt 1983). Prolonged exposure to toxic fumes from oil can also cause permanent eye damage, especially in seals. The severity of such lesions is directly related to the duration of exposure and the concentration of volatile compounds, which can cause severe irritation (Geraci and Smith 1976; St. Aubin 1988).

Not long after the *Exxon Valdez* oil spill, several hundred seals died as a result of the inhalation of toxic fumes, which caused brain lesions, stress and disorientation (Peterson 2001; Peterson et al. 2003). Stress alone can lead to mortality in pinnipeds. Severe stress can cause adrenal insufficiency leading to disorientation and death, even in individuals not directly exposed to the toxic compounds in oil (Geraci and Smith 1976). Following the *Deepwater Horizon* spill, mortalities of common bottlenose dolphins due to adrenal insufficiency were reported; the deaths were believed to be directly related to exposure to petroleum (Schwacke et al. 2014).

Oiling

Direct contact with oil can cause irritation of sensitive tissues such as eyes and mucous membranes, especially in pinnipeds (Ziccardi et al. 2015). Oiling caused by the heavy compounds in fuel oil such as Bunker C (oil mainly composed of heavy hydrocarbon fractions) can weigh down a seal, even an adult, and make swimming so difficult that the seal will drown from exhaustion (Warner 1969 in Engelhardt 1983). Oiling can also prevent juveniles from swimming by causing their flippers to stick to the sides of their bodies (Davis and Anderson 1976). Less critically, oiling can impede the animals' movements on land and in the water, change their feeding behaviour (Ziccardi et al. 2015) and alter mother-pup interactions (Geraci and St. Aubin 1990).

Oil fouling is not known to cause thermoregulatory problems in seals as it does in other furbearers. For insulation, seals rely on their thick layer of subcutaneous fat rather than their pelage (Ziccardi et al. 2015). Oiling may be more harmful to very young animals that have not yet developed enough fat (Geraci and Smith 1976; Engelhardt 1983). Since oil does not appear to adhere to cetaceans' thick, smooth skin, dermal contact is not reported to be a major absorption route (Helm et al. 2015).

Ingestion

In mammals, damage caused by the ingestion of oil may include anaemia, immune problems, gastrointestinal damage, liver and kidney necrosis, and reproductive organ and adrenal gland dysfunctions. The impacts on marine mammals are difficult to predict and depend mainly on the type of oil ingested, as well as on the physiological condition and natural history of the affected animals (Ziccardi et al. 2015). Oil is ingested mainly through the consumption of contaminated prey. Since seals do not lick or bite their own fur, or that of their young in order to clean them, grooming is an unlikely route of oil ingestion (McLaren 1990). Baleen whales are more likely to ingest oil than other cetaceans because of their feeding habits. Oil is likely to temporarily clog their baleen plates and then be ingested with prey (Gaskin 1982).

Delayed mortality is also likely to occur in marine mammals, and was observed in killer whales during the 18-month period following the *Exxon Valdez* spill. This type of mortality is believed to be caused by the consumption of contaminated prey and by diseases resulting from the inhalation of toxic compounds (Matkin et al. 2008). Similarly, after the explosion of the *Deepwater Horizon* drilling platform, significant bottlenose dolphin mortality was observed during the acute phase of the spill. Spring mortality of premature, newborn and stillborn dolphins was also documented up to five years after the event (NOAA 2016a).

Impacts on social groups

Matkin et al. (2008) assessed the impacts of the *Exxon Valdez* spill on two socially and genetically isolated West Coast killer whale populations: a resident (coastal) population and a transient population. In the year after the spill, the two pods suffered losses of 33% and 41%, respectively; at the time of the study, their numbers had not yet recovered to the pre-spill level (Matkin et al. 2008; NOAA 2016b). This study on killer whales showed that the mortality of key individuals within a clan (adult females in this case) can be a devastating event for a small population. In addition to causing individual mortality, oil spills can disrupt the organization and cohesion of social groups, to the extent that their reproductive success is affected (Würsig 1990).

2.3.5. Early life stages of invertebrates and fish

The early life stages of invertebrates and fish (eggs and larvae) are extremely vulnerable to spills, since they have little or no capacity for movement and their toxicological sensitivity is generally much greater than that of juveniles and adults (Rice et al. 1983; Suchanek 1993; Hughes 1999; NRC 2003; Lee et al. 2015). Their small size, less developed metabolic capacity and greater cell permeability may explain this greater sensitivity (Georges-Ares and Clark 2000).

In pelagic environments, early life stages can remain in the top few metres of the water column for periods ranging from a few days to a few months; the presence of pelagic eggs and larvae there is dependent on surface currents and the existence of retention areas (Ouellet 2007; Couillard et al. 2017). The trajectory of an oil slick typically follows the same path as eggs and larvae, which are therefore affected by prolonged exposure (Fodrie and Heck 2011). For example, after the *Exxon Valdez* spill, herring larvae presenting reduced growth rates, deformities and genetic damage were collected from the areas through which the oil slicks moved (Norcross et al. 1996).

Benthic stages are exposed to oil as a result of their interaction with sediment and the persistence of the oil. Eggs and larvae can therefore be affected regardless of whether the habitat becomes contaminated before or after spawning. This habitat contamination can lead to significant embryo and larval mortality, and may affect a given year-class and recruitment to the population (Heintz et al. 1999). For example, following the *North Cape* oil spill, the survival of winter flounder embryos (to the larval stage) collected from salt ponds in the spill area decreased by 51% compared to the survival of embryos raised under laboratory-controlled conditions (Hughes 1999).

3. VULNERABILITY ASSESSMENT

Section 2, which discusses oil behaviour, toxicity and effects, describes situations that increase the vulnerability of aquatic organisms. The current section presents a criteria-based assessment of the vulnerability of various biological components of the St. Lawrence to ship-source oil spills.

3.1. LIMITATIONS

Given the complexity of this topic, the specific limitations of this assessment of the vulnerability of the biological components of the St. Lawrence ARP have been identified:

- It is a semi-quantitative analysis;
- It is limited to the context of ship-source oil spills and excludes incidents related to pipelines and oil and gas exploration and development;
- It considers all types of petroleum hydrocarbons, regardless of their specific differences, and does not cover other hazardous products;
- It is limited to the direct effects of oil on biological components and excludes indirect effects such as the transfer of contaminants to the food chain;
- It is limited to estuarine and marine species that fall under DFO's jurisdiction and to diadromous† species occurring in the study area, and therefore excludes birds and freshwater species;
- It is limited to juvenile and adult stages. Early life stages (eggs and larvae) of all species are all considered a vulnerable component to be prioritized in the event of an oil spill;
- It does not assess the sensitivity of taxa to hydrocarbons.

3.2. METHODOLOGY

3.2.1. Study area

The pilot area for the St. Lawrence Area Response Plan (ARP) extends from the Montreal area eastward to a line drawn between the tip of the Gaspé Peninsula (on the south shore of the St. Lawrence) and the Mingan Archipelago (on the north shore), and includes the western part of Anticosti Island.

To meet the objective of this assessment while respecting its limitations, a smaller study area was defined within the St. Lawrence ARP pilot area (Figure 5). From upstream to downstream, this area extends more than 600 km from the upper and lower estuaries to a portion of the northwestern Gulf. It excludes all the tributaries of the St. Lawrence. In the coastal zone, the study area is delineated by the higher high water large tide (HHWLT),† which includes the midlittoral zone† and excludes the supralittoral zone.†

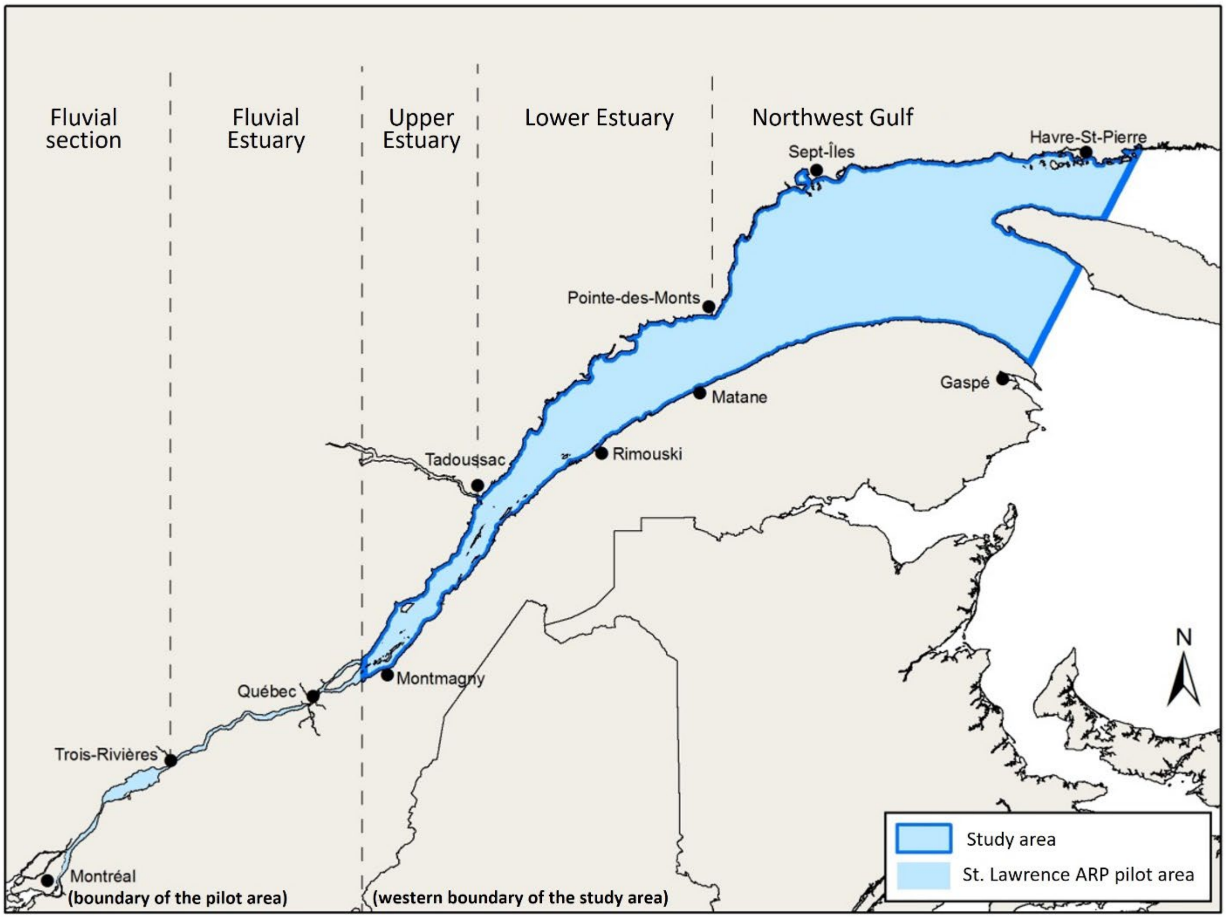

Figure 5. St. Lawrence ARP pilot area and study area

3.2.2. Vulnerability assessment method

The assessment uses the concept of vulnerability developed by De Lange et al. (2010). It considers the potential for exposure to a stressor, sensitivity or the impacts likely to result from exposure, and the affected population's level of resilience (see sections 2.1.5 and 2.2).

Table 1. Exposure potential criteria

Littoral zone use	
Question	Does the taxon use the littoral zone?
Rationale	In the event that an oil slick reaches the shore, the littoral zone is more at risk of oiling and contamination by dissolved toxic compounds.
Benchmark	The littoral zone extends, along the coast, from the high water mark[†] to a maximum depth of 10 metres below chart datum[†].
Scoring	The taxon receives a score of 1 if it uses the littoral zone on a recurring or permanent basis.
Sea surface interacting	
Question	Is the taxon dependent on the surface water layer or does it interact with it on a regular basis?
Rationale	During an oil spill, the surface layer is the first point of contact between the oil and the aquatic environment.
Benchmark	The surface layer includes the air-water interface, the first metre of the water column and the midlittoral zone.
Scoring	The taxon is assigned a score of 1 if it interacts with the surface layer on a regular basis.
Limited capacity for movement	
Question	Is the taxon sessile[†] or does it have a limited capacity for movement?
Rationale	A taxon with a limited capacity for movement is more likely to be exposed to oil than one with the ability to move away from the spill.
Benchmark	Movement capacity is considered limited when it is less than 50 km in a 48-hour period.
Scoring	The taxon is assigned a score of 1 if it is sessile or has a limited capacity for movement.
Aggregation potential	
Question	Do the individuals of the taxon have aggregation potential or are they gregarious[†]?
Rationale	A spill is more likely to affect a large number of individuals of a given taxon if they aggregate in one location.
Benchmark	The individuals of the taxon usually gather in a specific habitat that is the same size as, or smaller than, a bay, or they aggregate in order to perform a specific life cycle activity or due to their gregariousness.
Scoring	The taxon is assigned a score of 1 if it has aggregation potential.

Table 2. Resilience criteria

Population status	
Question	Does the species or any of its populations have official conservation status?
Rationale	An oil spill would increase the level of stress already experienced by a weakened species or population.
Benchmark	The status of the species or population must have been assessed by a competent international (IUCN†; Near Threatened, Vulnerable, Endangered), federal (COSEWIC†; Special Concern, Threatened, Endangered) or provincial (LEMV†; Vulnerable, Threatened) authority.
Scoring	A species is assigned a score of 1 if one of its populations occurring in the study area has official conservation status. The species is assigned a score of 1* if it is identified as vulnerable or imperiled by the Canadian Endangered Species Conservation Council (CESCC† 2016) but has not yet been assessed by COSEWIC. The species is assigned a score of 1’ (precautionary principle) if it has not been assessed.
Low recolonization potential	
Question	Does the taxon have low recolonization potential?
Rationale	Following an oil spill, a taxon with low recolonization potential will take longer to re-establish itself in its original range than one with high recolonization potential.
Benchmark	Recolonization potential is defined by dispersal† and/or geographic isolation.
Scoring	A taxon is assigned a score of 1 if it has low recolonization potential.
Low reproductive capacity	
Question	Does the taxon have low reproductive capacity?
Rationale	Following an oil spill, a taxon with low reproductive capacity will take longer to recover to its original population level than a taxon with high reproductive capacity.
Benchmark	A taxon’s reproductive capacity is based on parental care†, fecundity† and mode of reproduction†.
Scoring	The taxon is assigned a score of 1 if it has low reproductive capacity.
Association with sediment	
Question	Does the taxon have a close association with sediment†?
Rationale	A close association with sediment predisposes the taxon to chronic exposure to persistent hydrocarbons.
Benchmark	A close association with sediment involves reworking of sediment†.
Scoring	A taxon is assigned a score of 1 if it has a close association with sediment.

The species' relative sensitivity to oil was not measured in this assessment. Challenges include significant knowledge gaps in this area and a lack of uniformity in the protocols used to determine toxicity thresholds. In many cases, knowledge gaps and lack of uniformity prevent comparison between different studies. The complexity of the topic is also an issue. The sensitivity of aquatic organisms to oil is difficult to translate into a binary rating. It is recognized that sensitivity varies according to multiple species-specific physiological factors and according to the type of oil spilled (Lewis and Pryor 2013; Dupuis and Ucan-Marin 2015).

The vulnerability assessment was therefore conducted using two categories of criteria for assessing exposure potential and resilience. The assumption that all species are sensitive to oil was considered valid for this analysis.

Four groups of organisms, or components, were assessed: marine and estuarine algae and plants; marine and estuarine invertebrates; marine, estuarine and diadromous fish; and marine mammals. For each component, a list of taxa was compiled from bibliographic references and validated by experts in order to cover the vast majority of taxonomic groups occurring in the study area at some point in the year. Taxa were classified into various groups on the basis of taxonomy, lifestyle and/or vertical zonation. Commercial species are identified by a "C" ([C]). All the scientific names of the listed taxa (taxonomic hierarchy, genus and species) were updated based on the World Register of Marine Species [WoRMS] (2016). Parasites were excluded.

Table 1 shows the four criteria used to assess the exposure potential of the taxa and Table 2 shows the four criteria used to assess their resilience. The criteria were formulated on the basis of knowledge of oil spill behaviour in aquatic environments and knowledge of the lifestyles of the taxa. These criteria are generic enough to be applied consistently across all components. Each box in the tables contains the name of the criterion; the question to be asked and answered in relation to the criterion; a brief rationale for the choice of the criterion; benchmarks for scoring; and, finally, a brief explanation of what a score of 1 means. Keywords marked with a cross ([†]) are defined in the glossary in Appendix 1.

3.2.3. Choice of taxa and classification groups

Marine and estuarine algae and plants

This component consists of 54 taxa groups encompassing 152 species of benthic algae, 3 species of plants, and phytoplankton. Despite its high level of species diversity, phytoplankton was treated as a single group of pelagic protists. Benthic protists were not included in the assessment.

The list of benthic algae includes all of the species in the study area noted by Couillard et al. (1973) and by Cardinal (1990). Taxa affected by taxonomic ambiguity, either indicated by these authors or cited in WoRMS (2016), were excluded. Only three plant species were retained—common three-square bulrush, smooth cordgrass and common eelgrass. These species, which are typical of the study area, grow in aquatic grass beds or marshes and colonize the midlittoral and infralittoral zones (Mousseau et al. 1998; Chabot and Rossignol 2003).

Algae taxa were assigned to groups based on five characteristics: (1) vertical zonation; (2) distribution; (3) growth type; (4) taxonomic division; and (5) form and shape of the thallus. Some groups were further subdivided to differentiate species that form aggregations. Plants were divided into two groups on the basis of the vertical zone occupied (i.e. vertical zonation).

Vertical zonation was used to distinguish between taxa that colonize the intertidal zone to depths of one metre below the low-tide mark (midlittoral/ infralittoral) and taxa that are never exposed (infralittoral). Species that occupy the entire littoral zone (e.g. *Saccharina longicruris*) were classified in the zone where they are at the greatest risk should a spill occur—i.e. the midlittoral/ infralittoral zone. This classification by zone was based on a review of the literature.

The distribution of a taxon in the study area (wide or limited distribution) makes it possible to identify species with low recolonization potential in the event of a spill. This information is drawn from Couillard et al. (1973), South and Tittley (1986) and Cardinal (1990).

Growth type is divided into two classes: (1) fast-growing annual and/or opportunistic species; and (2) slow-growing perennial species. The first class includes all species that complete their entire life cycle in one year or less. It also includes some perennial species (i.e. with a life cycle lasting more than one year) that behave like annual species, in that they have the ability to rapidly colonize disturbed environments (e.g. *Fucus vesiculosus*). The second class includes species whose blades, holdfasts or roots persist from one year to the next and whose growth is much slower than the representatives of the first class. Classification was based on a literature review.

Taxonomic division refers to the three main divisions commonly used in phycology: green algae (Chlorophyceae), red algae (Rhodophyta, formerly Rhodophyceae) and brown algae [Phaeophyceae] (Cardinal 1990).

Lastly, form and shape of the thallus was used to classify algae to reflect their functional group (adapted from Wells 2002 and Littler et al. 1983). To some extent, the physical characteristics of the thallus make it possible to infer an algal species' lifestyle and ecosystem role. This classification took account of species' visible morphological characteristics, as well as information drawn from the literature (Leclerc 1987; Chabot and Rossignol 2003; Wilkinson and Wood 2003).

Marine and estuarine invertebrates

The list of taxa in the marine and estuarine invertebrates component was based on the *Catalogue of the Marine Invertebrates of the Estuary and Gulf of Saint Lawrence* (Brunel et al. 1998), supplemented with a list compiled under the Atlantic Zone Monitoring Program (AZMP), as well as information from Mark et al. (2010), Savard and Nozères (2012) and Bourdages et al. (2012, 2017).

Since this resulted in a very long list (1,174 taxa, see Appendix 6), taxa were categorized according to four criteria: (1) phylum; (2) class; (3) order; and (4) vertical zonation. Some groups were subdivided based on their adherence to the criteria, resulting in 181 taxa groups.

The taxa were assigned to the zones of the aquatic province they occupy (pelagic or benthic province) based on the information in Brunel et al. (1998). The pelagic province includes the upper epipelagic zone [UEP] (depths of 0–40 m); the glacial epipelagic zone [GEP] (depths of 40–200 m); and the mesopelagic zone [MP] (depths of 200–500 m). The benthic province includes the midlittoral (M) and infralittoral (I) zones (depths of 0–20 m), the circalittoral zone [C] (depths of 20–200 m), and the bathyal zone [B] (depths of 200–500 m), the last two of which were combined (CB). Since invertebrates typically occur in several zones, taxa were classified according to the upper limit of their vertical zonation. This limit was then validated—or in the case of taxa that are not covered in Brunel et al. (1998), determined—by using reference works and the scientific literature, whenever possible.

Some groups were split into sub-groups when their members' responses to the criteria differed. A few examples of taxa representing each group or subgroup were selected.

The name of each group corresponds to one of the species that is representative of the group or of the classification level. All commercial species occurring in the study area were included in the examples of representative taxa.

Marine, estuarine and diadromous fish

The vulnerability assessment addresses 75 marine, estuarine and diadromous fish taxa. The list of species in this component was taken from the Northern Gulf of St. Lawrence Fishes database compiled by Dutil et al. (2015). This database, available on the Ocean Biodiversity Information System (OBIS) website (OBIS 2017), was queried to extract all documented fish occurrences in the study area. Freshwater species and species for which documented occurrences are rare and exclusively located at depths greater than 300 m were excluded. Similarly, species—although widely distributed in the Gulf of St. Lawrence—that were caught less than five times in the study area were not considered. Finally, a few taxonomically ambiguous species (according to experts) were eliminated. The result was a list of 82 fish species. All species were assessed individually, except snailfishes of the genus *Paraliparis* and eelpouts of the genera *Lycenchelys* and *Lycodes*. In the last two cases, the various species were grouped together owing to knowledge gaps regarding their biology. These 75 taxa were divided into three broad groups based on their lifestyle (diadromous, pelagic or demersal), with demersal fish making up the largest group, containing 46 taxa (61%), and pelagic and diadromous fish, 13 (17%) and 16 (21%) taxa, respectively.

Marine mammals

The marine mammals component consists of 13 species that occur in the study area (Lesage et al. 2007; Richard Sears, Mingan Island Cetacean Study, pers. comm.). These species were classified at two different taxonomic levels. They can first be divided into two infraorders: Cetacea (cetaceans) and Pinnipedia (pinnipeds). Cetacea can then be further divided into two superfamilies—Mysticeti (baleen whales) and Odontoceti (toothed whales). All pinnipeds in eastern North America belong to a single family, the Phocidae (seals). All the species were assessed individually against the different criteria.

3.2.4. Scoring of criteria and assessment of uncertainty

Scores for each of the eight criteria were determined for each taxon based on a literature review and input from experts (Appendix 3). To receive a score of 1, a taxon had to meet the criterion being assessed at least one time of the year when it is present in the study area.

The results for each component are presented in separate assessment tables for the exposure potential criteria and resilience criteria (Appendix 5). A few supporting references for the scoring of each taxon against each criterion were selected from the literature consulted; they are provided in the “Source” column of the tables. Although some sources are very specific, most are general works that were used to ensure consistency in scoring.

In order to identify knowledge gaps and assess the uncertainty surrounding the scoring, the following rules were observed in the scoring of criteria. A score of 1 or 0 was given when sufficient information was available on the taxon to make an informed decision, whether that information originated from Quebec or elsewhere in the world. When information gaps prevented scoring, the score was considered uncertain and this was characterized using different symbols. When the information available was incomplete, or was specific but concerned a higher taxonomic level (e.g. family), a score of 0* or 1* was given. When no information was available, the precautionary principle was applied and a score of 1’ was awarded. These various types of uncertainty were taken into account for each component.

3.2.5. Presentation of results

Once the vulnerability assessment tables were completed, the taxa or taxa groups were placed in vulnerability matrices based on the total score obtained for each of the two categories of criteria: resilience and exposure potential. The position of a taxa group in the matrix indicates its level of vulnerability (high, medium, low, very low), as shown in the model presented in Figure 6. It should be noted that the resilience scale is an inverse one: the greater the number of resilience criteria met, the lower the resilience.

To simplify the presentation of results, each matrix only shows the taxa groups receiving a score of 1, 1* or 1' (i.e. a positive score) for at least one exposure potential criterion and one resilience criterion. Taxa groups with high, medium and low vulnerability are listed in the red, orange and yellow boxes, respectively. The taxa groups not shown are considered to have very low vulnerability (grey portion of the matrix).

The figures in table form that follow the matrices provide a more detailed picture of the results for each criterion (positive scores) for each taxa or group of taxa considered.

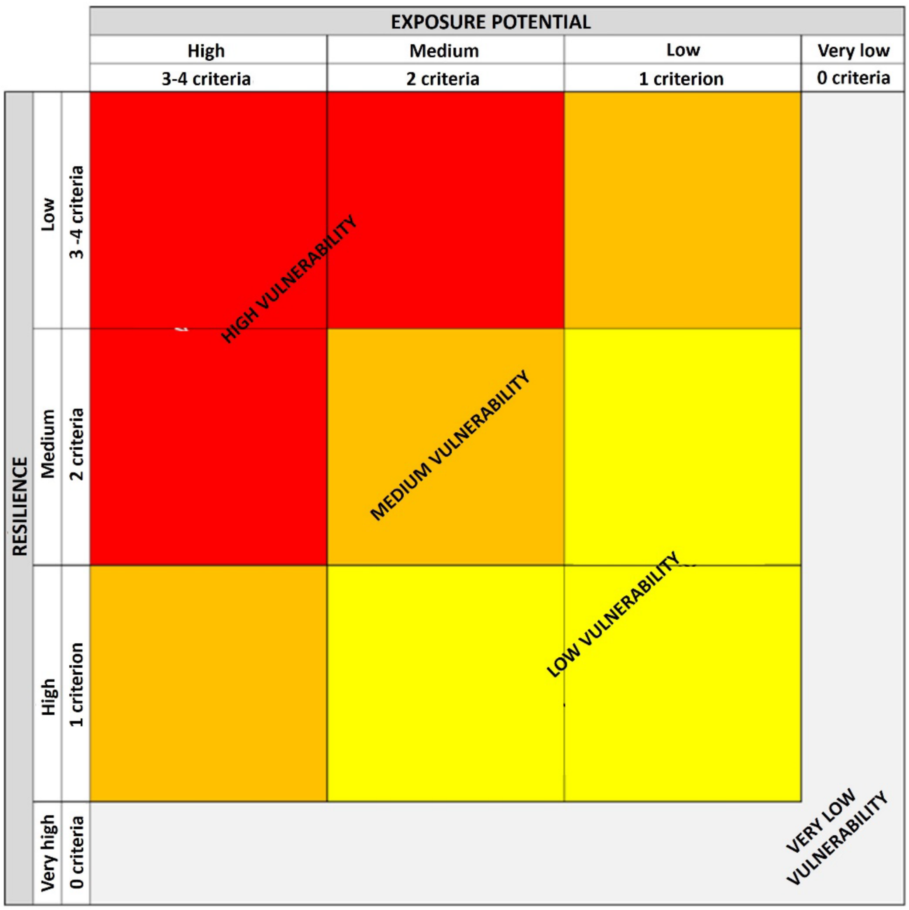

Figure 6. Vulnerability matrix model

3.3. RESULTS

3.3.1. Marine and estuarine algae and plants

Exposure potential

The assessment of the exposure potential of the various taxa in the marine and estuarine algae and plants component is presented in Appendix 5.1.1.

Littoral zone use

Although some red algae can live at greater depths, all (100%) benthic algae and plants in the study area were considered likely to occur in the littoral zone at depths of less than 10 m, and therefore received a score of 1 for this criterion. Phytoplankton are not limited to the inshore environment and occupy the entire photic zone†, therefore receiving a score of 0 for this criterion.

Sea surface interacting

Thirty-nine (39) out of 54 taxa groups (72%) received a score of 1 for the criterion of interaction with the surface water layer. Taxa that occur in the midlittoral zone or in the first metre below the surface in the infralittoral zone (identified as M/I) periodically come into contact with the surface, specifically during each tidal cycle, and were given a score of 1. Phytoplankton periodically reach the surface in their diel migrations.† Common eelgrass also received a score of 1 due to the length of its foliage. It is an infralittoral plant whose roots are never exposed but whose foliage regularly reaches the surface at low tide. Conversely, benthic algae occurring exclusively in the infralittoral zone (identified as I) in habitat below one metre deep generally do not come in contact with the surface and received a score of 0.

Limited capacity for movement

All taxa (100%) in this component received a score of 1 because they are sessile or not very mobile (phytoplankton).

Aggregation potential

Nine (9) out of 54 taxa groups (17%) obtained a score of 1 for aggregation potential, because the species making up the group either form dense aggregations (e.g. *Ascophyllum nodosum*, phytoplankton) or are gregarious† (e.g. *Petalonia fascia*). The three plant species aggregate in marshes or in underwater grass beds. The other taxa groups received a score of 0, because there is no reference to their gregariousness or aggregation potential in the literature.

Resilience

The assessment of the resilience of the taxa in the marine and estuarine algae and plants component is presented in Appendix 5.1.2.

Population status

Although 52 out of 54 taxa groups (96%) meet the population status criterion, significant uncertainty surrounds this assessment since a formal population status assessment has not been conducted for any algal species. Consequently, the precautionary principle was applied for the 52 algae taxa (including phytoplankton), and they were given a score of 1’. This is a significant knowledge gap. Plants, on the other hand, received a score of 0 because they are considered secure by the CESCC (2016).

Low recolonization potential

Twenty-one (21) out of 54 taxa groups (39%) received a score of 1 for low recolonization potential. The fulfillment of this criterion was assessed indirectly based on a taxon’s distribution, which provides an indication of its degree of geographic isolation. The occurrence of a taxon at a single sampling site in the study area, based on the studies by Couillard et al. (1973) or Cardinal (1990), was considered a limited distribution. A score of 1* was given to 20 taxa groups. Relatively widespread taxa received a score of 0, except for common eelgrass, which, despite its wide distribution, has been documented to have low recolonization potential.

Low reproductive capacity

No taxa (0%) in this component received a score of 1 for low reproductive capacity, due to their diverse reproductive strategies (asexual and sexual reproduction, fragmentation, etc.), which allow them to adapt to various environmental vicissitudes, and because of the large number of propagules and spores that they usually produce. However, red algae obtained a score of 0*, because little is known about reproduction in this group, and some uncertainty is involved. The reproductive strategies of red algae, such as the gametophytes nourishing the sporophytes (which, according to some authors, could be likened to parental care) differ from those of brown algae and green algae. Overall, their reproductive capacity appears to be good.

Association with sediment

Only 2 out of 54 taxa groups (4%) received a score of 1 for association with sediment, consisting of plants that root in soft sediments.

Vulnerability and fulfillment of the criteria

Figure 7 shows the level of vulnerability of marine and estuarine algae and plants to ship-source spills.

This matrix differentiates between phytoplankton, the two plant groups and the six major algae groups. Each of these had similar responses to the criteria and their taxa were grouped together to facilitate the interpretation of the results. These broad groupings are made up of varying numbers of taxa groups: widely distributed, non-aggregated algae (18 groups) (M/I); widely distributed, aggregated algae [4 groups] (M/I); limited-distribution, non-aggregated algae [14 groups] (M/I); widely distributed, non-aggregated algae [7 groups] (I); widely distributed, aggregated algae [2 groups] (I); and, finally, limited-distribution, non-aggregated algae [6 groups] (I).

These nine groups (six algae, two plants and one phytoplankton) are shown according to their level of vulnerability (high, medium and low). The most vulnerable taxa are common eelgrass (I) and the limited-distribution, non-aggregated algae (M/I) group, which together account for 28% of the taxa groups analyzed (15 out of 54).

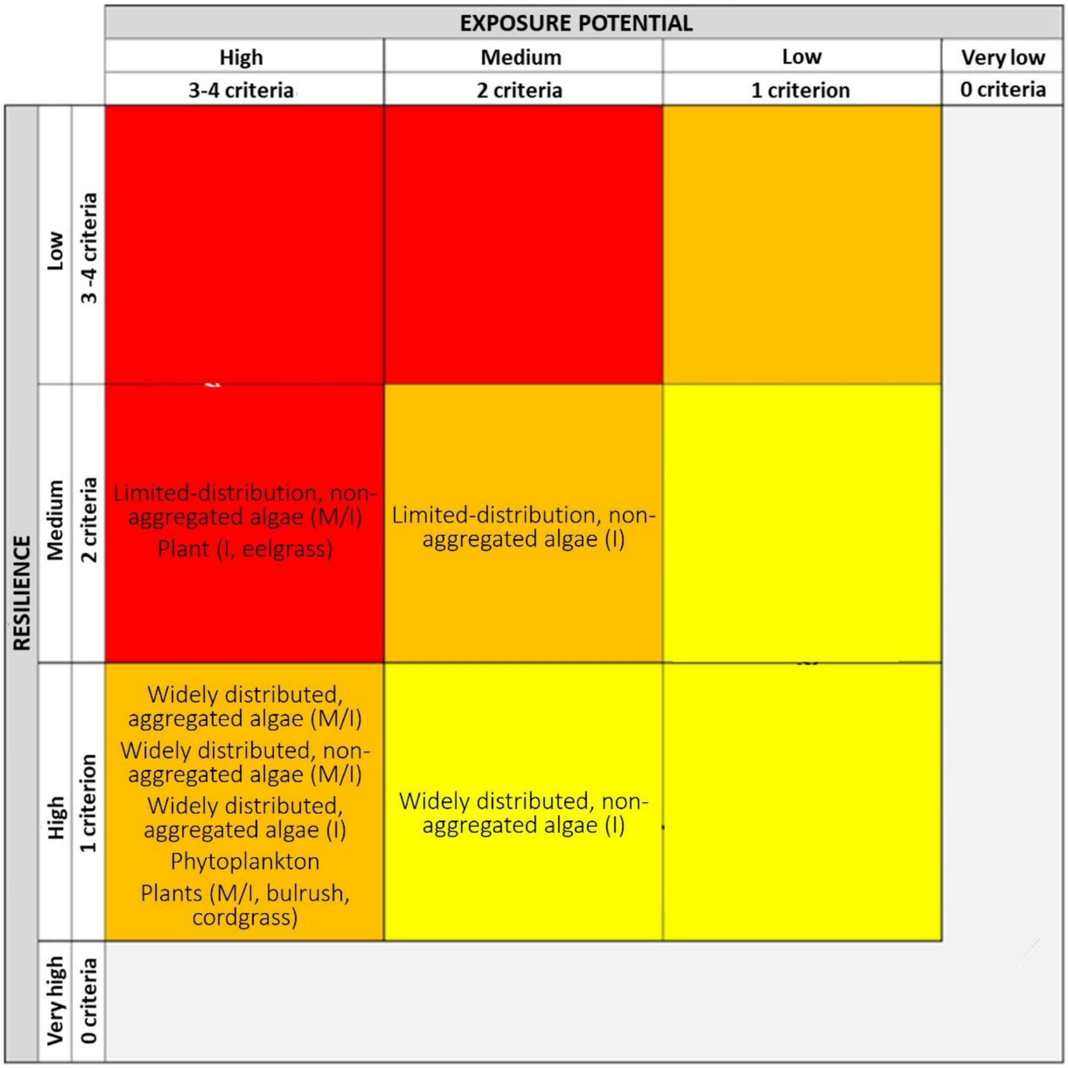

Figure 7. Vulnerability matrix for the marine and estuarine algae and plants component (M = Midlittoral zone; I = Infralittoral zone).

Figure 8 shows the results of the assessment against the criteria for the various taxa groups. The positioning of the taxa groups in the matrix shows that, for this component, exposure potential is a more important factor in their vulnerability (2 to 4 criteria) than their level of resilience (1 or 2 criteria). With respect to exposure potential, all taxa in the component are vulnerable due to their use of the littoral zone and their limited movement capacity. In the case of resilience, the population status criterion is dominant but involves significant uncertainty. The criteria that can be used to distinguish the groups include sea surface interacting (M/I vs. I); aggregation potential (aggregated vs. non-aggregated); low recolonization potential (wide vs. limited distribution) and association with sediment (only results in vulnerability in the plants).

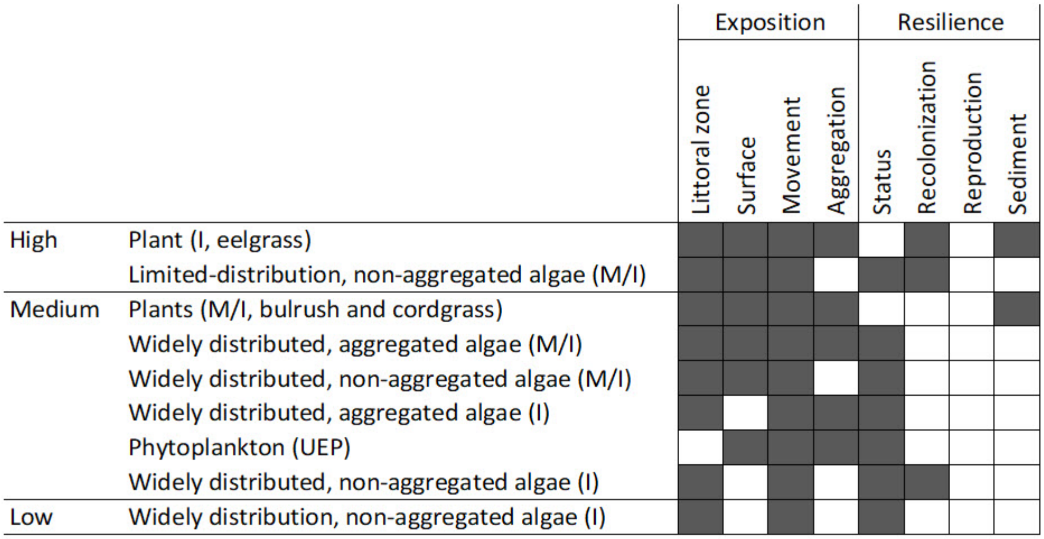

Figure 8. Positive scores for the exposure potential and resilience criteria for marine and estuarine algae and plants groups with high, medium and low vulnerability (M = Midlittoral zone; I = Infralittoral zone; UEP = upper epipelagic zone).

Uncertainty

The marine and estuarine algae and plants component was associated with an uncertainty level of 20.1% (Table 3). This was calculated by summing all the types of uncertainty found in the 432 boxes containing a score for each of the eight criteria for the 54 taxa groups assessed. This result is mainly explained by the resilience criteria category, which accounts for nearly 40% of the uncertainty, or 86 out of 216 scores. Owing to the lack of information on the population status of algae, the precautionary principle (1') was applied; as a result, this criterion alone accounted for 52 out of the 216 (24%) scores. The assessment of the recolonization potential (20 scores out of 216) and reproductive capacity (14 scores out of 216) of benthic algae also involved a significant measure of uncertainty (1* or 0* score). The assessment of the exposure potential criteria contributed very little to the overall uncertainty (0.5%; 1 score out of 216).

Table 3. Uncertainty (%) associated with the scores for taxa groups (number of taxa groups receiving score out of the total number of scores) in the marine and estuarine algae and plants component by criterion

	% of Uncertainty Type (Number of Scores out of the Total)			
Criterion	0*	1*	1’	Total
Littoral zone use	-	-	-	-
Sea surface interacting	-	-	-	-
Limited capacity for movement	-	-	-	-
Aggregation potential	1.9 (1/54)	-	-	1.9 (1/54)
Total, exposure potential category	0.5 (1/216)	-	-	0.5 (1/216)
Population status	-	-	96.3 (52/54)	96.3 (52/54)
Low recolonization potential	-	37.0 (20/54)	-	37.0 (20/54)
Low reproductive capacity	25.9 (14/54)	-	-	25.9 (14/54)
Association with sediment	-	-	-	-
Total, resilience category	25.9 (14/216)	37.0 (20/216)	96.3 (52/216)	39.8 (86/216)
Total	3.5 (15/432)	4.6 (20/432)	12.0 (52/432)	20.1 (87/432)

3.3.2. Marine and estuarine invertebrates

Preliminary notes on the presentation of results and on uncertainty

To facilitate the analysis and simplify the presentation of results, the 181 taxa groups, which include 372 examples of taxa, were separated into six phyla or groups of phyla:

1) Porifera, Cnidaria and Ctenophora, composed of 26 taxa groups and including 78 representative taxa;
2) The Vermiform Phyla group, consisting of nine phyla—Xenacoelomorpha, Platyhelminthes, Nemertea, Cephalorhyncha, Nematoda, Phoronida, Annelida, Sipuncula) and Hemichordata—29 taxa groups, and 326 representative taxa;
3) Mollusca, composed of 42 taxa groups and including 197 representative taxa;
4) Arthropoda, composed of 53 taxa groups and including 460 representative taxa;
5) Echinodermata, composed of 18 taxa groups and including 39 representative taxa; and,
6) The Other Phyla group, consisting of five phyla—Entoprocta, Bryozoa, Brachiopoda, Chaetognatha and Chordata—and 13 taxa groups, and including 74 representative taxa.

Our knowledge of the ecology and biology of invertebrate species in the St. Lawrence has many gaps. Consequently, the assessment captures only a portion of the diversity of responses by taxa to the criteria, which is reflected in the division of taxa into sub-groups. In addition, out of the 1,174 taxa identified, only a few examples are presented. To provide a more representative picture of the actual number of species recorded, the number of species was included in the "Order" column of the vulnerability assessment tables, for each of the invertebrate phyla and classes (Appendix 5.2). Finally, not all phyla were systematically reviewed by experts, although the vast majority of the taxa in the Mollusca, Arthropoda and Echinodermata phyla and the Other Phyla group were reviewed.

Exposure potential

The assessment of the exposure potential of the taxa in the marine and estuarine invertebrates component is presented by phylum or phyla group in the Exposure Potential subsection of appendices 5.2.1 (Porifera, Cnidaria and Ctenophora), 5.2.2 (Vermiform Phyla), 5.2.3 (Mollusca), 5.2.4 (Arthropoda), 5.2.5 (Echinodermata) and 5.2.6 (Other Phyla).

Littoral zone use

Among the 181 taxa groups, 127 groups (70%), all consisting of benthic invertebrates associated with the midlittoral zone or neritic zone†, received a score of 1 for the littoral zone use criteria. Ten of the scores (6%) for this criterion were uncertain (1* or 0*). In most cases (5% of the 6%), the uncertainty was associated with a group of pelagic taxa (UEP or GEP) that use the littoral zone to complete a life-cycle activity. Taxa groups with exposure potential based on this criterion include 58% of Porifera, Cnidaria and Ctenophora (15% uncertainty), 83% of Vermiform Phyla (3% uncertainty), 79% of Mollusca (no uncertainty), 60% of Arthropoda (9% uncertainty), 78% of Echinodermata (no uncertainty) and 69% of Other Phyla (no uncertainty).

Sea surface interacting

Among the 181 taxa groups, 67 (37%) received a score of 1 for sea surface interacting. Eight (8) of the scores (4%) for this criterion were uncertain (1* or 0*). All benthic invertebrates inhabiting the midlittoral zone and all invertebrates inhabiting the upper epipelagic zone (0–40 m) considered to occur at the surface based on at least one mention in the literature received a score of 1. Some species inhabiting the glacial epipelagic zone (40–200 m) also received positive scores (1 and 1* respectively)—specifically, merchant-cap [GEP] (*Periphylla periphylla*, a scyphozoan) and the oceanic ctenophore *Mertensia ovum* (GEP)—due to the fact that, although they are usually found at greater depths, they undertake diel migrations or reproduce at the surface. The medusa stage of the hydroid *Tubularia regalis* (CB) also occurs at the surface, although the polyp stage lives at significant depths. Lastly, the epitoke† of the benthic polychaetes *Alitta*, *Eteone* and *Glycera* (M/I) reproduce at the surface. Most of the uncertain scores (3.5% of 4%) were associated with pelagic taxa (UEP or GEP). According to this criterion, exposure potential is found in 50% of Porifera, Cnidaria and Ctenophora (12% uncertainty), 38% of Vermiform Phyla (3% uncertainty), 31% of Mollusca (no uncertainty), 34% of Arthropoda (6% uncertainty), 33% of Echinodermata (no uncertainty) and 46% of Other Phyla (8% uncertainty).

Limited capacity for movement

A total of 180 out of 181 taxa groups (99.4%) obtained a score of 1 for this criterion. None of the scores were associated with uncertainty. All the benthic and pelagic invertebrates have a limited capacity for movement and received a score of 1, except for one Arthropoda group, represented by the hemipteran insect *Trichocorixa verticalis,* which is able to fly. These organisms all share at least one of the following characteristics: (1) they are sessile (e.g. sponges, anemones, bryozoans, tunicates); (2) they are very small (e.g. nematodes, oligochaetes, copepods, amphipods); (3) they have limited capacity for movement (e.g. *Lucernaria*, ctenophores, most molluscs, echinoderms); or (4) they are fairly mobile, but only over short distances (e.g. euphausiids, striped and northern shrimp, lobster, snow crab).

Aggregation potential

Among the 181 taxa groups, 152 (84%) obtained a score of 1 for aggregation potential, with 140 (77%) of the scores for this criterion associated with uncertainty (score of 1*, 0* or 1'). A score of 1 was awarded when the taxa in a group (1) have an aggregated distribution (e.g. sponge, sea pen, striped and northern shrimp, basket star, daisy brittle star, and the brittle star *Stegophiura nodosa*); (2) form blooms (e.g. *Lucernaria*, jellyfish, ctenophore) or aggregate during the juvenile settlement period (e.g. rugose anemone, *Arenicola marina*, *Astarte*, barnacle, brachiopod); (3) play a habitat-structuring role and form single-species aggregations in a specific habitat (e.g. northern cerianthid anemone, tunicate: sea potato) or are locally abundant in a specific habitat (e.g. polyclad flatworm, *Cucumaria frondosa* [orange-footed sea cucumber], sand dollar, softshell clam, Stimpson's surfclam); (4) aggregate during reproduction, migration, feeding or as protection from predators (e.g. *Alitta*, *Eteone* and *Glycera*, *Margarites* sp., nudibranch, hermit crab, American lobster, sea urchin); or (5) exhibit gregarious behaviour (e.g. chiton, mysid, pycnogonid). The distribution and aggregation behaviour of a large proportion of the taxa groups analyzed are unknown. When information was available, it often involved a higher taxonomic group and therefore the score was associated with some uncertainty. Based on this criterion, 85% of Porifera, Cnidaria and Ctenophora (73% uncertainty), 66% of Vermiform Phyla (79% uncertainty), 88% of Mollusca (67% uncertainty), 92% of Arthropoda (77% uncertainty), 67% of Echinodermata (89% uncertainty) and all taxa groups in the Other Phyla category (100% uncertainty) have exposure potential.

Resilience

The assessment of the resilience of the various taxa making up the marine and estuarine invertebrates component is presented for each phylum or group of phyla in the Resilience subsection of appendices 5.2.1 to 5.2.6.

Population status

No invertebrates had a specific population status, since most of these organisms have not been assessed by the relevant authorities. For this reason, the precautionary principle was applied and a 1' score was assigned to 156 of the 181 taxa groups (86%). The remaining groups are considered secure by the CESCC (2016) and were given a score of 0. Secure taxa groups include, in the Porifera, Cnidaria and Ctenophora phyla, calcareous sponge (I), sponge (M) and soft coral (I); in Arthropoda, shrimp (Decapoda: Caridea), American lobster (I), hermit crab (I), northern stone crab (CB), rock crab (M), toad crab (I) and snow crab (I); and, in Echinodermata, all the sea urchins and sea cucumbers.

Low recolonization potential

Among the 181 taxa groups, 58 (32%) obtained a score of 1 for low recolonization potential; 64 (35%) of the scores for this criterion were uncertain (1* or 0*). A score of 1 was awarded for this criterion for two main reasons: (1) a taxon's endemism or geographic isolation; and (2) the limited dispersal ability of the early life stages or juveniles and adults, which limits the potential recolonization area. The only taxa obtaining a score of 1 for this criterion due to endemism were the oligochaete *Tubificoides bruneli* (CB) and the mite *Copidognathus biodomus* (I). The other taxa received a positive score due to their limited dispersal potential, either because of their (1) benthic larvae (e.g. *Lucernaria*, priapulid worm) or very short pelagic cycle (sculptured shrimp, *Astarte*, *Margarites* sp., lobster shrimp); or (2) direct development† (e.g. cephalopod, whelk, rough periwinkle, Atlantic dogwinkle, pale lacuna, amphipod). Uncertainty over scoring was mainly due to the lack of information on (1) the presence or absence of planktonic eggs; (2) the duration of the planktonic larval stage; (3) the type of development, in which latitudinal variations may be observed (information on this is lacking for the study area); (4) assessment based on a higher taxonomic level; and lastly, (5) small benthic organisms' capacity for resuspension after settling on the seabed, in the case of groups inhabiting the midlittoral zone. In all, 31% of Porifera and Cnidaria (27% uncertainty), 41% of Vermiform Phyla (59% uncertainty), 26% of Mollusca (36% uncertainty), 28% of Arthropoda (28% uncertainty), 28% of Echinodermata (22% uncertainty) and 54% of Other Phyla group (46% uncertainty) are less resilient based on this criterion.

Low reproductive capacity

Among the 181 taxa groups, 56 (31%) obtained a score of 1 for low reproductive capacity, with 92 (51%) of the scores for this criterion surrounded by uncertainty (1*, 0* or 1'). Taxa groups receiving a positive score for this criterion have several of the following characteristics, which reduce their reproductive capacity: (1) parental care of eggs, larvae and/or juveniles (e.g. polyclad flatworm, cephalopod, sculptured shrimp); (2) low fecundity (e.g. priapulid flatworm, amphipod, sculptured shrimp, pelicanfoot) and/or semelparity; (3) late maturity (e.g. Atlantic dogwinkle, Stimpson's surfclam, ocean quahog); and/or, (4) absence of an asexual mode of reproduction. In most cases, the uncertainty in scoring was due to the considerable knowledge required to score this criterion, including longevity, age at maturity, iteroparity vs. semelparity, fecundity, presence/absence of parental care and presence/absence of asexual mode of reproduction. According to this criterion, 4% of Porifera, Cnidaria and Ctenophora (69% uncertainty), 45% of Vermiform Phyla (76% uncertainty), 26% of Mollusca (45% uncertainty), 56% of Arthropoda (34% uncertainty), 0% of Echinodermata (61% uncertainty) and 8% of Other Phyla (31% uncertainty) are less resilient.

Association with sediment

Among the 181 taxa groups, 105 (58%) obtained a score of 1 for their association with sediment, with 24 (13%) uncertain scores (1*, 0* or 1'). Taxa were assigned a positive score for this criterion if they (1) live in sediment (entirely or partly) or are burrowers (e.g. sea pen, nematode, pelicanfoot, softshell clam, Greenland cockle, lobster shrimp, rock crab, sand dollar, *Molpaldia*); (2) live in the nepheloid layer, or thin layer of water at the water-sediment interface (e.g. minute hydrobe, amphipod); or (3) feed on infauna or epifauna by reworking the sediment (e.g. *Lucernaria*, striped and northern shrimp, euphausiid). Taxa that live attached to the substrate but whose survival does not require reworking the sediment were given a score of 0. In most cases, the uncertainty surrounding the scoring of this criterion was due to the fact that scoring was based on a partial knowledge of a taxon's lifestyle (e.g. polychaete, water flea, pelagic ostracod, benthic amphipod) and life cycle (e.g. Cnidaria). In total, 35% of Porifera, Cnidaria and Ctenophora (12% uncertainty), 86% of Vermiform Phyla (10% uncertainty), 60% of Mollusca (no uncertainty), 68% of Arthropoda (30% uncertainty), 56% of Echinodermata (11% uncertainty) and none of the Other Phyla category (no uncertainty) are considered to be less resilient based on this criterion.

Vulnerability

Among all the 181 invertebrate taxa groups, 177 (98%) were found to have high, medium or low vulnerability. The remaining four taxa groups (2%) have very low vulnerability as they did not meet any of the resilience criteria; these are the groups represented by toad crab (I), sea urchin (M), *Cucumaria frondosa* (M) and *Psolus fabricii* [scarlet sea cucumber] (I). All four have very high exposure potential, but also very high resilience.

Among the 181 groups, 101 (56%) have high vulnerability; 59 (33%), medium vulnerability; and 17 (9%), low vulnerability.

The phyla group that received the highest number of positive scores for all criteria was Vermiform Phyla (83% are highly vulnerable), followed by Arthropoda (60%) and Mollusca (60%), Other Phyla (46%), Echinodermata (33%) and Porifera, Cnidaria and Ctenophora (31%). The Vermiform Phyla group also had the most uncertainty related to scores (41%), followed by Porifera, Cnidaria and Ctenophora (38%), Other Phyla (36%), Arthropoda (32%), Mollusca (31%) and Echinodermata (30%).

Figures 9 to 14 show the level of vulnerability of marine and estuarine invertebrates by phylum or phyla group.

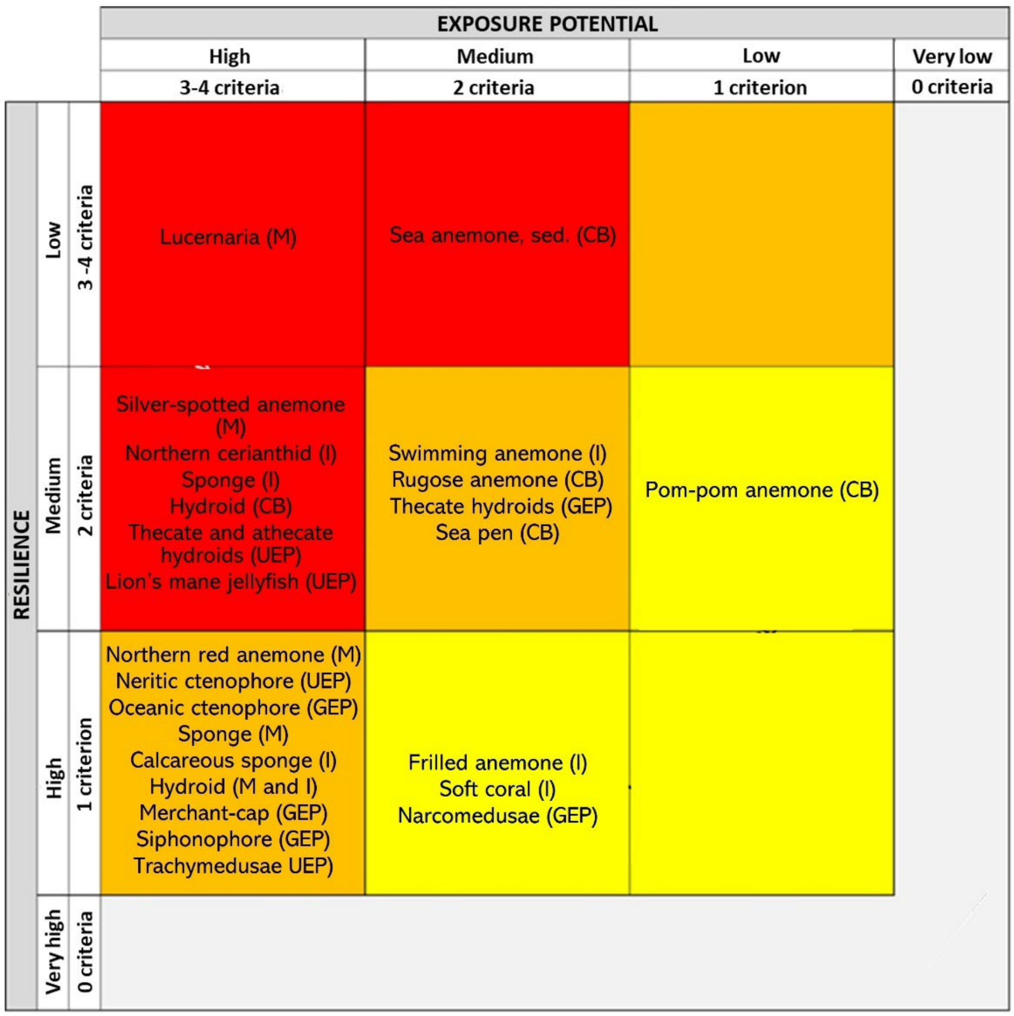

Figure 9. Vulnerability matrix for the taxa groups under Porifera, Cnidaria and Ctenophora phyla within the marine and estuarine invertebrates component (M = Midlittoral zone; I = Infralittoral zone; CB = Circalittoral and/or bathyal zone; GEP = glacial epipelagic zone; UEP = upper epipelagic zone).

Among the 26 taxon groups included in Porifera, Cnidaria and Ctenophora (Figure 9), 8 have high vulnerability (31%), with the most vulnerable being *Lucernaria* (M), which received a positive score for seven criteria; 14 taxa groups (54%) had medium vulnerability; and four groups (15%) had low vulnerability.

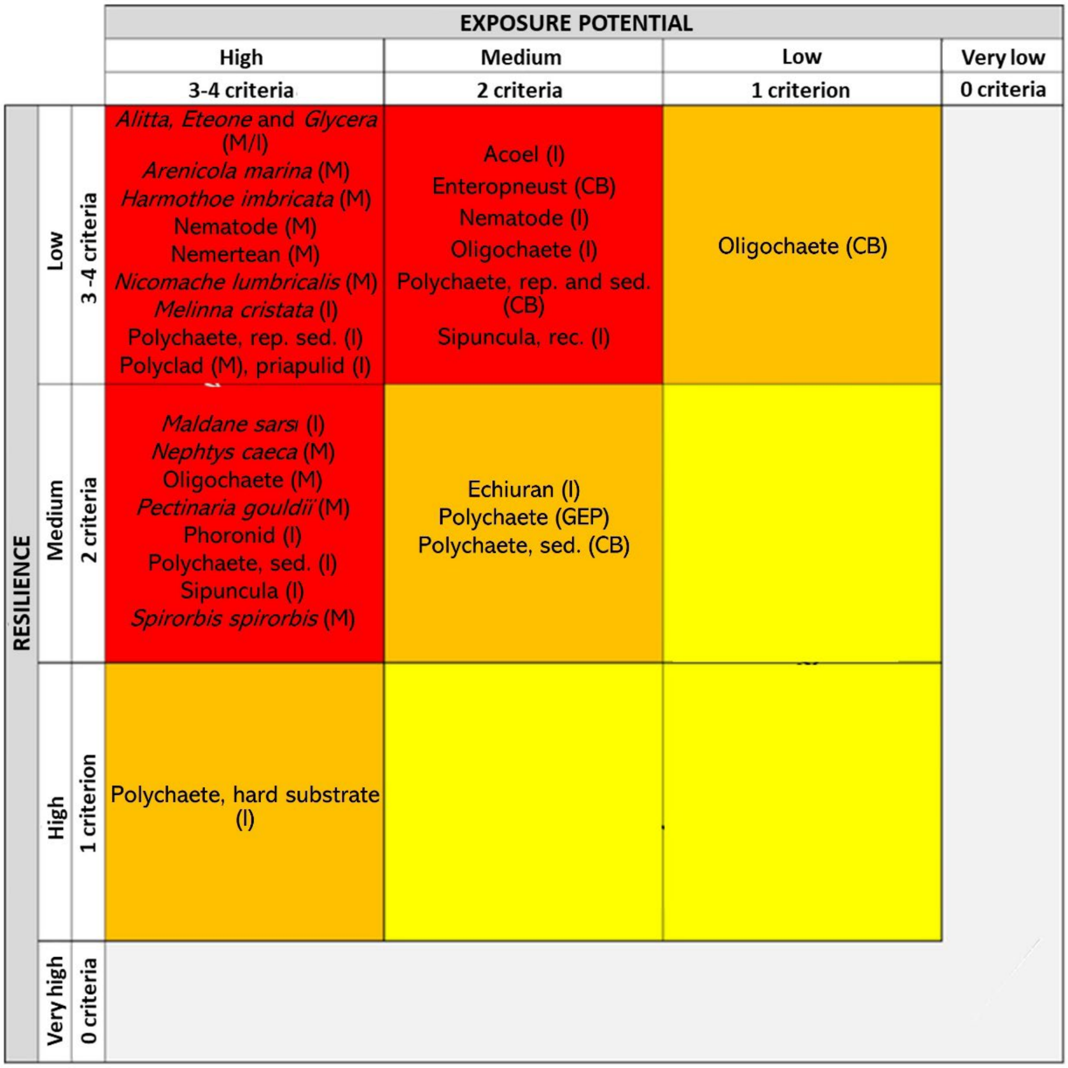

Figure 10. Vulnerability matrix for the taxa groups under Vermiform Phyla within the marine and estuarine invertebrates component (M = Midlittoral zone; I = Infralittoral zone; CB = Circalittoral and/or bathyal zone; GEP = glacial epipelagic zone).

Among the 29 taxa groups in the Vermiform Phyla (Figure 10), 24 groups (83%) have high vulnerability. The most vulnerable group is the *Nicomache lumbricalis* group (M), which received a positive score for all eight criteria. Five groups (17%) have medium vulnerability, and no groups have low vulnerability.

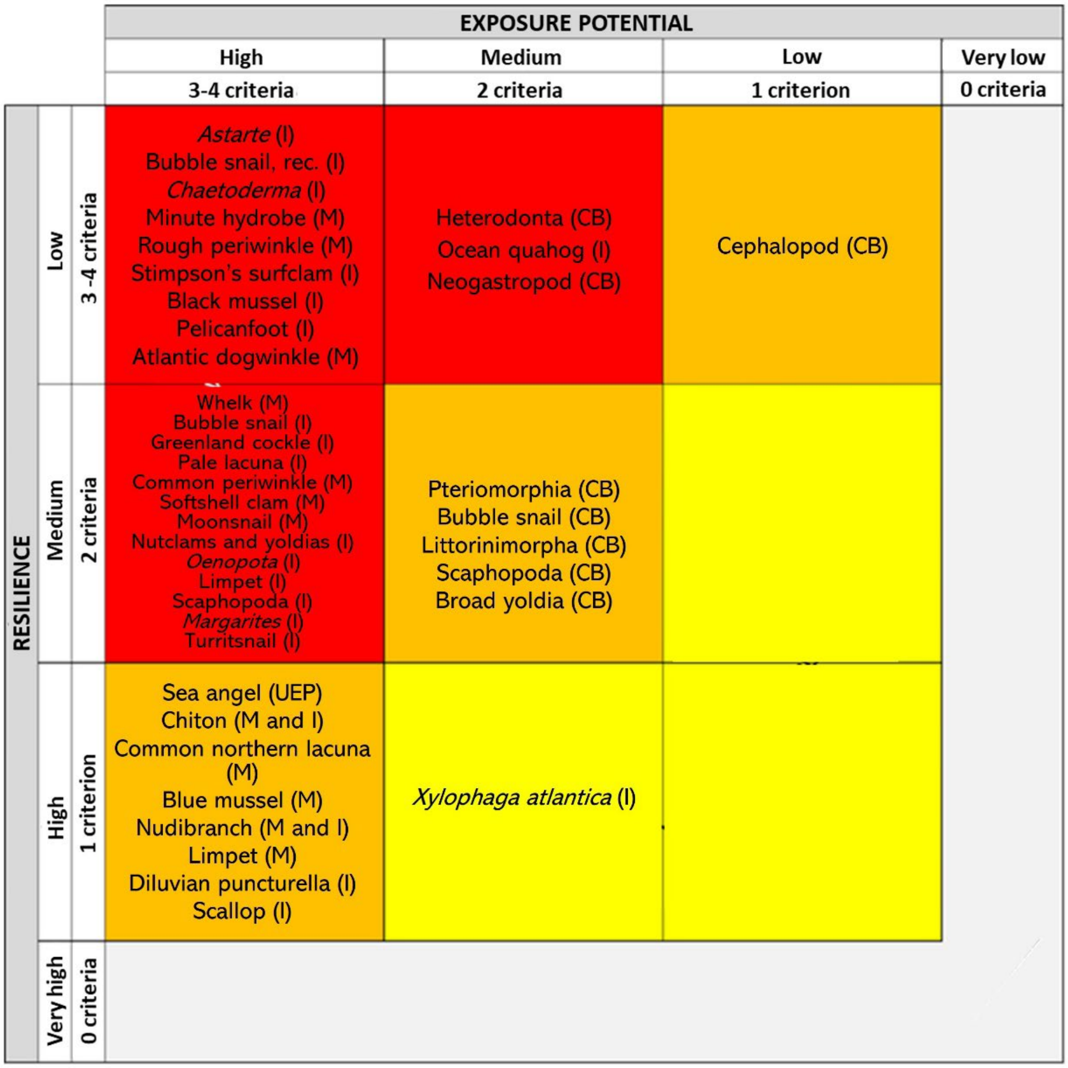

Figure 11. Vulnerability matrix for the taxa groups under Mollusca phylum within the marine and estuarine invertebrates component (M = Midlittoral zone; I = Infralittoral zone; CB = Circalittoral and/or bathyal zone; UEP = upper epipelagic zone).

Among the 42 taxa groups in Mollusca (Figure 11), 25 groups (60%) have a high level of vulnerability. The most vulnerable groups are the minute hydrobe (M) and Atlantic dogwinkle (M), each of which received a positive score for seven criteria. In all, 16 groups (38%) have medium vulnerability and one group (2%), low vulnerability.

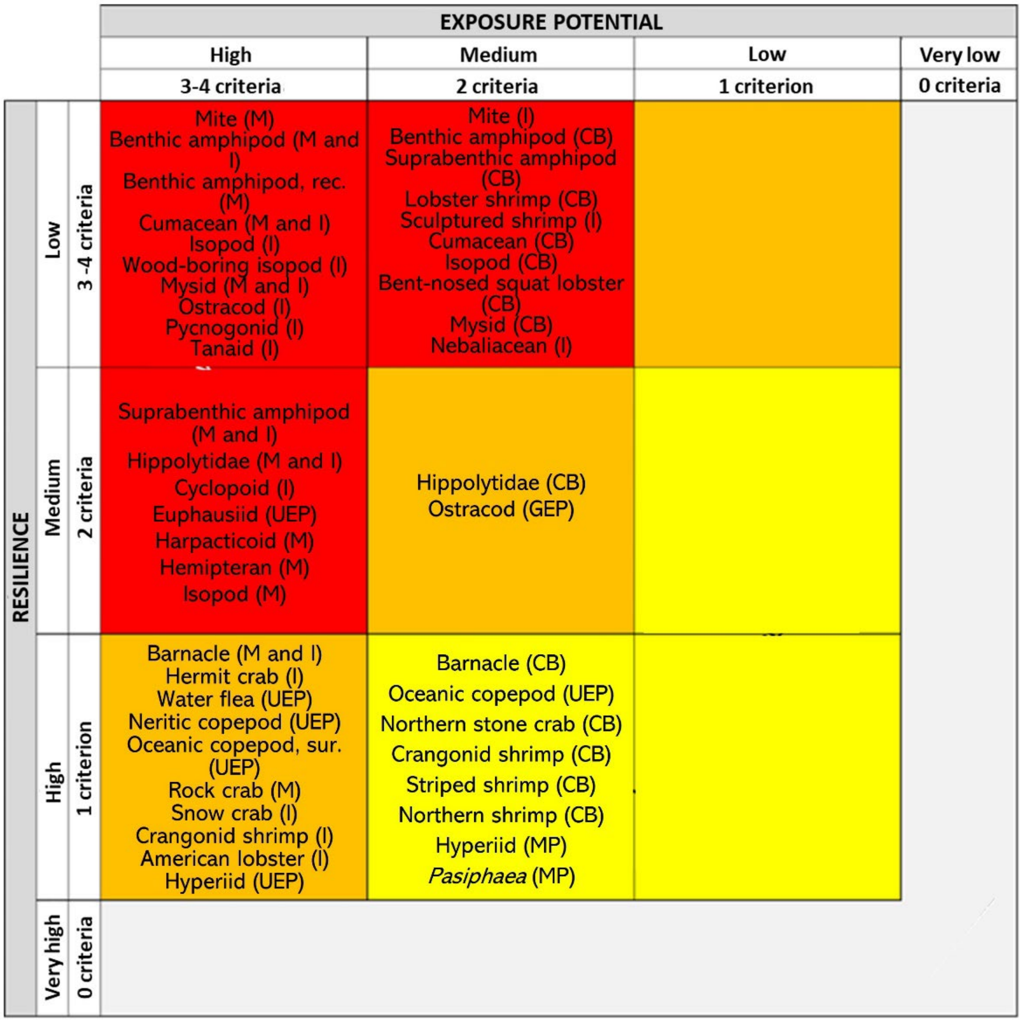

Figure 12. Vulnerability matrix for the taxa groups under Arthropoda phylum within the marine and estuarine invertebrates component (M = Midlittoral zone; I = Infralittoral zone; CB = Circalittoral and/or bathyal zone; GEP = glacial epipelagic zone; UEP = upper epipelagic zone).

Among the 53 taxa groups in Arthropoda (Figure 12), 32 groups (62%) have a high level of vulnerability. The most vulnerable group is benthic amphipods, which have low recolonization potential (M) and obtained a positive score for all eight criteria. In all, 13 taxa groups (25%) have medium vulnerability, and eight groups (15%), low vulnerability. One group was considered to have very low vulnerability and is not shown in Figure 12, specifically toad crab (I).

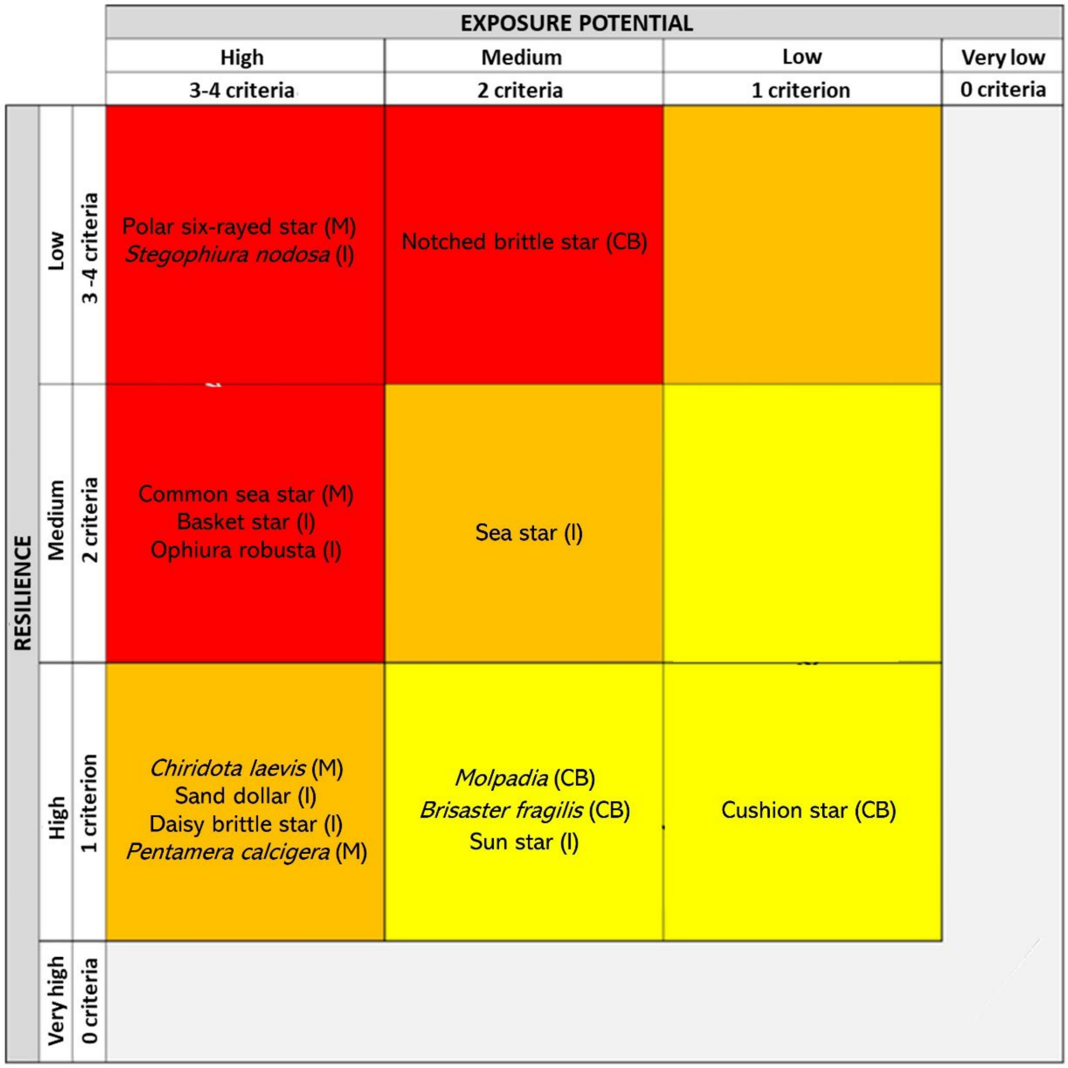

Figure 13. Vulnerability matrix for the taxa groups under Echinodermata phylum within the marine and estuarine invertebrates component (M = Midlittoral zone; I = Infralittoral zone; CB = Circalittoral and/or bathyal zone).

Among the 18 taxa groups in the Echinodermata phylum (Figure 13), 6 (33%) have high vulnerability. The most vulnerable groups are the polar six-rayed star (M) and the brittle star *Stegophiura nodosa* (M), both obtaining positive scores for six criteria. Five groups (28%) have medium vulnerability and four groups (22%), low vulnerability. Three taxa groups, specifically sea urchin (M), *Cucumaria frondosa* (M) and *Psolus fabricii* (I), did not satisfy any criteria for low resilience, are considered to have very low vulnerability, and therefore are not shown in Figure 13.

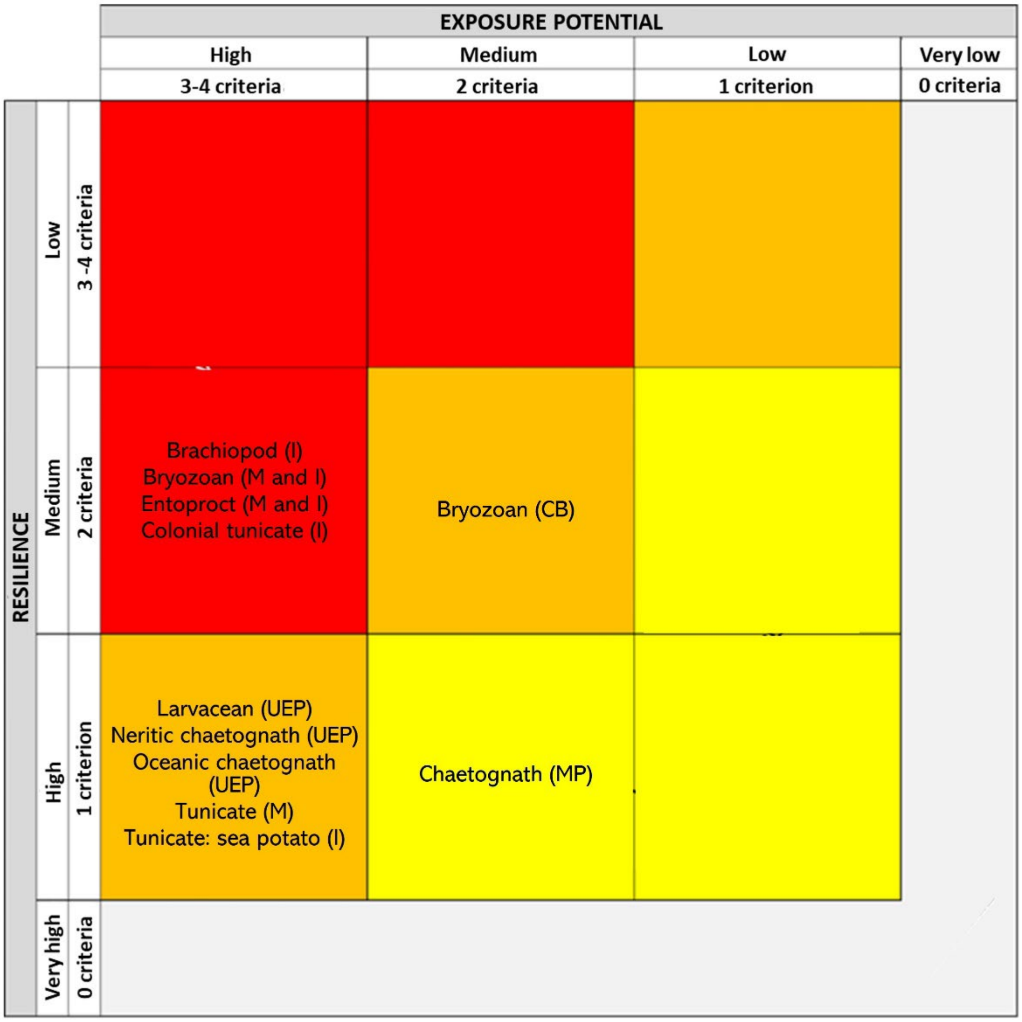

Figure 14. Vulnerability matrix for the taxa groups under Other Phyla within the marine and estuarine invertebrates component (M = Midlittoral zone; I = Infralittoral zone; CB = Circalittoral and/or bathyal zone; UEP = upper epipelagic zone; MP = mesopelagic zone).

Among the 13 taxa groups in the Other Phyla group (Figure 14), 6 (46%) have a high level of vulnerability. The most vulnerable groups are the bryozoans (M) and entoprocts (M), both of which received a positive score for six criteria. Six groups (46%) have medium vulnerability and only one taxon (8%), low vulnerability.

Fulfillment of criteria

All marine and estuarine invertebrate phyla and phyla groups had a higher number of positive scores for the exposure potential category than the resilience category. Invertebrates therefore have very high potential for exposure, although they are fairly resilient overall.

A particularly high number of positive scores were received for the following criteria: limited movement capacity (99%), population status (86%), aggregation potential (83%) and littoral zone use (70%). However, among these dominant criteria, population status and aggregation potential have a high level of uncertainty—86% and 77%, respectively. Low reproductive capacity is also marked by high uncertainty (51%). These high levels of uncertainty call into question the accuracy of scoring.

Uncertainty was a particularly significant issue in population status, given that the precautionary principle (1') was applied in the case of almost all of the scores for invertebrates and that, for 39 taxa groups (22%), population status was the only criterion prompting a group's inclusion in the matrix. If these taxa groups did not have a positive score for this criterion, they would be considered to have very low vulnerability due to their very high resilience.

Figures 15 to 20 provide a detailed breakdown (by taxa group and criterion) of positive scores for each phylum or phyla group.

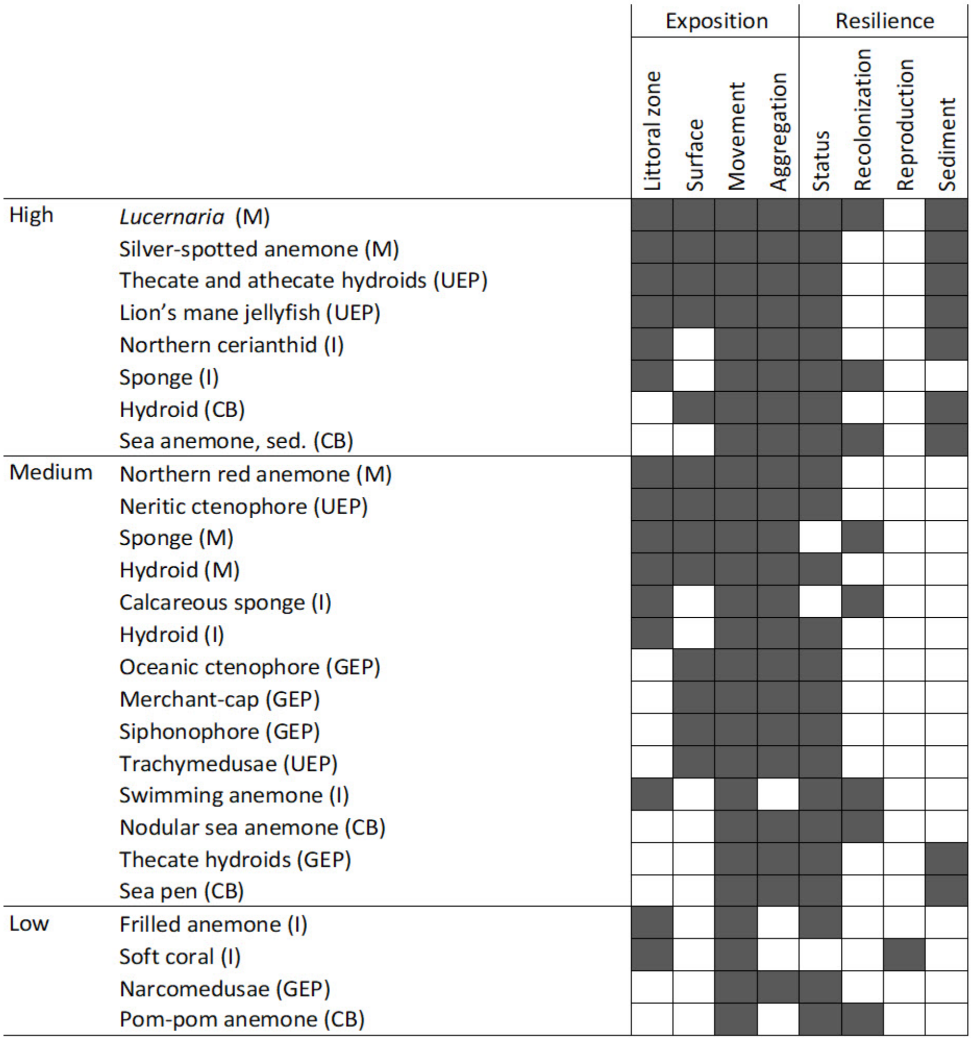

Figure 15. Positive scores for the exposure potential and resilience criteria for the taxa groups under Porifera, Cnidaria and Ctenophora phyla within the marine and estuarine invertebrates component with high, medium and low vulnerability (M = Midlittoral zone; I = Infralittoral zone; CB = Circalittoral and/or bathyal zone; GEP = glacial epipelagic zone; UEP = upper epipelagic zone).

All the taxa groups in the Porifera, Cnidaria and Ctenophora phyla group (Figure 15) have a limited capacity for movement, but only three received a score of 0 for population status, specifically sponge (M), calcareous sponge (I) and soft coral (I). The others obtained a positive score in accordance with the precautionary principle. Lastly, 22 out of the 26 taxa groups obtained a positive score for aggregation potential. Among the 26 scores, 19 were associated with uncertainty (0*, 1* and 1') and three were awarded in accordance with the precautionary principle. Fewer than 50% of the taxa groups received positive scores for the other criteria.

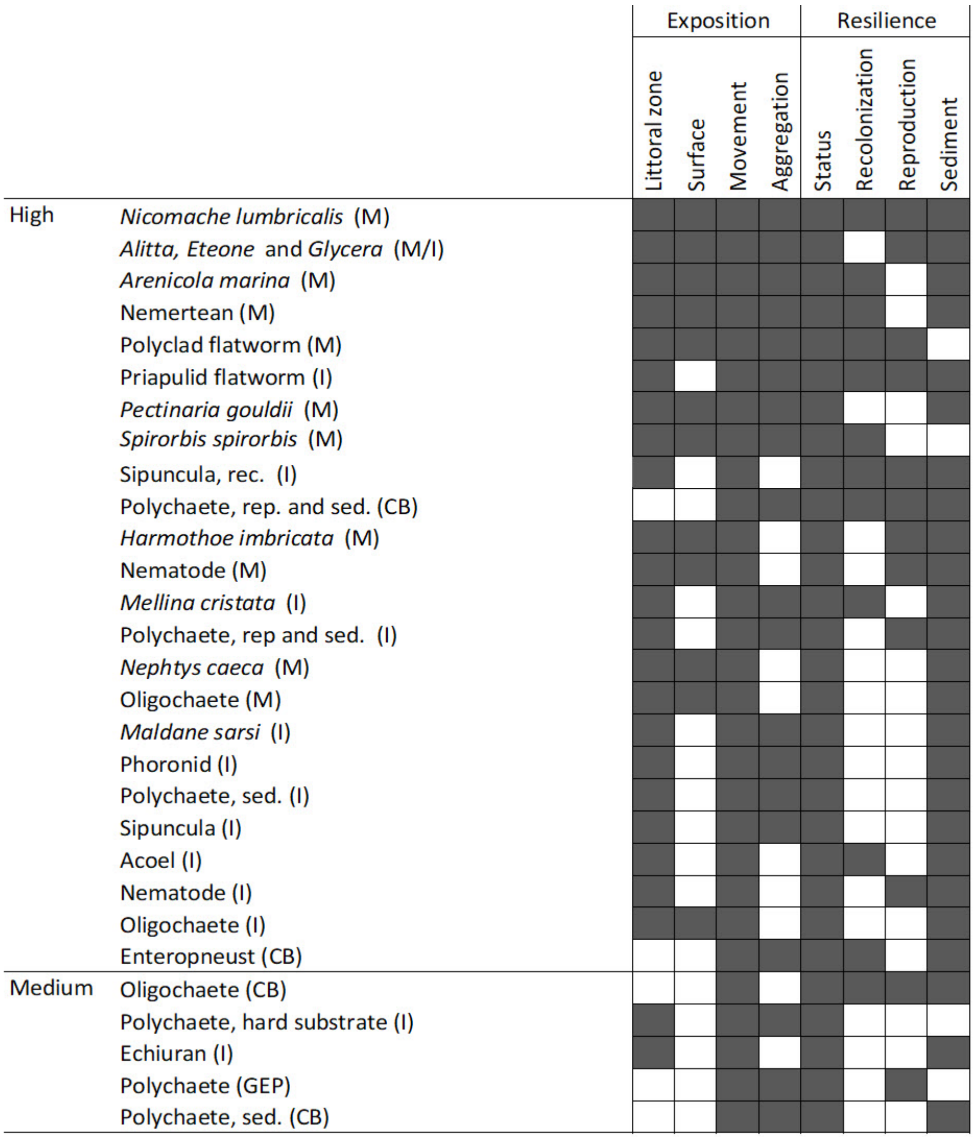

Figure 16. Positive scores for the exposure potential and resilience criteria for the taxa groups under Vermiform Phyla within the marine and estuarine invertebrates component with high and medium vulnerability (M = Midlittoral zone; I = Infralittoral zone; CB = Circalittoral and/or bathyal zone; GEP = glacial epipelagic zone; rec. = low recolonization potential; sed. = sediment-associated; rep.= low reproduction capacity).

All the taxa groups in the Vermiform Phyla group (Figure 16) have a limited capacity for movement, and were assigned a score for population status based on the precautionary principle. Most taxa groups received a positive score for their association with sediment (25 out of 29) and littoral zone use (24 out of 29). Three out of the 29 scores for sediment association were uncertain (1*, 0*), while only one score for littoral zone use was uncertain (0*). Among the 29 taxa groups, 19 obtained a positive score for aggregation potential, but the scoring of this criterion was associated with a high degree of uncertainly: 23 out of the 29 scores were uncertain (0*, 1*, 1’) and among these, 6 involved a positive score based on the precautionary principle. Positive scores for the other criteria were observed in less than 50% of the taxa groups.

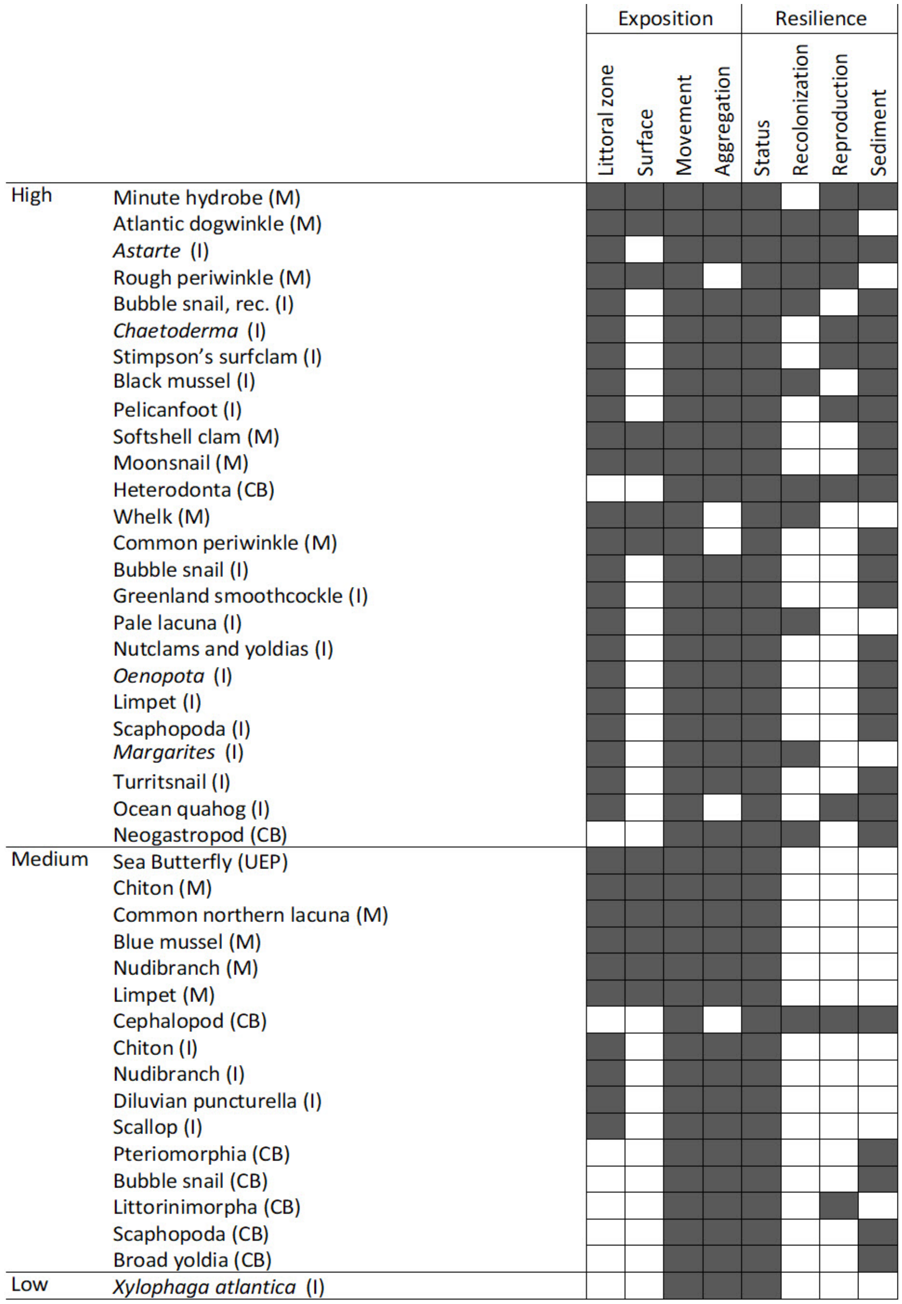

Figure 17. Positive scores for the exposure potential and resilience criteria for the taxa groups under Mollusca phylum within the marine and estuarine invertebrates component with high , medium and low vulnerability (M = Midlittoral zone; I = Infralittoral zone; CB = Circalittoral and/or bathyal zone).

All Mollusca (Figure 17) have limited movement capacity, and obtained a positive score for population status based on the precautionary principle. Most of the taxa groups also received a positive score for aggregation potential (37 out of 42), littoral zone use (33 out of 42) and association with sediment (25 out of 42). Among the 42 scores for aggregation potential, 28 were uncertain (0*, 1* or 1') and, among these, 8 were the result of scoring based on the precautionary principle. No uncertainty was associated with the scoring for littoral zone use or sediment association. Positive scores for the other criteria were observed in less than 50% of the groups.

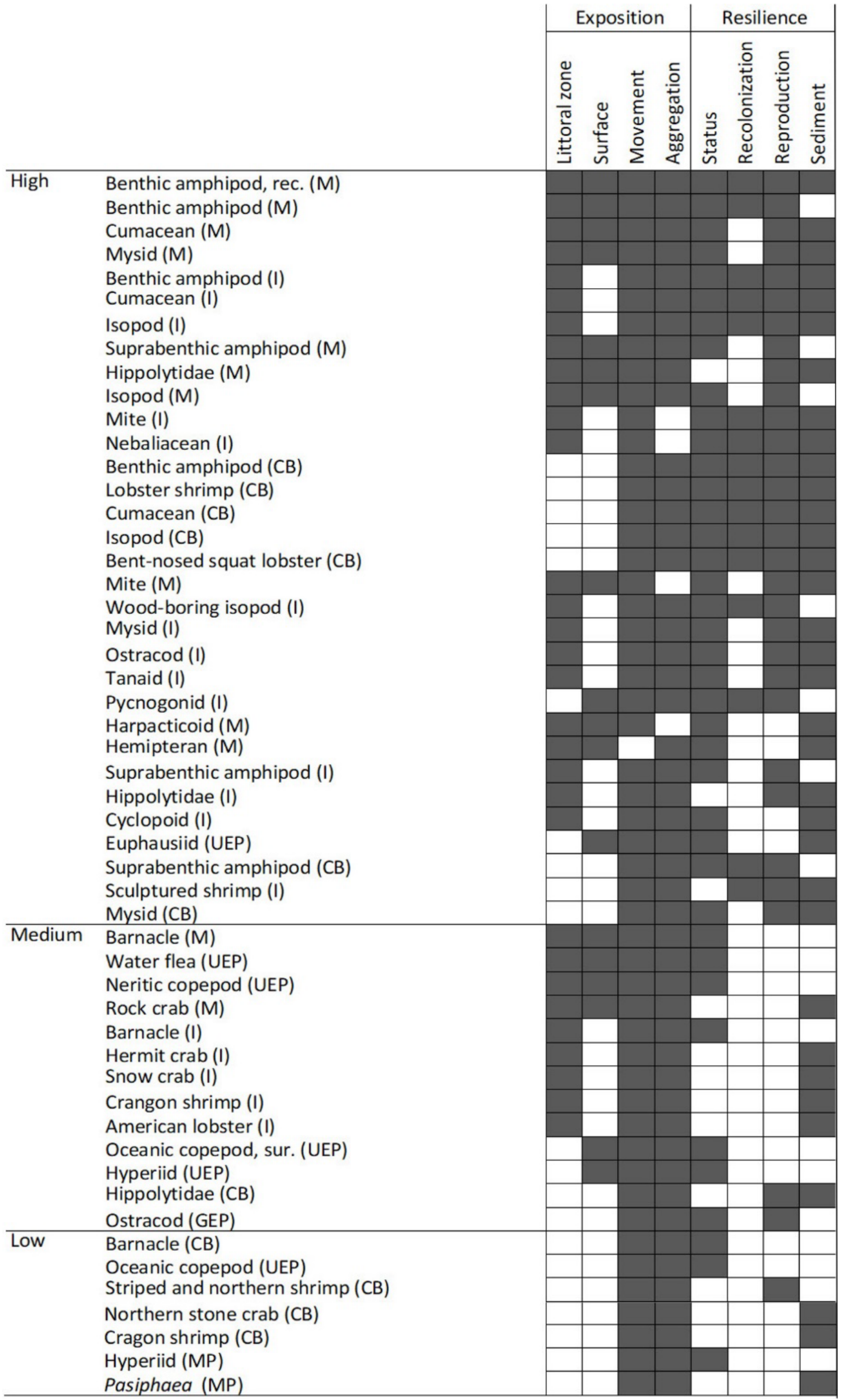

Figure 18. Positive scores for the exposure potential and resilience criteria for the taxa groups under Arthropoda phylum within the marine and estuarine invertebrates component with high, medium and low vulnerability (M = Midlittoral zone; I = Infralittoral zone; CB = Circalittoral and/or bathyal zone; GEP = glacial epipelagic zone; UEP = upper epipelagic zone).

All Arthropoda (Figure 18), except for the hemipterans (M), have a limited capacity for movement. Most of the taxa groups obtained a positive score for aggregation potential (49 out of 53), population status (39 out of 53, based on the precautionary principle), association with sediment (36 out of 53), littoral zone use (32 out of 53) and low reproductive capacity (30 out of 53). Forty-one (41) of the 53 scores for aggregation potential were uncertain (0*, 1* and 1’), including 8 based on the precautionary principle. For sediment association, 16 of the 53 scores were uncertain (0*, 1* or 1’) and only one was assigned based on the precautionary principle. For littoral zone use, five of the 53 scores were uncertain (0*, 1*). Lastly, for low reproductive capacity, 18 of the 53 scores were uncertain (0*, 1* and 1’), one of which was assigned based on the precautionary principle. Positive scores for the other criteria were observed in less than 50% of the taxa groups.

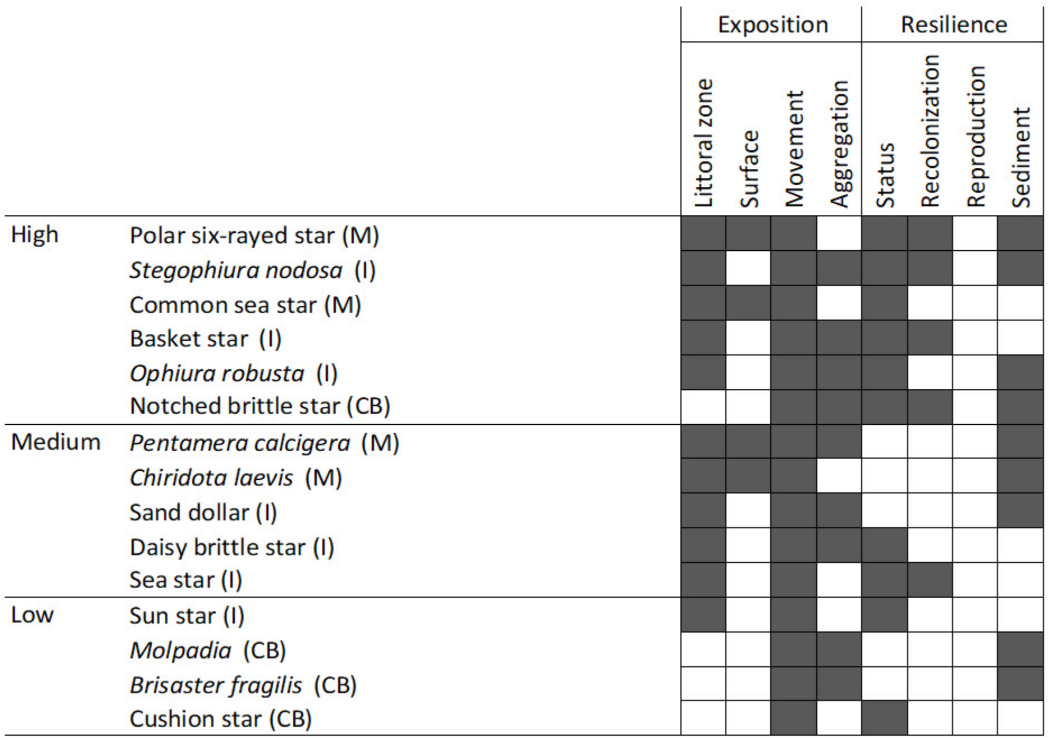

Figure 19. Positive scores for the exposure potential and resilience criteria for taxa groups under the Echinodermata phylum within the marine and estuarine invertebrates component with high, medium and low vulnerability (M = Midlittoral zone; I = Infralittoral zone; CB = Circalittoral and/or bathyal zone).

All Echinodermata (Figure 19) have a limited capacity for movement. Most taxa groups received a positive score for littoral zone use (14 out of 18), aggregation potential (12 out of 18), population status (10 out of 18, based on the precautionary principle) and association with sediment (also 10 out of 18). Sixteen (16) out of the 18 scores for aggregation potential were uncertain (0*, 1* and 1’) and, among them, three were obtained based on the precautionary principle. For sediment association, only two out of the 18 scores were uncertain (1*). Positive scores for the other criteria were observed in less than 50% of taxa groups.

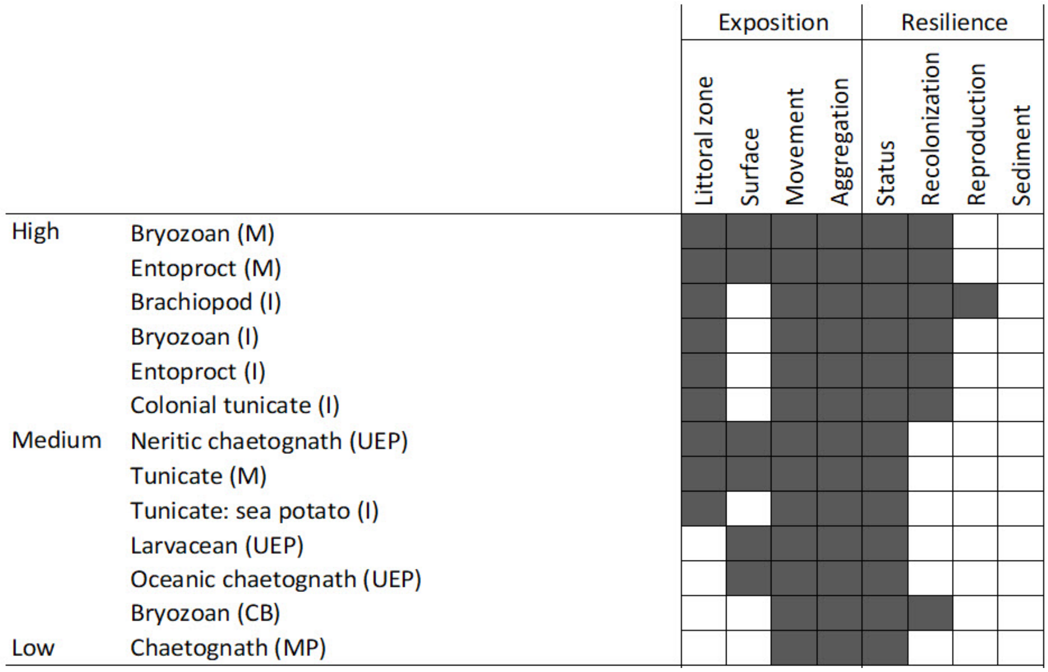

Figure 20. Positive scores for the exposure potential and resilience criteria for the taxa groups under Other Phyla within the marine and estuarine invertebrates component with high, medium and low vulnerability (M = Midlittoral zone; I = Infralittoral zone; CB = Circalittoral and/or bathyal zone; UEP = upper epipelagic zone).

All the taxa groups in the Other Phyla group (Figure 20) received positive scores for limited movement capacity, aggregation potential and population status (in accordance with the precautionary principle). All scores for aggregation potential were uncertain (0*, 1*, 1’), and 11 out of the 13 scores were based on the application of the precautionary principle. Most taxa groups were assigned a positive score for littoral zone use (9 out of 13) and low recolonization potential (7 out of 13). Six of the 13 scores for low recolonization potential were uncertain (0*, 1*). Positive scores for the other criteria were observed in less than 50% of groups of taxa.

Uncertainty

The scores for the marine and estuarine invertebrates component are associated with an overall uncertainty level of 34.1% (Table 4). This was calculated by summing all the types of uncertainty (0*, 1* and 1’) in the 1,448 boxes containing a score for each of the eight criteria and 181 groups of taxa assessed. The resilience criteria scores account for most of the uncertainty (46.4% uncertainty, or 337 out of 724 scores). Owing to the lack of information on the status of invertebrate populations, the precautionary principle (1’ scores) had to be applied to 86.2% of the taxa groups, which alone accounted for 156 uncertain scores out of 724 (21.5%) in the resilience category. A significant amount of uncertainty (0* and 1* scores) was also associated with the scores for low reproductive capacity (92 out of 724 scores were uncertain), recolonization potential (64 out of 724 scores) and association with sediment (24 out of 724 scores). Less than 1% of the resilience criteria scores resulted from the application of the precautionary principle (6 out of 724 scores). The uncertainty (21.8%) associated with the exposure criteria scoring is largely attributable to the aggregation potential criterion, for which 140 out of 724 scores (77.3%) were uncertain. The precautionary principle was applied for 39 exposure potential scores, all of which were associated with the aggregation potential criterion.

Little uncertainty was associated with the scores for littoral zone use and sea surface interacting: 5.5% (10 out of 724 scores) and 4.4% (8 out of 724 scores), respectively.

Table 4. Uncertainty (%) associated with the scores for taxa groups (number of taxa groups receiving the score out of the total number of scores) in the marine and estuarine invertebrates component by criterion

	% of Uncertainty Type (Number of Scores out of the Total)			
Criterion	0*	1*	1’	Total
Littoral zone use	3.3 (6/181)	2.2 (4/181)	-	5.5 (10/181)
Sea surface interacting	1.7 (3/181)	2.8 (5/181)	-	4.4 (8/181)
Limited capacity for movement	-	-	-	-
Aggregation potential	12.2 (22/181)	43.7 (79/181)	21.6 (39/181)	77.3 (140/181)
Total, exposure potential category	4.3 (31/724)	12.2 (88/724)	5.4 (39/724)	21.8 (158/724)
Population status	-	-	86.2 (156/181)	86.2 (156/181)
Low recolonization potential	20.4 (37/181)	14.9 (27/181)	-	34.4 (64/181)
Low reproductive capacity	37.6 (68/181)	10.5 (19/181)	2.8 (5/181)	50.8 (92/181)
Association with sediment	2.8 (5/181)	9.9 (18/181)	0.6 (1/181)	13.3 (24/181)
Total, resilience category	15.2 (110/724)	8.8 (64/724)	22.4 (162/724)	46.4 (337/724)
Total	9.7 (141/1448)	10.5 (152/1448)	13.8 (201/1448)	34.1 (494/1448)

3.3.3. Marine, estuarine and diadromous fish

Exposure potential

The assessment of the exposure potential of the various taxa in the marine, estuarine and diadromous fish component is presented in Appendix 5.3.1.

Littoral zone use

Among the 75 taxa, 37 (49%) obtained a score of 1 for littoral zone use. Some taxa occupy the littoral zone at all times (e.g. sculpins, sticklebacks and fish doctor), while others use it for spawning (e.g. capelin and Atlantic herring), exclusively during the juvenile stage (e.g. Atlantic cod and white hake), or during migrations (e.g. Atlantic salmon, striped bass and American eel). All diadromous fish (100%) received a score of 1 for this criterion, compared to 38% of pelagic fish and 35% of demersal fish.

Sea surface interacting

Among the 75 taxa, 29 (39%) were assigned a score of 1 for sea surface interacting. These taxa interact with the surface owing to their use of very shallow water habitat (e.g. sticklebacks and rock gunnel), or their feeding or movement behaviour. For example, some large pelagic fish may pursue their prey up to the first metre of the water column (e.g. basking shark, Greenland shark). In addition, the uppermost fish in a large school of fish can reach the surface (e.g. rainbow smelt and Atlantic mackerel). Only 22% of demersal fish taxa were considered to interact with the surface. In contrast, 69% of diadromous fish and 62% of pelagic fish were awarded a score of 1 for this criterion.

Limited capacity for movement

Nearly half the taxa, i.e. 38 out of 75 (51%), have a limited capacity for movement. Pelagic and diadromous fish are typically better swimmers than demersal fish. In all, 32 demersal taxa (70%) received a positive score for this criterion, while only six taxa (21%) from the combined pelagic and diadromous groups met the criterion. Four of the latter were sticklebacks and, although they are not considered to be sedentary, they were assigned a score of 1 owing to their very small size, which prevents them from migrating as quickly as large species (e.g. salmon or brook trout). Note that this criterion is difficult to assess, given the fact that a time factor is involved (distance travelled in 48 hours). Consequently, only taxa that are highly migratory or that have been included in tagging studies were given a score of 0 or 1. Many taxa (11%) received a score of 1* since they are deemed poor swimmers (e.g. snailfish) or to be sedentary (e.g. snakeblenny). In many cases, it is impossible to determine whether a fish species can swim 50 km in 48 hours in an effort to escape a spill. Various other taxa (13%) were assigned a score of 1 (e.g. Atlantic poacher, sculpin and eelpout) based on the precautionary principle, as no information on their swimming ability is available in the literature. Therefore, the overall uncertainty associated with the assessment of this criterion for the fish component is 24%.

Aggregation potential

Twenty-seven (27) out of the 75 taxa (36%) have aggregation potential. This characteristic is more common in diadromous (69%) and pelagic (62%) taxa than in demersal taxa (17%). Many pelagic species are known to form schools (e.g. Atlantic mackerel, Atlantic herring and capelin), while diadromous taxa aggregate mainly during the spawning season when migrating to spawning sites (e.g. Atlantic sturgeon, sea lamprey and Atlantic salmon). Species that remain solitary year-round (e.g. Greenland shark, porbeagle and wolffish) were given a score of 0.

Resilience

An assessment of the resilience of the various taxa in the marine, estuarine and diadromous fish component can be found in Appendix 5.3.2.

Population status

Twenty-three (23) out of the 75 taxa (31%) received a score of 1 for this criterion, as they have official conservation status accorded by a competent authority (see Appendix 4 for the type of status assigned to each taxon). The percentage of species with official status (thus affecting their resilience) is as follows: 46% of pelagic fish, 38% of diadromous fish and 24% of demersal fish.

For species with IUCN status exclusively, note that even if a species has official status on the international level, its regional stocks can be healthy and may even be increasing, for example, Atlantic halibut in the St. Lawrence. It is nonetheless important to identify these species given the decline in their global stocks. Local individuals could play a role in recolonizing areas where a species is vulnerable (Consultation of DFO experts 2016).

For this criterion, the scores for three taxa involved some uncertainty: Atlantic mackerel (1*) and witch flounder (1*), identified as vulnerable by the CESCC (2016), and sea tadpole (1'), which it considers unrankable owing to knowledge gaps.

Low recolonization potential

Nineteen out of 75 taxa (25%) obtained a score of 1 for low recolonization potential. These are taxa that exhibit (1) strict natal homing behaviour† (e.g. American shad, Atlantic salmon and brook trout); (2) a lack of connectivity (geographic or genetic) between distinct populations (e.g. Atlantic sturgeon); or (3) a limited capacity for movement due to the absence of a pelagic larval stage (e.g. ocean pout and sea tadpole). This criterion characterizes 31% of diadromous taxa, 24% of demersal taxa and 23% of pelagic taxa. Conversely, a score of 0 was assigned to species that are very widespread, do not exhibit strict natal homing behaviour and have good dispersal potential owing to their pelagic larvae.

Low reproductive capacity

Thirty-eight (38) out of 75 taxa (51%) received a score of 1 for low reproductive capacity because (1) they produce a small number of eggs annually (e.g. Atlantic soft pout, Atlantic hagfish, rays and sharks [ovoviviparous†]); (2) they are long-lived and late-maturing (e.g. Atlantic sturgeon and redfish); (3) they care for their eggs until they hatch (e.g. sculpin, stickleback and lumpfish); or (4) they are late-maturing and semelparous (e.g. sea lamprey). In total, 57% of demersal taxa, 46% of pelagic taxa and 38% of diadromous taxa received positive scores for this criterion.

Association with sediment

Forty-eight (48) out of 75 taxa (64%) received a score of 1 for this criterion, including 76% of demersal taxa, 50% of diadromous taxa and 38% of pelagic taxa. These taxa (1) use sediment for shelter or camouflage (e.g. rays, flounder, sand lance and wrymouth); (2) feed on infauna (e.g. sculpins, moustache sculpin, ocean pout and tomcod); or 3) engage in spawning behaviour that involves reworking the sediment (e.g. capelin, sticklebacks and Atlantic soft pout). A score of 0 was given to taxa that live in the water column and are pelagic feeders, as well as to taxa that live near the bottom but are epipelagic feeders.

Vulnerability and fulfillment of the criteria

Figure 21 shows the level of vulnerability of marine, estuarine and diadromous fish. Out of a total of 75 taxa assessed, 60 taxa (80%) were placed in the matrix, based on their high, medium or low level of vulnerability. Atlantic sturgeon, ocean pout, rock gunnel and fish doctor had the highest number of positive scores for the criteria (6 out of 8 criteria). The 15 taxa not shown did not meet any criteria for exposure potential and/or resilience and were deemed to have very low vulnerability; most of these (11 out of 15 taxa) were demersal fish. Among the taxa assessed as having very low vulnerability, seven species have conservation status (i.e. they fulfill the population status criterion) [Appendix 4], but do not fulfill any exposure potential criteria (Atlantic halibut, Greenland shark, Atlantic wolffish, spotted wolffish, spinytail skate, thorny skate and smooth skate). In addition, two species are exposed to directed fishing pressure (Atlantic halibut and Greenland halibut). Other species in this category include white perch, monkfish, alewife, white barracudina, longfin hake, alligatorfish and Arctic cod.

Overall, 23% of the taxa in the component showed a high level of vulnerability, 27% a medium level and 31% a low level. Vulnerability patterns were influenced by the species' lifestyle. In all, 44% of diadromous species had high vulnerability, compared with only 17% of demersal species and 15% of pelagic species. Species with a medium level of vulnerability included 38% of diadromous fish, 31% of pelagic fish and 22% of demersal fish. Finally, 38% of pelagic fish, 37% of demersal fish and as few as 6% of diadromous fish had a low level of vulnerability.

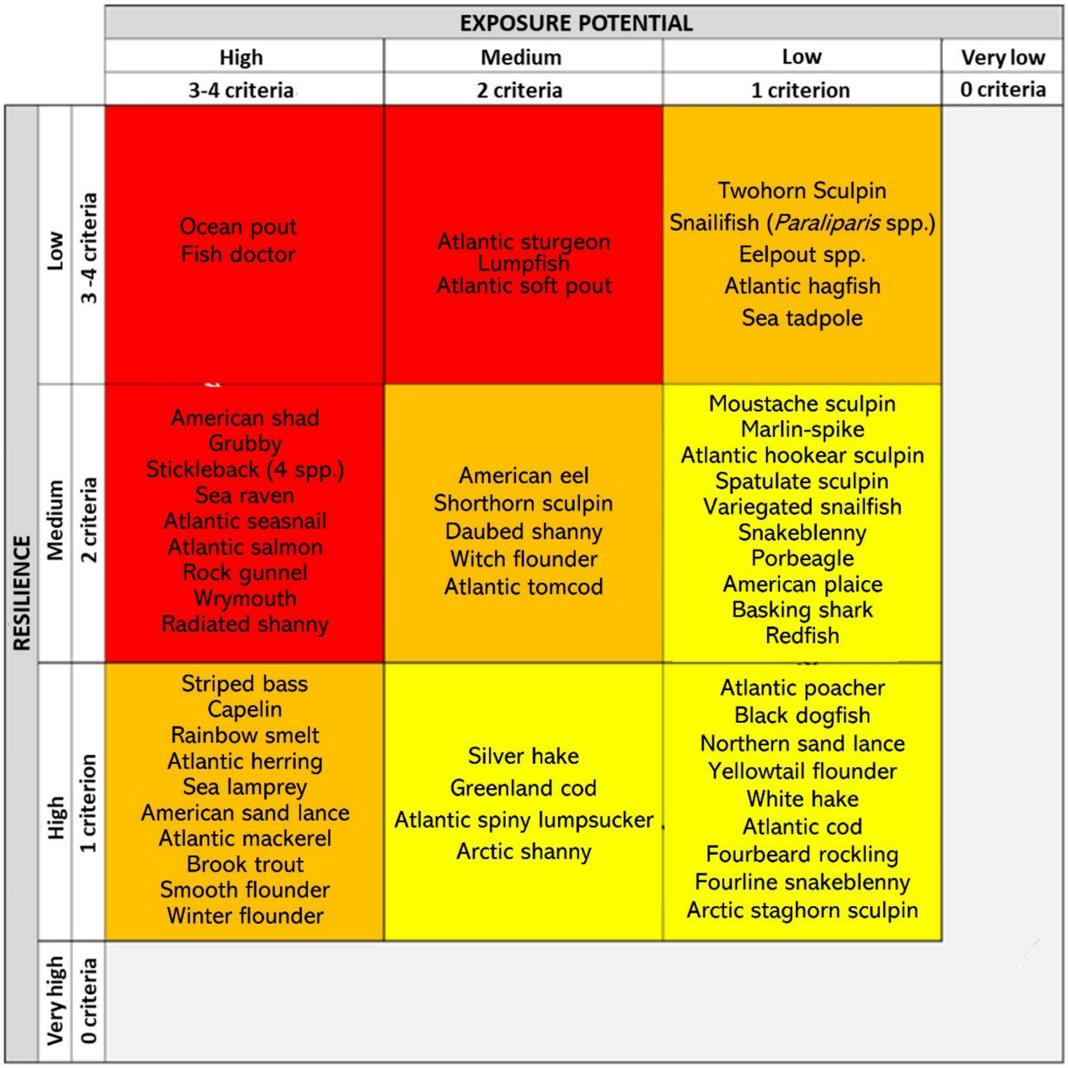

Figure 21. Vulnerability matrix for the marine, estuarine and diadromous fish component

Figure 22 shows the results for the eight assessment criteria for the various taxa. Fish respond differently to these criteria, depending on their lifestyle. All of the diadromous fish use the littoral zone (100%), often interact with the surface (69%) and have relatively high aggregation potential (69%). Therefore, their vulnerability stems from their exposure potential, rather than their level of resilience. This was also the case for pelagic fish, with 69% of taxa interacting with the surface and 62% showing fairly high aggregation potential. In contrast, almost all of these pelagic fish had good capacity for movement (only one taxon with low mobility). Among demersal fish, 76% of taxa had positive scores for the association with sediment criterion and 70% met the limited capacity for movement criterion. In addition, 57% of taxa showed low reproductive capacity. In this case, the lack of resilience of demersal fish seemed to contribute to their vulnerability.

Regardless of their lifestyle, most of the highly vulnerable taxa met the criteria related to littoral zone use (16 out of 17), sea surface interacting (14 out of 17), limited capacity for movement (13 out of 17), low reproductive capacity (14 out of 17) and association with sediment (15 out of 17), while their response to the other criteria varied.

There were two main groups of moderately vulnerable taxa: those for which vulnerability was mainly associated with their high exposure potential (12 out of 20); and those for which it was mainly associated with a low level of resilience (5 out of 20). Three taxa met two criteria in each category.

Lastly, taxa with low vulnerability met various combinations of criteria. However, limited capacity for movement (14 out of 23) and association with sediment (15 out of 23) were the dominant criteria.

Uncertainty

The scores for the marine, estuarine and diadromous fish component are associated with an overall uncertainty level of 9.3% (Table 5). This was calculated by summing all the types of uncertainty in the 600 boxes containing a score for each of the eight criteria and 75 taxa assessed. The uncertainty associated with the assessment of exposure potential was slightly higher (11.7%) than that associated with the assessment of resilience (7.0%). The limited capacity for movement (24%) and aggregation potential (22.7%) criteria were associated with the greatest uncertainty. Overall, the precautionary principle (1') was applied infrequently in the assessment of this component, only affecting 2.2% of scores (13 out of 600 scores).

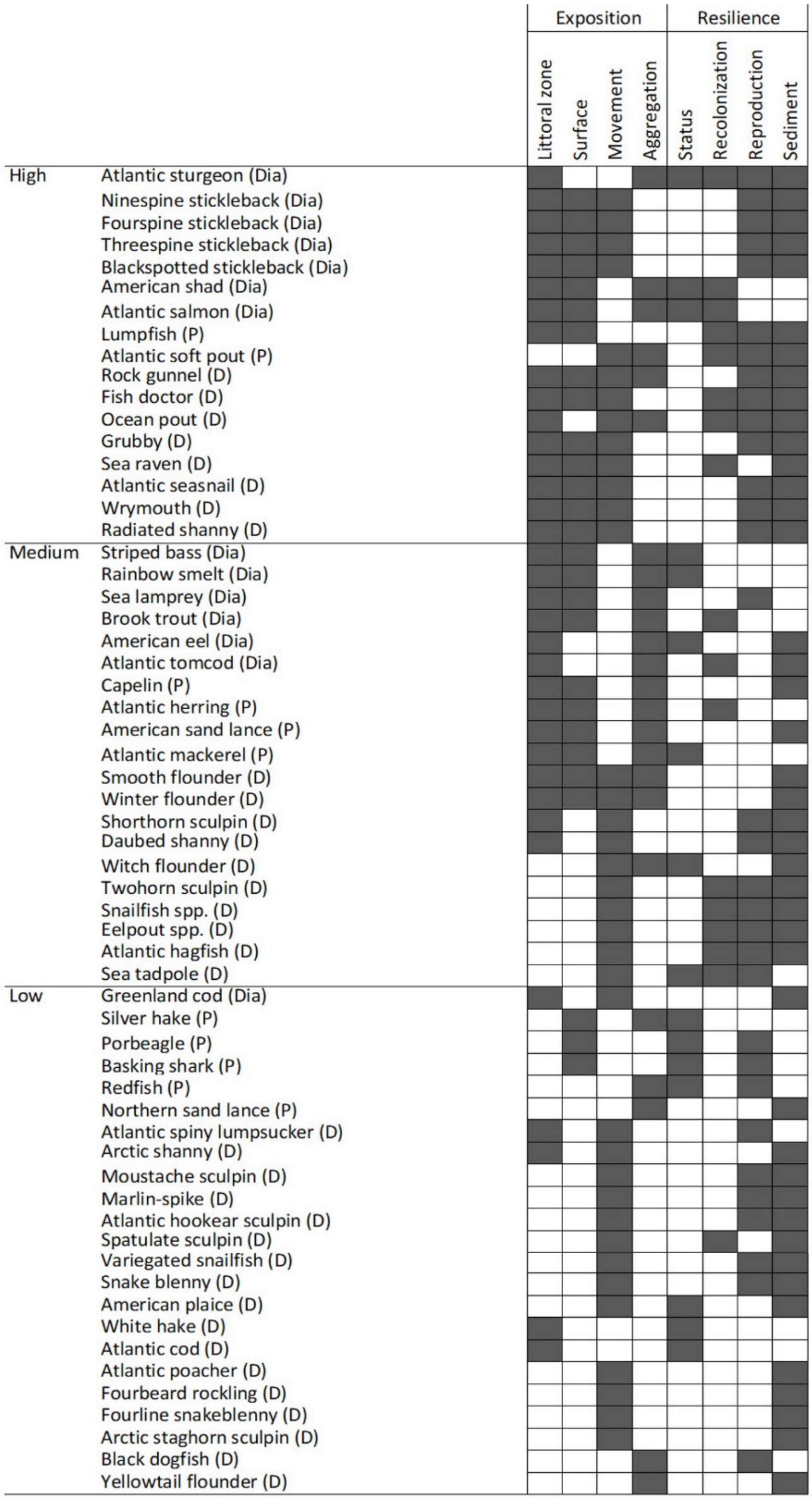

Figure 22. Positive scores for the exposure potential and resilience criteria for diadromous (Dia), pelagic (P) and demersal (D) fish with high, medium and low vulnerability.

Table 5. Uncertainty (%) associated with the scores for marine, estuarine and diadromous fish taxa (number of taxa receiving the score out of the total number of scores) by criterion

	% of Uncertainty Type (Number of Scores out of the Total)			
Criterion	0*	1*	1'	Total
Littoral zone use	-	-	-	-
Sea surface interacting	-	-	-	-
Limited capacity for movement	-	10.7 (8/75)	13.3 (10/75)	24.0 (18/75)
Aggregation potential	22.7 (17/75)	-	-	22.7 (17/75)
Total, exposure potential category	5.7 (17/300)	2.7 (8/300)	3.3 (10/300)	11.7 (35/300)
Population status	-	2.7 (2/75)	1.3 (1/75)	4.0 (3/75)
Low recolonization potential	4.0 (3/75)	6.7 (5/75)	-	10.7 (8/75)
Low reproductive capacity	5.3 (4/75)	2.7 (2/75)	2.7 (2/75)	10.7 (8/75)
Association with sediment	-	2.7 (2/75)	-	2.7 (2/75)
Total, resilience category	2.3 (7/300)	3.7 (11/300)	1.0 (3/300)	7.0 (21/300)
Total	4.0 (24/600)	3.2 (19/600)	2.2 (13/600)	9.3 (56/600)

3.3.4. Marine mammals

Exposure potential

The assessment of the exposure potential of the various taxa in the marine mammals component is detailed in Appendix 5.4.1.

Littoral zone use

Four out of 13 species (31%) use the littoral zone. Among cetaceans, the common minke whale and beluga whale are known to occur in shallow nearshore waters and were given a score of 1, while all the other cetaceans occur in deeper waters offshore and received a score of 0. Similarly, pinnipeds may use the nearshore environment for resting, reproduction and moulting. In the study area, this is the case for harbour seals and grey seals, which received a score of 1. Harp and hooded seals visit the study area in winter and do not occur in the nearshore environment; they remain in the pelagic zone and were assigned a score of 0.

Sea surface interacting

All marine mammals (100%) need to come to the surface to breathe, and were therefore assigned a score of 1.

Limited capacity for movement

All marine mammals (100%) are good swimmers, and most migrate over long distances. They were all assigned a score of 0.

Aggregation potential

Four out of 13 species (31%) received a positive score for the aggregation potential criterion. Belugas are the only cetacean species that live in groups year-round in the study area, and the species was therefore assigned a score of 1 for this criterion. The Atlantic white-sided dolphin visits the St. Lawrence in fall. As it is highly gregarious, it received a score of 1. All the other cetaceans obtained a score of 0, as they tend to occur in the study area alone or in small groups of a few individuals.

Pinnipeds show strong fidelity to their haulout sites, where they gather for pupping, moulting or resting. Since some harbour seal and grey seal haulout sites are located in the study area, these species were assigned a score of 1. The harp seal and the hooded seal use the study area mainly for feeding in winter, a season when individuals tend to be fairly solitary. They were given a score of 0 for this criterion.

Resilience

The resilience of the various species in the marine mammals component is assessed in Appendix 5.4.2.

Population status

Six out of 13 species (46%) have one or more international, national or provincial status designations, which are set out in Appendix 4. All cetaceans received a score of 1 for this criterion, while the other species have no special status and were assigned a score of 0.

Low recolonization potential

Two out of 13 species (15%) have a low recolonization potential. The St. Lawrence Estuary population of the beluga is geographically, socially and genetically isolated from the other beluga populations, which occur in the Arctic. This population therefore has low recolonization potential and was assigned a score of 1. The North Atlantic right whale was also assigned a score of 1, because its population is extremely small, having been estimated at fewer than 500 individuals worldwide. The other marine mammal species were assigned a score of 0 for this criterion.

Low reproductive capacity

All marine mammals (100%) were assigned a score of 1 for low reproductive capacity, given their reproductive strategy, which includes late maturity, a long gestation period, and parental investment in a single offspring.

Association with sediment

Three out of 13 species (23%) received a positive score for the sediment association criterion. The beluga whale is the only cetacean species that interacts closely with sediment. Its diet is highly varied and includes a large proportion of infauna, such as polychaetes. It reworks the sediment while feeding and was therefore assigned a score of 1 for this criterion. Two phocids, the harbour seal and the grey seal, feed by foraging in bottom sediments, and also received a score of 1. All the other marine mammals are pelagic or demersal feeders and were assigned a score of 0 for this criterion.

Vulnerability and fulfillment of the criteria

Figure 23 shows the level of vulnerability of the different species of marine mammals.

The most vulnerable species are the beluga whale, harbour seal and grey seal. The North Atlantic right whale is the only species with medium vulnerability, while most species (i.e. two seals and seven cetaceans) have low vulnerability. Figure 24 details the scoring against the various criteria.

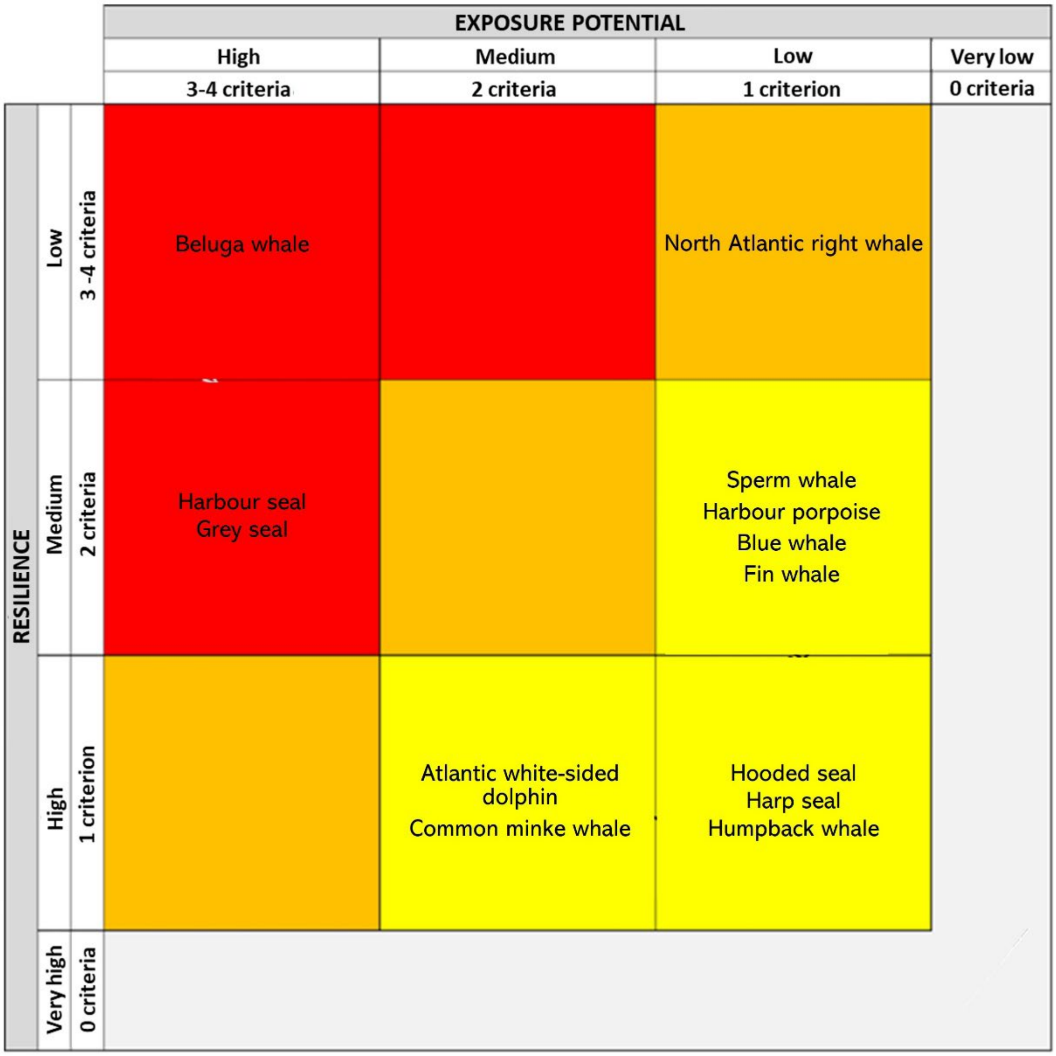

Figure 23. Vulnerability matrix for the marine mammals component

While all marine mammals received positive scores for two criteria, sea surface interacting and low reproductive capacity, none had a limited capacity for movement. The three highly vulnerable species had similar results for the other exposure potential criteria, since they all use the littoral zone and have aggregation potential. However, the beluga whale had lower resilience, receiving a positive score for all four criteria in this category, than the harbour and grey seals, which do not meet the criteria for population status and low recolonization potential. The low resilience of North Atlantic right whales makes them vulnerable (population status, low recolonization potential and low reproductive capacity), as their exposure potential is low (sea surface interacting only).

		Exposition				Resilience			
		Littoral zone	Surface	Movement	Aggregation	Status	Recolonization	Reproduction	Sediment
High	Beluga whale	■	■		■	■	■	■	■
	Harbour seal	■	■		■			■	■
	Grey seal	■	■		■			■	■
Medium	North Atlantic right whale		■			■	■	■	
Low	Minke whale	■	■					■	
	Atlantic white-sided dolphin		■		■			■	
	Sperm whale		■			■		■	
	Harbour porpoise		■			■		■	
	Blue whale		■			■		■	
	Fin whale		■			■		■	
	Hooded seal		■					■	
	Harp seal		■					■	
	Humpback whale		■					■	

Figure 24. Positive scores for the exposure potential and resilience criteria for marine mammals with high, medium and low vulnerability

Among the species with low vulnerability, three species (hooded seal, harp seal and humpback whale) only had positive scores for the two criteria for which all marine mammals were assigned positive scores. The other species had a positive score for an additional criterion: littoral zone use for the common minke whale; aggregation potential for the Atlantic white-sided dolphin; and population status for the sperm whale, harbour porpoise, blue whale and fin whale.

Uncertainty

Scoring uncertainty for the marine mammal component is nil. Although there are still a few knowledge gaps regarding marine mammal ranges, the assessment of the vulnerability of the species in this component was not affected by any of these gaps.

4. MODIFICATIONS TO THE NATIONAL FRAMEWORK

The vulnerability assessment presented in Section 3 shows that the Quebec Region approach meets the main objective of the mandate entrusted to DFO, specifically to conduct an assessment of the vulnerability of the biological components of the St. Lawrence to ship-source oil spills. The following section describes the various changes that the Quebec Region has made to the National Framework.

4.1. CHANGES TO GROUPS AND SUBGROUPS

The National Framework developed by Thornborough et al. (2017) allowed for a certain amount of flexibility in the creation of groups and subgroups of taxa to account for regional differences in Canada’s aquatic ecosystems. The use of taxa groups was intended to facilitate the scoring of criteria and reduce the effort that scoring individual taxa (i.e. genus or species) would require. It was also aimed at developing a classification approach, grouping together taxa that share similar characteristics with respect to their vulnerability to oil spills, as this would facilitate the subsequent analysis of results.

Table 6 summarizes the changes made by the Quebec Region to the classification approach set out in the National Framework. The proposed components were retained, except for marine reptiles, which are not represented in the study area. However, all subgroups (N1, N2, … Ni) were modified on the basis of practical considerations identified during the application of the National Framework. Among other factors, the assessment of individual taxa used represents a major difference between the Quebec Region’s application and the recommendations of the National Framework, and also increases the level of accuracy.

Table 6. Changes made by the Quebec Region to the National Framework classification

Component	Subgroups – National Framework	Subgroups – Quebec Region	Use of individual taxa
Algae/plants	N1: Pelagic/benthic N2: Vascular/non-vascular N3: Morphology	N1: Zone (vertical zonation) N2: Distribution range N3: Growth type N4: Taxonomic division N5: Form and shape N6: Taxa (in groups)	Yes (partial)
Invertebrates	N1: Midlittoral/ infralittoral benthic/pelagic N2: Preferred substrate N3: Mobility	N1: Taxonomy (three levels) N2: Zone (vertical zonation) N3: Taxa (in groups with examples of taxa)	Yes (partial)
Fish	N1: Preferred environment (intertidal, estuary, etc.) N2: Lifestyle (pelagic, demersal, diadromous) N3: Taxonomy	N1: Lifestyle (pelagic, demersal, diadromous) N2: Taxa (individuals)	Yes (all)
Marine mammals	N1: Taxonomy N2: Physical characteristics N3: Aggregation	N1: Taxonomy (two levels) N2: Taxa (individuals)	Yes (all)
Reptiles	N1: Sea turtle	No reptiles occur in the study area	N/A

4.1.1. Issues encountered

The main issue encountered during the classification process involved subgroup optimization, as the approach used required making several errors/attempts and proved to be more time consuming than assessing individual taxa. For example, if a group of intertidal sessile invertebrates is created, as per the National Framework, numerous taxa in this group will have the same score for limited capacity for movement, but not necessarily the same score for low reproductive capacity. This will make it necessary to create subgroups. The creation of these subgroups, which was initially intended to save time during scoring, requires very thorough knowledge of all the taxa in the component and extensive research to justify the scoring of each criterion.

Although the creation of subgroups is essential for components with a large number of taxa, such as algae/plants and invertebrates, individual taxon scoring was chosen for marine mammals and fish. The Quebec Region therefore used a hybrid method, which helped increase the accuracy of the analysis. The resulting assessment is exhaustive and may lend itself to purposes other than those for which it was developed.

4.2. CHANGES TO THE CRITERIA PROPOSED IN THE NATIONAL FRAMEWORK

Three major changes were made to the criteria proposed in the National Framework. The first involved the creation of a new criterion, littoral zone use (exposure potential category). The second is the dropping of the sediment interaction criterion in the exposure potential category and the third, the exclusion of all sensitivity criteria. All the other changes were aimed mainly at better defining the criteria, either by modifying the wording or clarifying the guidelines to make scoring less subjective and more consistent across the groups and components. All the changes are shown in Table 7.

Table 7. Description of, and rationale for, the changes made to the National Framework by the Quebec Region

Category	National	Quebec	Rationale
Exposure *(referred to as exposure potential)*	Concentration (aggregation) and/or site fidelity	Aggregation potential *Criterion modified*	The concept of site fidelity proposed in the National Framework was dropped. The complexity of defining this concept made it difficult to assign a score and maintain consistency across components. Site fidelity is more closely related to resilience.
	Sea surface interacting	Sea surface interacting *Guideline clarified*	The guideline specifies that the surface includes the air-water interface, the first metre of the water column and the midlittoral zone.
	Mobility	Limited capacity for movement *Name modified* *Guideline clarified*	The criterion was renamed to better reflect the factor that is associated with vulnerability to an oil spill. The guideline was refined by adding a movement speed (50 km/48 h) to reduce ambiguity.
	Sediment interacting	*Criterion not used in Quebec*	This criterion is the same as that included in the resilience category, which meant that the scoring for vulnerability associated with this criterion was duplicated.

Category	National	Quebec	Rationale
Exposure	N/A	Littoral zone use *New criterion added*	To replace the previous criterion, a criterion associated with occurrence in the nearshore environment was added. The nearshore environment includes the midlittoral and infralittoral zones to a depth of 10 metres. This part of the aquatic environment is one of the areas most severely affected in an oil spill (Lee et al. 2015).
Sensitivity	Loss of insulation	*Criterion not used in Quebec*	This criterion focused on furbearer taxa; oiling causes fur to lose its insulating properties and can lead to death. It was not used because, in Quebec, no taxa were assigned a score for this criterion. In addition, the criterion targets only the marine mammals component.
	Reduction of feeding/photosynthesis	*Criterion not used in Quebec*	This criterion was intended to target taxa with specific physiological structures such as baleen plates or filtering organs, which have a high risk of becoming clogged with oil, resulting in a reduced feeding capacity. This criterion targeted a specific physiological function, i.e. feeding, and excluded other physiological damage, such as impairment of respiratory capacity. It was therefore dropped.
	Impairment due to toxicity	*Criterion not used in Quebec*	Following a preliminary assessment of feasibility, the decision was made not to use this criterion. Using lethal toxicity thresholds to compare hydrocarbon sensitivity among a large number of species presents a number of problems, a primary one being the many knowledge gaps in this field. For example, lethal concentrations (LC_{50}) are only known for a small number of living organisms. Similarly, the methods and indicators used, and the oil types tested are not consistent throughout the literature. Therefore, it may be difficult to compare two studies on the same species (Rice et al. 1983; Lewis and Pryor 2013; Dupuis and Ucan-Marin 2015). Another problem relates to the systematic overestimation of sensitivity to different types of oils based on laboratory testing as compared with field observations (Macinnis-Ng and Ralph 2003).

Category	National	Quebec	Rationale
Resilience	Population status	Population status *Guideline clarified*	The scope of this criterion was limited to taxa that have official conservation status granted by a competent international, federal or provincial authority. The CESCC species status assessments (2016) were used in keeping with the National Framework's recommendation that any taxa with a greatly reduced or declining population be included in this criterion.
	Endemism or isolation	Low recolonization potential *Criterion modified*	This criterion proposed in the National Framework targeted endemic taxa, i.e. species with a single or isolated and genetically distinct population that is restricted to a limited biogeographical area. This criterion is applicable to a very limited number of taxa. The scope of the criterion was therefore broadened to include taxa with low recolonization potential if they occur in an impacted area. In addition to endemic species, it includes those with limited dispersal capacity and/or geographic isolation.
	Low reproductive capacity	Low reproductive capacity *Guideline clarified*	This criterion is not clearly defined in the National Framework, which makes it difficult to apply, particularly for invertebrates and fish. Where should the threshold for low reproductive capacity be set? The guideline was therefore clarified by adding well-defined keywords: *parental care, fecundity* and *mode of reproduction*.
	Close association with sediments	Association with sediment *Name modified* *Guideline clarified*	The name was changed slightly. The guideline now includes the reworking of sediment.

4.3. CHANGES IN THE SCORING, PROCESSING AND PRESENTATION OF RESULTS

The method set out in the National Framework recommends that the criteria be scored based on the most sensitive life stages in each subgroup created. This approach does not sufficiently differentiate the vulnerability of the various subgroups, since the early life stages are typically more vulnerable than the juvenile and adult stages. This is acknowledged in section 2.9.3 of the National Framework. Applying the precautionary approach to early life stages was deemed to be a way of obtaining a more accurate analysis, while recognizing that these life stages could be the focus of a more detailed analysis that is better adapted to this component.

The National Framework also recommends that the criteria for each category (exposure, sensitivity and resilience) be scored using a sequential approach, and that taxa not fulfilling any exposure criteria be excluded before scoring the next category of criteria. The subgroups selected through this approach would be ranked in descending order using the sum of the resilience criteria.

The Quebec Region adopted a different approach since the decision to exclude the sensitivity criteria resulted in there being two categories. We decided to use an approach based on a vulnerability matrix, which uses the sum of the scores obtained in the exposure and resilience categories. The matrix has four levels of vulnerability: high, medium, low and very low. The exposure potential is shown on the x-axis and the resilience on the y-axis. The various proposed changes to the National Framework result in a number of advantages including:

- a reduction in the number of levels of vulnerability from 11 to 4 (high, medium, low and very low);
- the ability to identify at a glance whether one taxon or taxa group is more vulnerable than another;
- the ability to identify at a glance whether a given taxon or taxa group is more vulnerable owing to its exposure potential or to its resilience; and
- the prevention of loss of resilience information owing to sequential scoring.

4.4. CONCLUSION

While the creation of subgroups is necessary for some components with a large number of taxa, this exercise is very demanding and requires input from experts. Care must be exercised in selecting, combining and determining the sequence of the classification levels, as they impact the number of groups and subgroups that are created and the scoring of the vulnerability criteria. Whenever possible, it is preferable to use individual taxa as this helps to increase the accuracy of the analysis.

Once the guidelines were clarified, the criteria set out in the National Framework proved to be efficient and relatively easy to apply, except for the sensitivity criteria. The guidelines adopted by the Quebec Region help to ensure scoring consistency across the biological components and taxa, and tend to reduce subjectivity. The use of a matrix is a clear and concise way to present results, which should facilitate the development of area response plans.

5. GENERAL CONCLUSION

- According to the results of the vulnerability assessment, 136 taxa groups (42%) are highly vulnerable, including 28% of marine and estuarine algae and plants, 56% of marine and estuarine invertebrates, 23% of marine, estuarine and diadromous fish, and 23% of marine mammals.
- The most vulnerable species by component are:
  - marine and estuarine algae and plants: common eelgrass and benthic algae with a limited distribution in the midlittoral/ infralittoral zone;
  - marine and estuarine invertebrates: *Lucernaria*; the taxa represented by *Nicomache lumbricalis*, minute hydrobe and Atlantic dogwinkle; midlittoral-zone-dwelling benthic amphipods with low recolonization potential; taxa represented by the polar six-rayed star

  and by the brittle star *Stegophiura nodosa*; midlittoral bryozoans; and midlittoral entoprocts;
  - marine, estuarine and diadromous fish: Atlantic sturgeon, ocean pout, rock gunnel and fish doctor;
  - marine mammals: beluga whale.

- The level of uncertainty related to the overall assessment is 25%: 20% for algae and plants, 34% for invertebrates, 9% for fish, and none for marine mammals. These uncertainties affected scoring accuracy. They are mainly attributable to the population status criterion.
- The National Framework was adapted to the Quebec Region to take into account the specific biological characteristics of the St. Lawrence ARP study area, and could be applied to other areas of the St. Lawrence or elsewhere in Canada.
- The criteria are sufficiently rigorous and clearly enough defined to meet the objectives of the mandate. They are independent and discriminating, and all of the criteria categories have an equal weighting. They also permit consistent application across the components.
- The changes made to the National Framework are appropriate and have made it possible to improve the accuracy of the analysis. Presenting the results in a matrix provides a simplified approach in support of oil spill response and planning.
- Vulnerability assessment is a useful reference tool for oil spill response and planning experts.
- Relative ecotoxicological sensitivities across species and the various life stages of a given species were not assessed owing to knowledge gaps. Including this information would ensure a more comprehensive assessment.

6. RECOMMENDATIONS AND FUTURE WORK

- Existing DFO databases on the taxa identified as vulnerable should be made available to Environment and Climate Change Canada's National Environmental Emergencies Centre (NEEC).
- The assessment results can be used to improve the protection of vulnerable biological components in the context of ship-source oil spill response and planning in the Quebec Region.
- The assessment results are valid for a limited time and must be updated given the population status criterion, which can change and affect a given species' level of vulnerability.
- If the event of a reassessment of the vulnerability of the St. Lawrence ARP study area:
  - The sensitivity of taxa to oil should be better integrated into the assessment and additional knowledge needs to be acquired.
  - The assessment results should be validated using examples from actual oil spills.
  - The criterion of [legal] population status could be modified and renamed state of the population, in collaboration with the Species at Risk team and the Stock Assessment team, who have datasets on commercial species and associated species.
  - The approach proved to be adequate for the assessment of individual species. However, for species that live in communities (e.g. algae, plants and invertebrates), a different approach to creating groups should be considered. The taxonomic approach could be

replaced by using a different scheme such as one based on the concept of functional groups.

- In future, this assessment could be used to create more synthetic tools that are adapted to different response levels. New information could also be used to enhance the results, such as introducing the concepts of ecologically significant species or functional groups (species that play a habitat structuring role or provide forage) or characterizing the habitat of highly vulnerable species for mapping purposes. Seasonality could also be addressed.

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APPENDIX 1. GLOSSARY

ABBREVIATIONS AND ACRONYMS

ARP: Area Response Plan (four pilot areas across Canada)

ARPI: Area Response Planning Initiative (under the responsibility of Transport Canada and the Canadian Coast Guard)

AZMP: Atlantic Zone Monitoring Program

BTEX: Low-molecular-weight monoaromatic hydrocarbons. The acronym stands for the group of compounds benzene, toluene, ethylbenzene and xylene.

CB: Combination of two benthic province: the circalittoral zone (depths of 20-200m) and the bathyal zone (depths of 200-500 m)

CCG: Canadian Coast Guard

CESCC: Canadian Endangered Species Conservation Council. The Council is made up of federal, provincial and territorial ministers responsible for plant and animal species. The CESCC is responsible for assessing the status of all species in Canada and reporting on this every five years.

COSEWIC: Committee on the Status of Endangered Wildlife in Canada. Organization tasked with assessing the conservation status of species and designating those that may be at risk in Canada.

DFO: Fisheries and Oceans Canada

ECCC: Environment and Climate Change Canada

GEP: Glacial epipelagic zone (depths of 40-200 m)

HHWLT: Higher high water large tide. The average of the highest high waters, 1 from each of 19 years of predictions (DFO 2017).

IUCN: International Union for Conservation of Nature. Organization that assesses the global extinction risk and status of wildlife species. It publishes a reference document on the status of threatened species called the Red List (The IUCN Red List of Threatened Species 2016).

LEMV: *Loi sur les espèces menacées ou vulnérables* [Act Respecting Threatened or Vulnerable Species] (Government of Quebec). Quebec legislation that governs the designation of species.

MP: Mesopelagic zone (depths of 200-500 m)

PAH: Polycyclic aromatic hydrocarbons

SARA: Species at Risk Act (Government of Canada). The purposes of SARA are to prevent wildlife species from being extirpated or becoming extinct, provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity, and manage species of special concern to prevent them from becoming endangered or threatened.

TC: Transport Canada

UEP: Upper epipelagic zone (depths of 0-40 m)

DEFINITIONS

Chart datum: The reference plane to which all depths on a published chart and all tide height predictions in tide tables are related (CHS 2024, Termium Plus 2025).

Component: A constituent part of a complex whole (Larousse 2017). For the purposes of this study, the four major components of the biocenosis of the St. Lawrence River are algae and plants, invertebrates, fish, and mammals.

Diadromous: Said of migratory fishes which migrate between the sea and freshwater, where they spend part of their life cycle (Termium Plus 2025, Ramade 2002).

Diel vertical migration: Daily vertical movement of some marine organisms at night and during the day between the surface layer of the ocean and the deep waters (NOAA 2024).

Direct development: Process of development whereby an organism already resembles the adult stage at birth or hatching and merely increases in size and weight as it matures (Ramade 2002, Merriam-Webster 2025).

Dispersal: Movement away from the place of birth (or origin) to another area, movement of individuals or their seed, larvae, or spores into or out of an area (Ferdous and Ahad 2019). Process by which individuals or species colonize or recolonize an area. For the purposes of this study, dispersal is considered possible when the eggs or larvae of a taxon are pelagic for more than 24 hours and/or the adults are pelagic and/or capable of more than limited movement. Fragmentation and resuspension of juveniles or adults by currents and waves are processes that enable dispersal. Taxa with natal homing† do not disperse.

Endemism: The condition of a subspecies or species native to, and restricted to a particular geographical region (Berthet 2006, Termium Plus 2025).

Epitoke: Pelagic morphs of polychaete marine worms (whose immature form is typically benthic) that rise to the surface in order to reproduce (Hébert *et al*. 2008, Pechenik 2015).

Fecundity: The reproductive capacity of a living organism (Parent 1990, Termium Plus 2025). An organism is considered fecund if it is iteroparous† rather than semelparous†, if it produces a large number of eggs (more than 500 [large], 50 to 500 [medium], 1 to 50 [small]), and if it is long-lived and matures early.

Geographic isolation: Physical separation of populations of organisms from one another due to geographic barriers, such as distance (GDT 2025). This can lead to endemism†.

Gregarious: Pertaining to animal species in which individuals tend to live together in groups, instead of on their own and spatially dispersed in their habitat (Ramade 2002, Termium Plus 2025).

High water mark: A line indicating the higher high water large tide (HHWLT).

Iteroparous: A living organism that reproduces more than once in its lifetime (Termium Plus 2025).

Midlittoral: The zone of a seashore which is both covered and uncovered by neap tides (Terminum Plus 2025). It lies between mean high water spring tide and mean low water spring tide (Brunel *et al.* 1998).

Mode of reproduction: Living organisms have two main modes of reproduction: sexual reproduction and asexual reproduction. It is considered in this study that asexual reproduction increases reproductive capacity.

Natal homing: Ability of a migratory animal to return to natal site to reproduce (Termium Plus 2025). It is a fundamental life-history trait of most anadromous salmon and trout.

Neritic zone: Pertains to the part of the ocean that lies between the littoral zone and the continental shelf break [depth of around 200 m] (GDT 2025).

Opportunistic: Said of organisms that are able to quickly exploit new resources and habitats that become available. They are typically found in unpredictable and transient environments, including ones that are undergoing succession (Science Encyclopedia 2025).

Ovoviviparous: Said of animals that produce eggs that hatch within the maternal body (Termium Plus 2025).

Parental care: Behaviour of an adult animal that includes providing prenatal care, such as nest preparation and incubation, and postnatal care. Postnatal care requires significant parental investment.

Perennial: Vegetation (algae or plants) that lives for several years or growing seasons (Termium Plus 2025).

Photic zone: The upper layer of a body of water where light penetration is sufficient to support effective photosynthesis (Termium Plus 2025).

Reworking: Displacement of sediment particles by benthic organisms through their feeding, defecation, locomotion and burrowing activities, or through their construction of biogenic structures such as burrows or tubes/tunnels (Meysman *et al*. 2006).

Sediment: Deposits composed of unconsolidated material of mineral or organic (biogenic) origin, variable in nature (Ramade 2002, Termium Plus 2025).

Semelparous: A living organism that reproduces only once after reaching the adult stage and usually dies soon afterwards (Ramade 2002, Termium Plus 2025).

Sessile: A living organism that are not free to move about, because they spend their lives attached to an inert or living substrate (Ramade 2002, Termium Plus 2025).

Species: In this document, the term ”species” is sometime used in the broad sense, and equates to taxon[†]. This choice was made in order to simplify the text for readers. In other instances, the term may refer to the taxonomic classification level.

Supralittoral: Coastal zone above the mean high water spring tide (Brunel *et al.* 1998).

Taxon: Any group of organisms treated as a taxonomic unit, regardless of level (Berthet 2006, Termium Plus 2025).

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APPENDIX 2. MAJOR OIL SPILLS

Major oil spills in the Northern Hemisphere between 1967 and 2017.

Name	Location	Date	Oil type	Quantity (tonnes)
Amoco Cadiz	Brittany (France)	March 16, 1978	Crude	227,000
MV Braer	Shetland (Scotland)	January 5, 1993	Crude	85,000
Deepwater Horizon	Gulf of Mexico (U.S.)	April 20, 2010	Crude	780,000
Erika	Brittany (France)	December 12, 1999	Refined (No. 2 fuel oil)	20,000
Exxon Valdez	Alaska (U.S.)	March 24, 1989	Crude	38,500
Florida	Massachusetts	September 16, 1969	Refined (No. 2 fuel oil)	650
North Cape	Rhode Island (U.S.)	January 19, 1996	Refined (Diesel, heating oil)	2,5600
Sea Empress	United Kingdom	February 15, 1996	Crude	73,000
Tsesis	Sweden	October 26, 1977	Refined (No. 5 fuel oil)	18,000

Sources: Cedre 2017, ITOPF 2017

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REMB: Regional Ecosystems Management Branch
DBSB: Demersal and Benthic Science Branch
PESB: Pelagic and Ecosystem Science Branch
MFFP: Quebec Ministère des Forêts, de la Faune et des Parcs
UQAR: Université du Québec à Rimouski

APPENDIX 4. SPECIES WITH OFFICIAL STATUS

List of species with official conservation status (international, federal or provincial), in 2016, by biological component.

		POPULATION STATUS								
		IUCN (International)			COSEWIC (Federal)			SARA	LEMV (Provincial, QC)	
COMPONENT	SPECIES	Near Threatened	Vulnerable	Endangered	Special Concern	Threatened	Endangered	Listed in Schedule 1	Vulnerable	Threatened
MARINE MAMMALS	North Atlantic Right Whale (*Eubalaena glacialis*)	-	-	X	-	-	X	X	-	-
	Beluga Whale (*Delphinapterus leucas*)	X	-	-	-	-	X	X	-	X
	Sperm Whale (*Physeter macrocephalus*)	-	X	-	-	-	-	-	-	-
	Harbour Porpoise (*Phocoena phocoena*)	-	-	-	X	-	-	-	-	-
	Blue Whale (*Balaenoptera musculus*)	-	-	X	-	-	X	X	-	-
	Fin Whale (*Balaenoptera physalus*)	-	-	X	X	-	-	X	-	-
FISH	Spiny Dogfish (*Squalus acanthias*)	-	-	-	X	-	-	-	-	-
	American Shad (*Alosa sapidissima*)	-	-	-	-	-	-	-	X	-
	American Eel (*Anguilla rostrata*)	-	-	X	-	X	-	-	-	-
	Striped Bass (*Morone saxatilis*)	-	-	-	-	-	X	X	-	-
	Rainbow Smelt (*Osmerus mordax*)	-	-	-	-	-	-	-	X	-
	Atlantic Sturgeon (*Acipenser oxyrinchus*)	X	-	-	-	X	-	-	-	-
	Atlantic Halibut (*Hippoglossus hippoglossus*)	-	-	X	-	-	-	-	-	-
	Greenland Shark (*Somniosus microcephalus*)	X	-	-	-	-	-	-	-	-
	Atlantic Wolffish (*Anarhichas lupus*)	-	-	-	X	-	-	X	-	-
	Spotted Wolffish (*Anarhichas minor*)	-	-	-	-	X	-	X	-	-
	Porbeagle (*Lamna nasus*)	-	-	-	-	-	X	-	-	-
	Silver Hake (*Merluccius bilinearis*)	X	-	-	-	-	-	-	-	-
	White Hake (*Urophycis tenuis*)	-	-	-	-	X	-	-	-	-
	Atlantic Cod (*Gadus morhua*)	-	-	-	-	-	X	-	-	-
	American Plaice (*Hippogloissoides platessoides*)	-	-	-	-	X	-	-	-	-
	Smooth Skate (*Malacoraja senta*)	-	-	X	X	-	-	-	-	-
	Spinytail Skate (*Bathyraja spinicauda*)	-	X	-	-	-	-	-	-	-
	Thorny Skate (*Amblyraja radiata*)	-	-	-	X	-	-	-	-	-
	Basking Shark (*Cetorhinus maximus*)	-	-	-	X	-	-	-	-	-
	Atlantic Salmon (*Salmo salar*)	-	-	-	X	-	-	-	-	-
	Deepwater Redfish (*Sebastes mentella*)	-	-	-	-	-	X	-	-	-
	Acadian Redfish (*Sebastes fasciatus*)	-	-	-	-	X	-	-	-	-

APPENDIX 5. EXPOSURE POTENTIAL AND RESILIENCE ASSESSMENT TABLES

5.1. MARINE AND ESTUARINE ALGAE AND PLANTS

5.1.1. Exposure potential

Assessment of marine and estuarine algae and plant taxa groups in the St. Lawrence ARP study area on the basis of exposure potential criteria

							CRITERIA USED TO ASSESS EXPOSURE POTENTIAL								
							LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
SUB-COMPONENT	ZONE	DISTRIBUTION	GROWTH TYPE	TAXONOMIC DIVISION	FORM AND SHAPE	TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
PHYTOPLANKTON	**PELAGIC**	**WIDE**	**ANNUAL AND/OR OPPORTUNISTIC**	**N/A**	**Unicellular**	Autotrophic protists	0	Dufour et al. 2010	1	Dufour et al. 2010	1	Dufour et al. 2010	1	Dufour et al. 2010	3
BENTHIC ALGAE	**MIDLITTORAL / INFRALITTORAL**	**WIDE**	**ANNUAL AND/OR OPPORTUNISTIC**	**GREEN ALGAE**	**Small epiphytic**	*Chlorochytrium cohnii, Percursaria percursa, Ulothrix flacca, Ulothrix implexa, Ulvella scutata*	1	Couillard et al. 1973 Cardinal 1990	1	Chabot and Rossignol 2003 Couillard et al. 1973 Edelstein et al. 1969 Leclerc 1987 Mathieson et al. 2008	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3

							CRITERIA USED TO ASSESS EXPOSURE POTENTIAL								
							LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
SUB-COMPONENT	**ZONE**	**DISTRIBUTION**	**GROWTH TYPE**	**TAXONOMIC DIVISION**	**FORM AND SHAPE**	**TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
					Thin membranous	*Blidingia minima, Capsosiphon fulvescens, Gayralia oxysperma, Monostroma grevillea, Protomonostroma undulatum, Pseudothrix groenlandica, Ulva compressa, Ulva flexuosa* subsp. *paradoxa, Ulva intestinalis, Ulva lactuca, Ulva linza, Ulva prolifera, Ulva prolifera* var. *blidingiana, Ulvaria obscura*	1	Couillard et al. 1973 Cardinal 1990	1	Chabot and Rossignol 2003 Couillard et al. 1973 Edelstein et al. 1969 Gauvreau 1956 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
BENTHIC ALGAE	**MIDLITTORAL / INFRALITTORAL**	**WIDE**	**ANNUAL AND/OR OPPORTUNISTIC**	**GREEN ALGAE**	**Filamentous**	*Acrosiphonia arcta, Chaetomorpha aerea, Chaetomorpha capillaris, Chaetomorpha melagonium, Rhizoclonium riparium, Spongomorpha aeruginosa, Spongomorpha arcta, Urospora penicilliformis, Urospora wormskjoldii*	1	Couillard et al. 1973 Cardinal 1990	1	Chabot and Rossignol 2003 Couillard et al. 1973 Edelstein et al. 1969 Gauvreau 1956 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
				RED ALGAE	**Small epiphytic**	*Bangia atropurpurea, Bangia fuscopurpurea*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Gauvreau 1956 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
					Thin membranous	*Porphyra linearis, Porphyra umbilicalis, Wildemania miniata*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Edelstein et al. 1969 Gauvreau 1956 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3

							CRITERIA USED TO ASSESS EXPOSURE POTENTIAL								
							LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
SUB-COMPONENT	**ZONE**	**DISTRIBUTION**	**GROWTH TYPE**	**TAXONOMIC DIVISION**	**FORM AND SHAPE**	**TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
					Filamentous	*Antithamnion cruciatum, Ceramium virgatum, Harveyella mirabilis, Polysiphonia flexicaulis, Polysiphonia stricta, Polysiphonia subtilissima, Scagelia pylaisaei, Scagelothamnion pusillum, Scytosiphon complanatus*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Edelstein 1970 Edelstein et al. 1969 Gauvreau 1956 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
				BROWN ALGAE	**Small epiphytic**	*Elachista fucicola, Laminariocolax tomentosoides, Myrionema strangulans*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Gauvreau 1956 Leclerc 1987 Lockhart 1979	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
BENTHIC ALGAE	**MIDLITTORAL / INFRALITTORAL**	**WIDE**	**ANNUAL AND/OR OPPORTUNISTIC**	**BROWN ALGAE**	**Thin membranous**	*Asperococcus fistulosus*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Gauvreau 1956 Fortes and Lüning 1980	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
					Aggregated, thin membranous	*Coilodesme bulligera, Petalonia fascia, Scytosiphon lomentaria*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Gauvreau 1956 Leclerc 1987	1	Wilkinson and Wood 2003	1	Gauvreau 1956 Leclerc 1987	4
					Filamentous	*Battersia arctica, Ectocarpus fasciculatus, Ectocarpus siliculosus, Isthmoplea sphaerophora, Pylaiella littoralis*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Edelstein et al. 1969 Gauvreau 1956 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3

							CRITERIA USED TO ASSESS EXPOSURE POTENTIAL								
							LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
SUB-COMPONENT	**ZONE**	**DISTRIBUTION**	**GROWTH TYPE**	**TAXONOMIC DIVISION**	**FORM AND SHAPE**	**TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
					Cartilaginous	*Chordaria flagelliformis, Desmarestia viridis, Dictyosiphon foeniculaceus, Dictyosiphon macounii*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Edelstein et al. 1969 Gauvreau 1956 Gosner 1978 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
					Aggregated, leathery	*Alaria esculenta, Chorda filum, Fucus vesiculosus, Saccharina longicruris, Saccorhiza dermatodea*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Edelstein et al. 1969 Gauvreau 1956 Leclerc 1987	1	Wilkinson and Wood 2003	1	Chabot and Rossignol 2003 Gagnon et al. 2004 Leclerc 1987 Tamigneaux and Johnson 2016	4
			PERENNIAL	**RED ALGAE**	**Thin membranous**	*Phycodrys rubens*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Edelstein et al. 1969 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
BENTHIC ALGAE	**MIDLITTORAL / INFRALITTORAL**	**WIDE**	**PERENNIAL**	**RED ALGAE**	**Filamentous**	*Polysiphonia elongata, Rhodomela confervoides, Rhodomela lycopodioides, Scagelia americana*	1	Couillard et al. 1973 Cardinal 1990	1	Bird and McLachlan 1992 Couillard et al. 1973 Edelstein et al. 1969 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
					Cartilaginous	*Ahnfeltia plicata, Cystoclonium purpureum, Membranoptera alata, Odonthalia dentata*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Edelstein et al. 1969 Gauvreau 1956 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3

SUB-COMPONENT	ZONE	DISTRIBUTION	GROWTH TYPE	TAXONOMIC DIVISION	FORM AND SHAPE	TAXA	LITTORAL ZONE USE: SCORE	LITTORAL ZONE USE: SOURCE	SEA SURFACE INTERACTING: SCORE	SEA SURFACE INTERACTING: SOURCE	LIMITED CAPACITY FOR MOVEMENT: SCORE	LIMITED CAPACITY FOR MOVEMENT: SOURCE	AGGREGATION POTENTIAL: SCORE	AGGREGATION POTENTIAL: SOURCE	TOTAL
					Aggregated, cartilaginous	*Chondrus crispus, Devaleraea ramentacea*	1	Couillard et al. 1973 Cardinal 1990	1	Edelstein et al. 1969 Leclerc 1987	1	Wilkinson and Wood 2003	1	Leclerc 1987 Santelices 1990	4
					Leathery	*Dilsea socialis, Palmaria palmata*	1	Couillard et al. 1973 Cardinal 1990	1	Chabot and Rossignol 2003 Couillard et al. 1973 Edelstein et al. 1969 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
					Erect, calcareous	*Corallina officinalis*	1	Couillard et al. 1973 Cardinal 1990	1	Chabot and Rossignol 2003 Edelstein et al. 1969	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
					Encrusting	*Clathromorphum circumscriptum, Hildenbrandia rubra, Rhodochorton purpureum*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Gauvreau 1956 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
BENTHIC ALGAE	MIDLITTORAL / INFRALITTORAL	WIDE	PERENNIAL	BROWN ALGAE	**Leathery**	*Fucus distichus, Fucus evanescens, Fucus spiralis*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Leclerc 1987	1	Wilkinson and Wood 2003	0*	Chabot and Rossignol 2003	3
					Aggregated, leathery	*Ascophyllum nodosum, Fucus edentatus, Laminaria digitata, Saccharina latissima*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Leclerc 1987	1	Wilkinson and Wood 2003	1	Chabot and Rossignol 2003 Gagnon et al. 2004	4

							CRITERIA USED TO ASSESS EXPOSURE POTENTIAL								
							LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
SUB-COMPONENT	**ZONE**	**DISTRIBUTION**	**GROWTH TYPE**	**TAXONOMIC DIVISION**	**FORM AND SHAPE**	**TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
					Encrusting	*Ralfsia fungiformis, Stragularia clavata*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
		LIMITED	**ANNUAL AND/OR OPPORTUNISTIC**	**GREEN ALGAE**	**Small epiphytic**	*Epicladia perforans, Gomontia polyrhiza, Pseudendoclonium submarinum, Pseudopringsheimia confluens, Tellamia contorta, Ulothrix laetevirens, Ulvella repens, Ulvella viridis, Ulvella wittrockii*	1	Couillard et al. 1973 Cardinal 1990	1	Chabot and Rossignol 2003 Couillard et al. 1973 Edelstein et al. 1969 Leclerc 1987 Mathieson et al. 2008	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
					Thin membranous	*Blidingia marginata, Kornmannia leptoderma, Protomonostroma undulatum f. pulchrum, Ulva clathrata, Ulva kylinii, Ulva rigida*	1	Couillard et al. 1973 Cardinal 1990	1	Chabot and Rossignol 2003 Couillard et al. 1973 Edelstein et al. 1969 Gauvreau 1956 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
BENTHIC ALGAE	**MIDLITTORAL/ INFRALITTORAL**	**LIMITED**	**ANNUAL AND/OR OPPORTUNISTIC**	**GREEN ALGAE**	**Filamentous**	*Chaetomorpha cannabina, Chaetomorpha linum, Cladophora albida, Cladophora sericea*	1	Couillard et al. 1973 Cardinal 1990	1	Chabot and Rossignol 2003 Couillard et al. 1973 Edelstein et al. 1969 Gauvreau 1956 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
				RED ALGAE	**Small epiphytic**	*Erythrotrichia carnea*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Gauvreau 1956 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3

							CRITERIA USED TO ASSESS EXPOSURE POTENTIAL								
							LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
SUB-COMPONENT	ZONE	DISTRIBUTION	GROWTH TYPE	TAXONOMIC DIVISION	FORM AND SHAPE	TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
					Filamentous	*Ceramium diaphanum* var. *elegans, Neosiphonia harveyi*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Edelstein 1970 Edelstein et al. 1969 Gauvreau 1956 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
					Cartilaginous	*Agardhiella subulata*	1	Couillard et al. 1973	1	Gabrielson and Hommersand 1982	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
				BROWN ALGAE	Small epiphytic	*Cladosiphon zosterae, Laminariocolax aecidioides, Mikrosyphar porphyrae*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Gauvreau 1956 Leclerc 1987 Lockhart 1979	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
					Thin membranous	*Punctaria latifolia, Punctaria plantaginea*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Gauvreau 1956 Fortes and Lüning 1980	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
BENTHIC ALGAE	MIDLITTORAL / INFRALITTORAL	LIMITED	ANNUAL AND/OR OPPORTUNISTIC	BROWN ALGAE	Filamentous	*Spongonema tomentosum*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Edelstein et al. 1969 Gauvreau 1956 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3

							CRITERIA USED TO ASSESS EXPOSURE POTENTIAL								
							LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
SUB-COMPONENT	ZONE	DISTRIBUTION	GROWTH TYPE	TAXONOMIC DIVISION	FORM AND SHAPE	TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
					Cartilaginous	*Dictyosiphon ekmanii*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Edelstein et al. 1969 Gauvreau 1956 Gosner 1978 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
			PERENNIAL	**RED ALGAE**	**Filamentous**	*Polysiphonia fucoides, Polysiphonia novae-angliae*	1	Couillard et al. 1973 Cardinal 1990	1	Bird and McLachlan 1992 Couillard et al. 1973 Edelstein et al. 1969 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
					Cartilaginous	*Polyides rotunda*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Edelstein et al. 1969 Gauvreau 1956 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
					Encrusting	*Lithophyllum orbiculatum*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Gauvreau 1956 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3
				BROWN ALGAE	**Encrusting**	*Petroderma maculiforme, Ralfsia bornetii, Ralfsia verrucosa*	1	Couillard et al. 1973 Cardinal 1990	1	Couillard et al. 1973 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	3

							CRITERIA USED TO ASSESS EXPOSURE POTENTIAL								
							LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
SUB-COMPONENT	ZONE	DISTRIBUTION	GROWTH TYPE	TAXONOMIC DIVISION	FORM AND SHAPE	TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
BENTHIC ALGAE	INFRALITTORAL	WIDE	ANNUAL AND/OR OPPORTUNISTIC	BROWN ALGAE	**Small epiphytic**	*Endodictyon infestans, Halosiphon tomentosus, Litosiphon laminariae*	1	Couillard et al. 1973 Cardinal 1990	0	Couillard et al. 1973 Edelstein et al. 1969 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	2
					Filamentous	*Leptonematella fasciculata*	1	Couillard et al. 1973 Cardinal 1990	0	Couillard et al. 1973 Edelstein et al. 1969	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	2
					Aggregated, filamentous	*Pogotrichum filiforme*	1	Couillard et al. 1973 Cardinal 1990	0	Couillard et al. 1973 Leclerc 1987	1	Wilkinson and Wood 2003	1	Leclerc 1987	3
			PERENNIAL	RED ALGAE	**Filamentous**	*Polysiphonia arctica, Ptilota serrata*	1	Couillard et al. 1973 Cardinal 1990	0	Couillard et al. 1973 Edelstein et al. 1969 Kjellman 1883 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	2
					Cartilaginous	*Coccotylus truncatus, Euthora cristata, Fimbrifolium dichotomum, Pantoneura fabriciana, Phyllophora pseudoceranoides*	1	Couillard et al. 1973 Cardinal 1990	0	Chabot and Rossignol 2003 Couillard et al. 1973 Edelstein et al. 1969 Leclerc 1987 Mathieson et al. 2008	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	2

							CRITERIA USED TO ASSESS EXPOSURE POTENTIAL								
							LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
SUB-COMPONENT	ZONE	DISTRIBUTION	GROWTH TYPE	TAXONOMIC DIVISION	FORM AND SHAPE	TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
					Aggregated, erect, calcareous	*Lithothamnion glaciale*	1	Cardinal 1990	0	Chabot and Rossignol 2003 Kenchington 2014	1	Wilkinson and Wood 2003	1	Kenchington 2014	3
BENTHIC ALGAE	**INFRALITTORAL**	**WIDE**	**PERENNIAL**	**RED ALGAE**	**Encrusting**	*Clathromorphum compactum, Leptophytum laeve, Lithothamnion lemoineae, Peyssonnelia rosenvingei*	1	Cardinal 1990	0	Chabot and Rossignol 2003 Couillard et al. 1973 Edelstein et al. 1969 Sears 1998	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	2
				BROWN ALGAE	**Cartilaginous**	*Desmarestia aculeata*	1	Couillard et al. 1973 Cardinal 1990	0	Couillard et al. 1973 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	2
					Leathery	*Agarum clathratum*	1	Couillard et al. 1973 Cardinal 1990	0	Couillard et al. 1973 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	2
		LIMITED	**ANNUAL AND/OR OPPORTUNISTIC**	**GREEN ALGAE**	**Small epiphytic**	*Epicladia flustrae*	1	Couillard et al. 1973 Cardinal 1990	0	Couillard et al. 1973	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	2

							CRITERIA USED TO ASSESS EXPOSURE POTENTIAL								
							LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
SUB-COMPONENT	**ZONE**	**DISTRIBUTION**	**GROWTH TYPE**	**TAXONOMIC DIVISION**	**FORM AND SHAPE**	**TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
				RED ALGAE	**Small epiphytic**	*Meiodiscus spetsbergensis*	1	Cardinal 1990	0	Bird and McLachlan 1992	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	2
					Thin membranous	*Kallymenia schmitzii*	1	Cardinal 1990	0	Lüning 1990	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	2
BENTHIC ALGAE	**INFRALITTORAL**	**LIMITED**	**ANNUAL AND/OR OPPORTUNISTIC**	**BROWN ALGAE**	**Small epiphytic**	*Hincksia ovata*	1	Couillard et al. 1973 Cardinal 1990	0	Couillard et al. 1973 Edelstein et al. 1969 Leclerc 1987	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	2
					Filamentous	*Ectocarpus penicillatus, Sphacelaria cirrosa*	1	Couillard et al. 1973 Cardinal 1990	0	Couillard et al. 1973 Edelstein et al. 1969	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	2
			PERENNIAL	**RED ALGAE**	**Leathery**	*Turnerella pennyi*	1	Couillard et al. 1973 Cardinal 1990	0	Couillard et al. 1973 Edelstein et al. 1969	1	Wilkinson and Wood 2003	0	Gauvreau 1956 Leclerc 1987	2

							CRITERIA USED TO ASSESS EXPOSURE POTENTIAL								
							LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
SUB-COMPONENT	**ZONE**	**DISTRIBUTION**	**GROWTH TYPE**	**TAXONOMIC DIVISION**	**FORM AND SHAPE**	**TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
PLANTS	**MIDLITTORAL / INFRALITTORAL**	**WIDE**		**N/A**	**N/A**	Common three-square bulrush (*Schoenoplectus pungens*), smooth cordgrass (*Spartina alterniflora*)	1	Dufour and Ouellet (eds.) 2007	1	Dufour and Ouellet (eds.) 2007	1	Dufour and Ouellet (eds.) 2007	1	Dufour and Ouellet (eds.) 2007	4
	INFRALITTORAL			**N/A**	**N/A**	Common eelgrass *(Zostera marina)*	1	DFO 2009	1	DFO 2009	1	DFO 2009	1	DFO 2009	4

5.1.2. Resilience

Assessment of marine and estuarine algae and plant taxa groups in the St. Lawrence ARP study area on the basis of resilience criteria

							RESILIENCE CRITERIA								
							POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
SUB-COMPONENT	ZONE	DISTRIBUTION	GROWTH TYPE	TAXONOMIC DIVISION	FORM AND SHAPE	TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
PHYTOPLANKTON	PELAGIC	WIDE	ANNUAL AND/OR OPPORTUNISTIC	N/A	Unicellular	Autotrophic protists	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Dufour et al. 2010	0	Dufour et al. 2010	0	Dufour et al. 2010	1
BENTHIC ALGAE	MIDLITTORAL / INFRALITTORAL			GREEN ALGAE	Small epiphytic	*Chlorochytrium cohnii, Percursaria percursa, Ulothrix flacca, Ulothrix implexa, Ulvella scutata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	1
					Thin membranous	*Blidingia minima, Capsosiphon fulvescens, Gayralia oxysperma, Monostroma grevillea, Protomonostroma undulatum, Pseudothrix groenlandica, Ulva compressa, Ulva flexuosa* subsp. *paradoxa, Ulva intestinalis, Ulva lactuca, Ulva linza, Ulva prolifera, Ulva prolifera* var. *blidingiana, Ulvaria obscura*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	1

SUB-COMPONENT	ZONE	DISTRIBUTION	GROWTH TYPE	TAXONOMIC DIVISION	FORM AND SHAPE	TAXA	RESILIENCE CRITERIA: POPULATION STATUS SCORE	POPULATION STATUS SOURCE	LOW RECOLONIZATION POTENTIAL SCORE	LOW RECOLONIZATION POTENTIAL SOURCE	LOW REPRODUCTIVE CAPACITY SCORE	LOW REPRODUCTIVE CAPACITY SOURCE	ASSOCIATION WITH SEDIMENT SCORE	ASSOCIATION WITH SEDIMENT SOURCE	TOTAL
BENTHIC ALGAE	MIDLITTORAL / INFRALITTORAL	WIDE	ANNUAL AND/OR OPPORTUNISTIC	GREEN ALGAE	**Filamentous**	*Acrosiphonia arcta, Chaetomorpha aerea, Chaetomorpha capillaris, Chaetomorpha melagonium, Rhizoclonium riparium, Spongomorpha aeruginosa, Spongomorpha arcta, Urospora penicilliformis, Urospora wormskjoldii*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	1
				RED ALGAE	**Small epiphytic**	*Bangia atropurpurea, Bangia fuscopurpurea*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	1
					Thin membranous	*Porphyra linearis, Porphyra umbilicalis, Wildemania miniata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	1
					Filamentous	*Antithamnion cruciatum, Ceramium virgatum, Harveyella mirabilis, Polysiphonia flexicaulis, Polysiphonia stricta, Polysiphonia subtilissima, Scagelia pylaisaei, Scagelothamnion pusillum, Scytosiphon complanatus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	1

							RESILIENCE CRITERIA								
							POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
SUB-COMPONENT	**ZONE**	**DISTRIBUTION**	**GROWTH TYPE**	**TAXONOMIC DIVISION**	**FORM AND SHAPE**	**TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
				BROWN ALGAE	**Small epiphytic**	*Elachista fucicola, Laminariocolax tomentosoides, Myrionema strangulans*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	1
BENTHIC ALGAE	**MIDLITTORAL / INFRALITTORAL**	**WIDE**	**ANNUAL AND/OR OPPORTUNISTIC**	**BROWN ALGAE**	**Thin membranous**	*Asperococcus fistulosus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	1
					Aggregated, membranous	*Coilodesme bulligera, Petalonia fascia, Scytosiphon lomentaria*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Luthringer et al. 2014 Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	1
					Filamentous	*Battersia arctica, Ectocarpus fasciculatus, Ectocarpus siliculosus, Isthmoplea sphaerophora, Pylaiella littoralis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Luthringer et al. 2014 Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	1
					Cartilaginous	*Chordaria flagelliformis, Desmarestia viridis, Dictyosiphon foeniculaceus, Dictyosiphon macounii*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Luthringer et al. 2014 Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	1
					Aggregated, leathery	*Alaria esculenta, Chorda filum, Fucus vesiculosus, Saccharina longicruris, Saccorhiza dermatodea*	1'	CESCC 2016 COSEWIC 2016	0	Cardinal 1990 Couillard et al. 1973	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	1

							RESILIENCE CRITERIA								
							POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
SUB-COMPONENT	ZONE	DISTRIBUTION	GROWTH TYPE	TAXONOMIC DIVISION	FORM AND SHAPE	TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
								Gouv. du Québec 2016 IUCN 2016		South and Titley 1986					
BENTHIC ALGAE	MIDLITTORAL / INFRALITTORAL	WIDE	PERENNIAL	RED ALGAE	**Thin membranous**	*Phycodrys rubens*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Schoschina 1996	0	Chabot and Rossignol 2003 Leclerc 1987	1
					Filamentous	*Polysiphonia elongata, Rhodomela confervoides, Rhodomela lycopodioides, Scagelia americana*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0*	Santelices 1990 Thornber 2006	0	Chabot and Rossignol 2003 Leclerc 1987	1
					Cartilaginous	*Ahnfeltia plicata, Cystoclonium purpureum, Membranoptera alata, Odonthalia dentata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0*	Santelices 1990 Thornber 2006	0	Chabot and Rossignol 2003 Leclerc 1987	1

							RESILIENCE CRITERIA								
							POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
SUB-COMPONENT	**ZONE**	**DISTRIBUTION**	**GROWTH TYPE**	**TAXONOMIC DIVISION**	**FORM AND SHAPE**	**TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
BENTHIC ALGAE	**MIDLITTORAL / INFRALITTORAL**	**WIDE**	**PERENNIAL**	**RED ALGAE**	**Aggregated, cartilaginous**	*Chondrus crispus, Devaleraea ramentacea*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0*	Santelices 1990 Thornber 2006	0	Chabot and Rossignol 2003 Leclerc 1987	1
					Leathery	*Dilsea socialis, Palmaria palmata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0*	Santelices 1990 Thornber 2006	0	Chabot and Rossignol 2003 Leclerc 1987	1
					Erect, calcareous	*Corallina officinalis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0*	Santelices 1990 Thornber 2006	0	Chabot and Rossignol 2003 Leclerc 1987	1

							RESILIENCE CRITERIA								
							POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
SUB-COMPONENT	ZONE	DISTRIBUTION	GROWTH TYPE	TAXONOMIC DIVISION	FORM AND SHAPE	TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
					Encrusting	*Clathromorphum circumscriptum, Hildenbrandia rubra, Rhodochorton purpureum*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0*	Santelices 1990 Thornber 2006	0	Chabot and Rossignol 2003 Leclerc 1987	1
BENTHIC ALGAE	**MIDLITTORAL / INFRALITTORAL**	**WIDE**	**PERENNIAL**	**BROWN ALGAE**	**Leathery**	*Fucus distichus, Fucus evanescens, Fucus spiralis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Luthringer et al. 2014	0	Chabot and Rossignol 2003 Leclerc 1987	1
					Aggregated, leathery	*Ascophyllum nodosum, Fucus edentatus, Laminaria digitata, Saccharina latissima*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Aberg and Pavia 1997 Luthringer et al. 2014 Vadas et al. 1990	0	Chabot and Rossignol 2003 Leclerc 1987	1

							RESILIENCE CRITERIA								
							POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
SUB-COMPONENT	ZONE	DISTRIBUTION	GROWTH TYPE	TAXONOMIC DIVISION	FORM AND SHAPE	TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
					Encrusting	*Ralfsia fungiformis, Stragularia clavata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Luthringer et al. 2014	0	Chabot and Rossignol 2003 Leclerc 1987	1
BENTHIC ALGAE	**MIDLITTORAL / INFRALITTORAL**	**LIMITED**	**ANNUAL AND/OR OPPORTUNISTIC**	**GREEN ALGAE**	**Small epiphytic**	*Epicladia perforans, Gomontia polyrhiza, Pseudendoclonium submarinum, Pseudopringsheimia confluens, Tellamia contorta, Ulothrix laetevirens, Ulvella repens, Ulvella viridis, Ulvella wittrockii*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	2
					Thin membranous	*Blidingia marginata, Kornmannia leptoderma, Protomonostroma undulatum f. pulchrum, Ulva clathrata, Ulva kylinii, Ulva rigida*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	2
					Filamentous	*Chaetomorpha cannabina, Chaetomorpha linum, Cladophora albida, Cladophora sericea*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	2

							RESILIENCE CRITERIA								
							POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
SUB-COMPONENT	ZONE	DISTRIBUTION	GROWTH TYPE	TAXONOMIC DIVISION	FORM AND SHAPE	TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
BENTHIC ALGAE	MIDLITTORAL / INFRALITTORAL	LIMITED	ANNUAL AND/OR OPPORTUNISTIC	RED ALGAE	**Small epiphytic**	*Erythrotrichia carnea*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	2
					Filamentous	*Ceramium diaphanum* var. *elegans, Neosiphonia harveyi*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	2
				RED ALGAE	**Cartilaginous**	*Agardhiella subulata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	2
				BROWN ALGAE	**Small epiphytic**	*Cladosiphon zosterae, Laminariocolax aecidioides, Mikrosyphar porphyrae*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	2

							RESILIENCE CRITERIA								
							POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
SUB-COMPONENT	**ZONE**	**DISTRIBUTION**	**GROWTH TYPE**	**TAXONOMIC DIVISION**	**FORM AND SHAPE**	**TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
					Thin membranous	*Punctaria latifolia, Punctaria plantaginea*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	2
					Filamentous	*Spongonema tomentosum*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	2
					Cartilaginous	*Dictyosiphon ekmanii*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	2
BENTHIC ALGAE	MIDLITTORAL / INFRALITTORAL	LIMITED	PERENNIAL	RED ALGAE	**Filamentous**	*Polysiphonia fucoides, Polysiphonia novae-angliae*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0*	Santelices 1990 Thornber 2006	0	Chabot and Rossignol 2003 Leclerc 1987	2
					Cartilaginous	*Polyides rotunda*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0*	Santelices 1990 Thornber 2006	0	Chabot and Rossignol 2003 Leclerc 1987	2

							RESILIENCE CRITERIA								
							POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
SUB-COMPONENT	ZONE	DISTRIBUTION	GROWTH TYPE	TAXONOMIC DIVISION	FORM AND SHAPE	TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
					Encrusting	*Lithophyllum orbiculatum*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0*	Santelices 1990 Thornber 2006	0	Chabot and Rossignol 2003 Leclerc 1987	2
				BROWN ALGAE	**Encrusting**	*Petroderma maculiforme, Ralfsia bornetii, Ralfsia verrucosa*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Luthringer et al. 2014	0	Chabot and Rossignol 2003 Leclerc 1987	2
	INFRALITTORAL	**WIDE**	**ANNUAL AND/OR OPPORTUNISTIC**		**Small epiphytic**	*Endodictyon infestans, Halosiphon tomentosus, Litosiphon laminariae*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	1
BENTHIC ALGAE	**INFRALITTORAL**	**WIDE**	**ANNUAL AND/OR OPPORTUNISTIC**	**BROWN ALGAE**	**Filamentous**	*Leptonematella fasciculata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	1
					Aggregated, filamentous	*Pogotrichum filiforme*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	1

							RESILIENCE CRITERIA								
							POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
SUB-COMPONENT	ZONE	DISTRIBUTION	GROWTH TYPE	TAXONOMIC DIVISION	FORM AND SHAPE	TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
			PERENNIAL	RED ALGAE	**Filamentous**	*Polysiphonia arctica, Ptilota serrata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0*	Santelices 1990 Thornber 2006	0	Chabot and Rossignol 2003 Leclerc 1987	1
					Cartilaginous	*Coccotylus truncatus, Euthora cristata, Fimbrifolium dichotomum, Pantoneura fabriciana, Phyllophora pseudoceranoides*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0*	Santelices 1990 Thornber 2006	0	Chabot and Rossignol 2003 Leclerc 1987	1
					Aggregated, erect, calcareous	*Lithothamnion glaciale*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0*	Santelices 1990 Thornber 2006	0	Chabot and Rossignol 2003 Leclerc 1987	1
BENTHIC ALGAE	INFRALITTORAL	WIDE	PERENNIAL	RED ALGAE	**Encrusting**	*Clathromorphum compactum, Leptophytum laeve, Lithothamnion lemoineae, Peyssonnelia rosenvingei*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0*	Santelices 1990 Thornber 2006	0	Chabot and Rossignol 2003 Leclerc 1987	1
				BROWN ALGAE	**Cartilaginous**	*Desmarestia aculeata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Luthringer et al. 2014	0	Chabot and Rossignol 2003 Leclerc 1987	1

							RESILIENCE CRITERIA								
							POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
SUB-COMPONENT	ZONE	DISTRIBUTION	GROWTH TYPE	TAXONOMIC DIVISION	FORM AND SHAPE	TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
					Leathery	*Agarum clathratum*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Luthringer et al. 2014	0	Chabot and Rossignol 2003 Leclerc 1987	1
		LIMITED	ANNUAL AND/OR OPPORTUNISTIC	GREEN ALGAE	**Small epiphytic**	*Epicladia flustrae*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	2
				RED ALGAE	**Small epiphytic**	*Meiodiscus spetsbergensis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	2
BENTHIC ALGAE	INFRALITTORAL	LIMITED	ANNUAL AND/OR OPPORTUNISTIC	RED ALGAE	**Thin membranous**	*Kallymenia schmitzii*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	2

							RESILIENCE CRITERIA								
							POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
SUB-COMPONENT	ZONE	DISTRIBUTION	GROWTH TYPE	TAXONOMIC DIVISION	FORM AND SHAPE	TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
				BROWN ALGAE	**Small epiphytic**	*Hincksia ovata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	2
				RED ALGAE	**Filamentous**	*Ectocarpus penicillatus, Sphacelaria cirrosa*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986	0	Orfanidis et al. 2001 Santelices 1990	0	Chabot and Rossignol 2003 Leclerc 1987	2
			PERENNIAL		**Leathery**	*Turnerella pennyi*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cardinal 1990 Couillard et al. 1973 South and Titley 1986 South et al. 1972	0*	Santelices 1990 South et al. 1972 Thornber 2006	0	Chabot and Rossignol 2003 Leclerc 1987	2
PLANTS	MID/INFRALITTORAL	WIDE		N/A	**N/A**	Common three-square bulrush (*Schoenoplectus pungens*), smooth cordgrass (*Spartina alterniflora)*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Giroux and Bédard 1988	0	Giroux and Bédard 1988	1	Giroux and Bédard 1988	1

							RESILIENCE CRITERIA								
							POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
SUB-COMPONENT	**ZONE**	**DISTRIBUTION**	**GROWTH TYPE**	**TAXONOMIC DIVISION**	**FORM AND SHAPE**	**TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
PLANTS	**INFRALITTORAL**	**WIDE**	**PERENNIAL**	**N/A**	**N/A**	Common eelgrass *(Zostera marina)*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	DFO 2009	0	DFO 2009	1	Chabot and Rossignol 2003	2

5.2. MARINE AND ESTUARINE INVERTEBRATES

5.2.1. Porifera, Cnidaria and Ctenophora

Exposure potential

Assessment of Porifera, Cnidaria and Ctenophora taxa groups in the St. Lawrence ARP study area on the basis of the exposure potential criteria

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
PORIFERA	**CALCAREA**	**(1)**	**I**	**Calcareous sponge**	*Grantia canadensis*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Giese and Pearse 1974 Murillo et al. 2016	3
	DEMOSPONGIAE	**(6)**	**M**	**Sponge**	*Halichondria panicea, Haliclona (Reniera) cinerea*	1	Brunel et al. 1998 Chabot and Rossignol 2002 Meinkoth 1981	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Giese and Pearse 1974 Murillo et al. 2016	4
			I	**Sponge**	*Haliclona oculata, Phakellia*	1	Brunel et al. 1998 Hooper and Van Soest 2002	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Giese and Pearse 1974 Murillo et al. 2016	3
CNIDARIA	**HYDROZOA**	**ANTHOATHECATA LEPTOTHECATA (41)**	**UEP**	**Thecate and athecate hydroids**	Leptothecata: *Staurostoma mertensii* Anthoathecata: *Plotocnida borealis, Euphysa*	1*	Brunel et al. 1998 Horner and Murphy 1985 Zelickman 1972	1*	Brunel et al. 1998 Williams and Conway 1981 Zelickman 1972	1	Ruppert and Barnes 1994	1*	Lehtiniemi et al. 2013 Zelickman 1972	4

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
			GEP	**Thecate hydroids**	Leptothecata: *Ptychogena lactea*	0	Brunel et al. 1998 Licandro et al. 2017	0	Brunel et al. 1998 Licandro et al. 2017	1	Ruppert and Barnes 1994	1*	Lehtiniemi et al. 2013	2
CNIDARIA	**HYDROZOA**	**ANTHOATHECATA LEPTOTHECATA (41)**	**M**	**Hydroid**	*Abietinaria turgida, Coryne pusilla, Dynamena pumila, Obelia dichotoma, Rhizocaulus verticillatus*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	4
			I	**Hydroid**	*Calycella syringa, Ectopleura larynx, Eudendrium ramosum, Hydractinia polyclina, Symplectoscyphus tricuspidatus*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	3
			CB	**Hydroid**	*Tubularia regalis*	0	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	3
		NARCOMEDUSAE TRACHYMEDUSAE (2)	**UEP**	**Trachymedusae**	Trachymedusae: *Aglantha digitale*	0*	Brunel et al. 1998 Zelickman 1972	1	Brunel et al. 1998 Williams and Conway 1981 Zelickman 1972	1	Ruppert and Barnes 1994	1*	Lehtiniemi et al. 2013 Zelickman 1972	3
			GEP	**Narcomedusae**	Narcomedusae: *Solmissus incisa*	0	Brunel et al. 1998 Licandro et al. 2017	0	Brunel et al. 1998 Licandro et al. 2017	1	Ruppert and Barnes 1994	1*	Lehtiniemi et al. 2013	2

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
		SIPHONO-PHORAE (3)	**GEP**	**Siphonophore**	*Dimophyes arctica, Nanomia cara, Physophora hydrostatica*	0*	Hosia and Banstedt 2008 Kirkpatrick and Pugh 1984 Williams and Conway 1981	1*	Hosia and Banstedt 2008 Kirkpatrick and Pugh 1984 Williams and Conway 1981	1	Ruppert and Barnes 1994	1*	Hosia and Banstedt 2008 Lehtiniemi et al. 2013	3
CNIDARIA	**SCYPHOZOA**	**(2)**	**UEP**	Scyphozoan: **Lion's mane jellyfish**	*Cyanea capillata*	1	Brewer 1989	1	Brewer 1989 Jarms et al. 2002	1	Costello and Colin 1995 Jarms et al. 2002	1*	Brewer 1989 Jarms et al. 2002 Lehtiniemi et al. 2013 Zelickman 1972	4
			GEP	Scyphozoan without a polyp stage: **Merchant-cap**	*Periphylla periphylla*	0	Jarms et al. 2002 Sötje et al. 2006	1	Jarms et al. 2002 Sötje et al. 2006	1	Costello and Colin 1995 Jarms et al. 2002	1*	Sötje et al. 2006	3
			M	Sessile (stalked) jellyfish: ***Lucernaria***	*Craterolophus convolvulus, Haliclystus octoradiatus*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Mills and Hirano 2007	1	Miranda et al. 2012	4
	ANTHOZOA (OCTOCORALLIA)	**ALCYONACEA (1)**	**I**	**Soft coral**: Sea strawberry	*Gersemia rubiformis*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	0	Murillo et al. 2016	2
		PENNA-TULACEA (4)	**CB**	**Sea pen**	*Anthoptilum grandiflorum, Halipteris finmarchica, Pennatula aculeata, Pennatula grandis*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1	Murillo et al. 2016	**2**

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
	ANTHOZOA (HEXACORALLIA)	**ACTINIARIA (12)**	**M**	Sea anemone: **Northern red anemone**	*Urticina crassicornis, Urticina felina*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1	Kaliszewicz et al. 2012	4
			M	Sediment-associated sea anemone: **Silver-spotted anemone**	*Aulactinia stella*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1	Kaliszewicz et al. 2012	4
CNIDARIA	**ANTHOZOA (HEXACORALLIA)**	**ACTINIARIA (12)**	**I**	Broadcast-spawning sea anemone: **Frilled anemone**	*Metridium senile*	1	Bourget 1997 Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	0*	Bocharova and Kozevich 2011 Kaliszewicz et al. 2012 Mercier and Hamel 2010	2
			I	Sea anemone: **Swimming anemone**	*Stomphia coccinea*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ellis et al. 1969 Ruppert and Barnes 1994	0*	Ellis et al. 1969 Kaliszewicz et al. 2012 Larson 2015	2
			CB	Sea anemone: **Rugose anemone**	*Hormathia nodosa*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Kaliszewicz et al. 2012 Larson 2015	2
			CB	**Sediment-associated sea anemone**	*Actinostola callosa, Edwardsia*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Daly et al. 2012 Kaliszewicz et al. 2012 Larson 2015	2

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
			CB	Solitary sea anemone: **Pom-pom anemone**	*Liponema multicorne*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	0*	Braby et al. 2009	1
	ANTHOZOA (CERIANTHARIA)	**(1)**	**I**	Tube-dwelling anemone (secretes its own tube): **Northern cerianthid**	*Pachycerianthus borealis*	1	Brunel et al. 1998 Meinkoth 1981 RSBA 2016 Shepard et al. 1986	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Shepard et al. 1986	3
CTENOPHORA	**-**	**(3)**	**UEP**	**Neritic ctenophore**	*Pleurobrachia pileus*	1	Fraser 1970	1	Fraser 1970	1	Mianzan et al. 2009	1	Fraser 1970 Lehtiniemi et al. 2013	4
		(3)	**GEP**	**Oceanic ctenophore**	*Beroe, Mertensia ovum*	0*	Lehtiniemi et al. 2013	1*	Lehtiniemi et al. 2013	1	Mianzan et al. 2009	1	Lehtiniemi et al. 2013	3

[1] The numbers in brackets correspond to the number of species recorded in the study area (Appendix 6) that belong to this ORDER.

[2] Common names in bold correspond to the names used in the vulnerability matrix. They represent the other taxa of their group.

Resilience

Assessment of Porifera, Cnidaria and Ctenophora taxa groups in the St. Lawrence ARP study area on the basis of resilience criteria

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
PORIFERA	**CALCAREA**	**(1)**	**I**	**Calcareous sponge**	*Grantia canadensis*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	DFO 2015b WoRMS 2016	0*	Giese and Pearse 1974 DFO 2015b	0	Fontaine 2006 Ruppert and Barnes 1994	1
	DEMOSPONGIAE	**(6)**	**M**	**Sponge**	*Halichondria panicea, Haliclona cinerea*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	DFO 2015b WoRMS 2016	0*	Giese and Pearse 1974 DFO 2015b	0	Fontaine 2006 Ruppert and Barnes 1994	1
			I	**Sponge**	*Haliclona oculata, Phakellia*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	DFO 2015b WoRMS 2016	0*	Giese and Pearse 1974 DFO 2015b	0	Fontaine 2006 Ruppert and Barnes 1994	2
CNIDARIA	**HYDROZOA**	**ANTHOATHECATA LEPTOTHECATA (41)**	**UEP**	**Thecate and athecate hydroids**	Leptothecata: *Staurostoma mertensii* Anthoathecata: *Plotocnida borealis, Euphysa*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Ruppert and Barnes 1994 WoRMS 2016	0*	Larson 1986 Ruppert and Barnes 1994	1*	Licandro et al. 2017 Young et al. 2002	2

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER**[1]	**ZONE**	**COMMON NAME**[2]	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
CNIDARIA	**HYDROZOA**	**ANTHOATHECATA LEPTOTHECATA (41)**	**GEP**	**Thecate hydroid**	Leptothecata: *Ptychogena lactea*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Ruppert and Barnes 1994 WoRMS 2016	0*	Larson 1986 Ruppert and Barnes 1994	1*	Licandro et al. 2017 Young et al. 2002	2
			M	**Hydroid**	*Abietinaria turgida, Coryne pusilla, Dynamena pumila, Obelia dichotoma, Rhizocaulus verticillatus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Bavestrello et al. 2000 Henry and Kenchington 2004 WoRMS 2016	0*	Bavestrello et al. 2000 Giese and Pearse 1974 Ruppert and Barnes 1994	0	Himmelman et al. 1983 Meinkoth 1981 Picton and Morrow 2016 Rudy et al. 2013 WoRMS 2016	1
			I	**Hydroid**	*Calycella syringa, Ectopleura larynx, Eudendrium ramosum, Hydractinia polyclina, Symplectoscyphus tricuspidatus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Bavestrello et al. 2000 Henry and Kenchington 2004 WoRMS 2016	0*	Bavestrello et al. 2000 Folino and Yund 1998 Giese and Pearse 1974 Ruppert and Barnes 1994	0	Ardisson and Bourget 1992 Folino and Yund 1998 Orlov and Marfenin 1995 Ronowicz et al. 2008	1
			CB	**Hydroid**	*Tubularia regalis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Bavestrello et al. 2000 Henry and Kenchington 2004 WoRMS 2016	0*	Bavestrello et al. 2000 Giese and Pearse 1974 Ruppert and Barnes 1994	1	Fontaine 2006	2
		NARCOMEDUSAE TRACHYMEDUSAE (2)	**UEP**	**Trachymedusae**	Trachymedusae: *Aglantha digitale*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Ruppert and Barnes 1994 WoRMS 2016	0*	Larson 1986 Ruppert and Barnes 1994	0	Licandro et al. 2017 Pertsova et al. 2006	1

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
CNIDARIA	**HYDROZOA**	**NARCOMEDUSAE TRACHYMEDUSAE (2)**	**GEP**	**Narcomedusa e**	Narcomedusae: *Solmissus incisa*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Ruppert and Barnes 1994 WoRMS 2016	0*	Larson 1986 Lucas and Reed 2009 Ruppert and Barnes 1994	0	Licandro et al. 2017 Lucas and Reed 2009	1
		SIPHONOPHORAE (3)	**GEP**	**Siphonophore**	*Dimophyes arctica, Nanomia cara, Physophora hydrostatica*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Ruppert and Barnes 1994 WoRMS 2016	0*	Larson 1986 Ruppert and Barnes 1994	0	Young et al. 2002	1
	SCYPHOZOA	**(2)**	**UEP**	Scyphozoan: **Lion's mane jellyfish**	*Cyanea capillata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Brewer 1989 WoRMS 2016	0	Brewer 1989	1*	Holst and Jarms 2010 Young et al. 2002	2
			GEP	Scyphozoan without a polyp stage: **Merchant-cap**	*Periphylla periphylla*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Jarms et al. 2002 WoRMS 2016	0	Jarms et al. 2002 Lucas and Reed 2010	0	Jarms et al. 2002	1
	STAUROZOA		**M**	Sessile (stalked) jellyfish: ***Lucernaria***	*Craterolophus convolvulus, Haliclystus octoradiatus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Mills and Hirano 2007 WoRMS 2016	0	Mills and Hirano 2007	1	Mills and Hirano 2007	3

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
CNIDARIA	ANTHOZOA (OCTOCORALLIA)	ALCYONACEA (1)	I	**Soft coral**: Sea strawberry	*Gersemia rubiformis*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Henry et al. 2003 Sun et al. 2011 WoRMS 2016	1*	Henry et al. 2003 Sun et al. 2011	0	Fontaine 2006 Henry et al. 2003	1
		PENNATULACEA (4)	CB	**Sea pen**	*Anthoptilum grandiflorum, Halipteris finmarchica, Pennatula aculeata, Pennatula grandis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Edwards and Moore 2008 WoRMS 2016	0	Baillon et al. 2015 Edwards and Moore 2008	1	Baillon 2014	2
	ANTHOZOA (HEXACORALLIA)	ACTINIARIA (12)	M	Sea anemone: **Northern red anemone**	*Urticina crassicornis, Urticina felina*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Kaliszewicz et al. 2012 Mercier and Hamel 2010 WoRMS 2016	0	Bocharova and Kozevich 2011 Kaliszewicz et al. 2012 Mercier and Hamel 2010	0	Fontaine 2006	1
			M	Sediment-associated sea anemone **Silver-spotted anemone**	*Aulactinia stella*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Bocharova 2015 Kaliszewicz et al. 2012 WoRMS 2016	0	Kaliszewicz et al. 2012 Mercier and Hamel 2010	1	Fontaine 2006	2
			I	Broadcast-spawning sea anemone: **Frilled anemone**	*Metridium senile*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Larson 2015 WoRMS 2016	0	Bocharova and Kozevich 2011 Mercier and Hamel 2010	0	Fontaine 2006	1

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
CNIDARIA	ANTHOZOA (HEXACORALLIA)	ACTINIARIA (12)	I	Sea anemone: **Swimming anemone**	*Stomphia coccinea*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Larson 2015 WoRMS 2016	0*	Larson 2015 Ruppert and Barnes 1994	0	Fontaine 2006	2
			CB	Sea anemone: **Rugose anemone**	*Hormathia nodosa*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Larson 2015 WoRMS 2016	0*	Larson 2015 Mercier and Hamel 2009 Ruppert and Barnes 1994	0	Fontaine 2006	2
			CB	**Sediment-associated sea anemone**	*Actinostola callosa, Edwardsia*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Larson 2015 WoRMS 2016	0*	Larson 2015 Ruppert and Barnes 1994	1	Acuña et al. 2003 Auster et al. 2011 Meinkoth 1981	3
			CB	Solitary sea anemone: **Pom-pom anemone**	*Liponema multicorne*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Larson 2015 WoRMS 2016	0*	Larson 2015 Ruppert and Barnes 1994	0	Acuña et al. 2003 Auster et al. 2011 Meinkoth 1981	2
	ANTHOZOA (CERIANTHARIA)	(1)	I	Tube-dwelling anemone (secretes its own tube): **Northern Cerianthid anemone**	*Pachycerianthus borealis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Shepard et al. 1986 WoRMS 2016	0	Hinsch and Moore 2011 Shepard et al. 1986 Wildish and Peer 1983	1	Hinsch and Moore 2011	2

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
CTENOPHORA	-	(3)	**UEP**	**Neritic ctenophore**	*Pleurobrachia pileus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Ruppert and Barnes 1994 WoRMS 2016	0*	Fraser 1970 Lehtiniemi et al. 2013 Mianzan et al. 2009	0	Fraser 1970 Ruppert and Barnes 1994	1
			GEP	**Oceanic ctenophore**	*Beroe, Mertensia ovum*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Ruppert and Barnes 1994 WoRMS 2016	0*	Fraser 1970 Lehtiniemi et al. 2013 Mianzan et al. 2009	0	Fraser 1970 Ruppert and Barnes 1994	1

[1] The numbers in brackets correspond to the number of species recorded in the study area (Appendix 6) that belong to this ORDER.

[2] Common names in bold correspond to the names used in the vulnerability matrix. They represent the other taxa of their group.

5.2.2. Vermiform Phyla

Exposure potential

Assessment of Vermiform Phyla taxa groups in the St. Lawrence ARP study area on the basis of exposure potential criteria

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
XENACOELO-MORPHA	-	ACOELA (1)	I	Acoel	N/A	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	0*	Achatz et al. 2013 Bourlat and Hejnol 2009	2
PLATY-HELMINTHES	RHABDITOPHORA	POLYCLADIDA (1)	M	Polyclad flatworm		1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Liana and Litvaitis 2010	4
NEMERTEA	-	(5)	M	Nemertean		1	Brunel et al. 1998	1	Brunel et al. 1998	1	Thiel and Kruse 2001	1	Ruppert and Barnes 1994 Thiel and Dernedde 1996	4
CEPHALO-RHYNCHA	PRIAPULIDA	(1)	I	Priapulid flatworm		1	Brunel et al. 1998	0	Brunel et al. 1998	1	Hammond 1970	1'	N/A	3

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
NEMATODA	-	**(42)**	**M**	**Nematode**		1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	0	Ruppert and Barnes 1994	3
			I	**Nematode**		1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	0	Ruppert and Barnes 1994	2
PHORONIDA		**(1)**	**I**	**Phoronid**		1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Brunel et al. 1998 Emig 1982	3
SIPUNCULA		**(4)**	**I**	**Sipuncula**		1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Murina 1984 Wanninger et al. 2005	3
			I	**Sipuncula with low recolonization potential**		1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	0*	Gibbs 1974	2
ANNELIDA	**POLYCHAETA (ERRANTIA SEDENTARIA)**	**(1)**	**GEP**	**Polychaete**		0*	Brunel et al. 1998 Simmons and VonThun 2009	0*	Brunel et al. 1998 Simmons and VonThun 2009	1	Ruppert and Barnes 1994	1'	N/A	2
		(209)	**M**	***Spirorbis spirorbis***	Serpulidae:	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Rouse and Pleijel 2001	1'	N/A	4

PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	EXPOSURE POTENTIAL CRITERIA: LITTORAL ZONE USE SCORE	LITTORAL ZONE USE SOURCE	SEA SURFACE INTERACTING SCORE	SEA SURFACE INTERACTING SOURCE	LIMITED CAPACITY FOR MOVEMENT SCORE	LIMITED CAPACITY FOR MOVEMENT SOURCE	AGGREGATION POTENTIAL SCORE	AGGREGATION POTENTIAL SOURCE	TOTAL
ANNELIDA	POLYCHAETA (ERRANTIA/SEDENTARIA)	(209)	M	***Nicomache lumbricalis***	Maldanidae:	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Rouse and Pleijel 2001	1	Dufour et al. 2008 Hughes 1973	4
			M	***Arenicola marina***	Arenicolidae: *Arenicola marina* Cirratulidae: *Cirratulus cirratus* Nereididae:	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Rouse and Pleijel 2001	1	Dales 1950 Hardege et al. 1998 Olive 1970	4
			M	***Pectinaria gouldii***	Pectinariidae	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Rouse and Pleijel 2001	1*	Busch and Loveland 1975 Rouse and Pleijel 2001	4
			M	***Harmothoe imbricata***	Pholoidae: *Pholoe minuta* Phyllodocidae: *Phyllodoce* Polynoidae: *Harmothoe imbricata* Spionidae	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Rouse and Pleijel 2001	0*	Blake 1969 Daly 1972 Rouse and Pleijel 2001	3
			M	***Nephtys caeca***	Capitellidae: *Capitella capitata* Nephtyidae	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Rouse and Pleijel 2001	0*	Caron et al. 1995 Rouse and Pleijel 2001	3
			M/I	***Alitta, Eteone*** **and** ***Glycera***	Glyceridae: *Glycera capitata, Glycera dibranchiata* Goniadidae: *Goniada maculata* Nereididae: *Alitta succinea, Alitta virens* Phyllodocidae	1	Brunel et al. 1998	1	Brunel et al. 1998 Rouse and Pleijel 2001	1	Rouse and Pleijel 2001	1	Carpelan and Linsley 1961 Creaser 1973 Hébert Chatelain et al. 2008 Olive 1975 Simpson 1962b	4
			I	**Hard-substrate-dwelling polychaete**	Phyllodocidae: *Eulalia viridis* Serpulidae: *Circeis spirillum* Syllidae: *Autolytus emertoni, Proceraea cornuta, Syllis gracilis*	1	Brunel et al. 1998	0	Brunel et al. 1998 Rouse and Pleijel 2001 Bourget et al. 1997 Franke 1999	1	Rouse and Pleijel 2001	1'	N/A	3

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
ANNELIDA	POLYCHAETA (ERRANTIA/SEDENTARIA)	(209)	I	***Melinna cristata***	Ampharetidae:	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Rouse and Pleijel 2001	1*	Hutchings 1973	3
			I	**Sediment-associated polychaete with low reproductive capacity**	Chrysopetalidae: *Dysponetus pygmaeus* Orbiniidae:	1	Brunel et al. 1998	0	Brunel et al. 1998 Rouse and Pleijel 2001	1	Rouse and Pleijel 2001	1'	N/A	3
			I	***Maldane sarsi***	Maldanidae:	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Rouse and Pleijel 2001	1*	Dufour et al. 2008	3
			I	**Sediment-associated polychaete**	Dorvilleidae: *Parougia caeca* Sabellidae: *Chone duneri* Terebellidae:	1	Brunel et al. 1998	0	Brunel et al. 1998 Rouse and Pleijel 2001	1	Rouse and Pleijel 2001	1'	N/A	3
		(50)	CB	**Sediment-associated polychaete with low reproductive capacity**	Lumbrineridae: *Lumbrineris latreilli* Nereididae:	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Rouse and Pleijel 2001	1*	Rouse and Pleijel 2001	2
			CB	**Sediment-associated polychaete**	Eunicidae: *Eunice pennata* Euphrosinidae: *Euphrosine cirrata* Oweniidae: *Galathowenia oculata* Paraonidae:	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Rouse and Pleijel 2001	1*	Rouse and Pleijel 2001	2
	POLYCHAETA (ECHIURA)	(2)	I	**Echiuran**		1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	0*	Giese and Pearse 1975	2

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
ANNELIDA	**CLITELLATA (OLIGOCHAETA)**	**(7)**	**M**	**Oligochaete**		1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	0*	Lindegaard 1994	3
			I	**Oligochaete**		1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	0*	Lindegaard 1994	2
			CB	**Oligochaete**		0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	0*	Lindegaard 1994	1
HEMICHORDATA	**ENTEROPNEUSTA**	**(1)**	**CB**	**Enteropneust**		0	Brunel et al. 1998	0	Brunel et al. 1998	1	Jones et al. 2013	1*	Jones et al. 2013	2

[1] The numbers in brackets correspond to the number of species recorded in the study area (Appendix 6) that belong to this ORDER.

[2] Common names in bold correspond to the names used in the vulnerability matrix. They represent the other taxa of their group.

Resilience

Assessment of Vermiform Phyla taxa groups in the St. Lawrence ARP study area on the basis of resilience criteria

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
XENACOELOMORPHA	-	ACOELA (1)	I	**Acoel**	N/A	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Achatz et al. 2013 Bourlat and Hejnol 2009	0	Achatz et al. 2013 Bourlat and Hejnol 2009	1	Bourlat and Hejnol 2009	3
PLATYHELMINTHES	RHABDITOPHORA	POLYCLADIDA (1)	M	**Polyclad flatworm**	*Pleioplana atomata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Rawlinson et al. 2008 WoRMS 2016	1	Rawlinson et al. 2008	0*	Rawlinson et al. 2008	3
NEMERTEA	-	(5)	M	**Nemertean**	*Amphiporus angulatus , A. lactifloreus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Maslakova 2010 Thiel and Dernedde 1996 WoRMS 2016	0	Ruppert and Barnes 1994 Thiel and Dernedde 1996 University of Alaska 2008	1	Thiel and Kruse 2001	3
CEPHALORHYNCHA	PRIAPULIDA	(1)	I	**Priapulid flatworm**	*Priapulus caudatus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Giese and Pearse 1975a Wennberg et al. 2009 WoRMS 2016	1*	Giese and Pearse 1975a Ruppert and Barnes 1994	1	Hammond 1970	4

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
NEMATODA	-	(42)	M	**Nematode**	*Daptonema, Metacomesoma, Nannolaimoides effilatus, Viscosia*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Commito and Tita 2002 Giese and Pearse 1974 Hagerman and Rieger 1981 Ullberg and Ólafsson 2003 WoRMS 2016	1	Giese and Pearse 1974 Moens and Vincx 1998 Ruppert and Barnes 1994	1	Ruppert and Barnes 1994	3
NEMATODA	-	(42)	I	**Nematode**	*Araeolaimus, Chromadorita, Enoplus, Monoposthia costata, Theristus acer*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Commito and Tita 2002 Giese and Pearse 1974 Hagerman and Rieger 1981 Ullberg and Ólafsson 2003 WoRMS 2016	1	Giese and Pearse 1974 Moens and Vincx 1998 Ruppert and Barnes 1994	1	Ruppert and Barnes 1994	3
PHORONIDA	-	(1)	I	**Phoronid**	*Phoronis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Brunel et al. 1998 Emig 1982 Ruppert and Barnes 1994	0	Brunel et al. 1998 Emig 1982 Ruppert and Barnes 1994	1*	Emig 1982 Ruppert and Barnes 1994	2
SIPUNCULA	-	(4)	I	**Sipuncula**	*Phascolion strombus, Phascolopsis gouldii*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Giese and Pearse 1975a WoRMS 2016	0*	Gibbs 1975 Giese and Pearse 1975a Wildish and Peer 1983	1	Meinkoth 1981 Ruppert and Barnes 1994 Wanninger et al. 2005	2

<table>
<tr><th colspan="6"></th><th colspan="8">RESILIENCE CRITERIA</th><th></th></tr>
<tr><th colspan="6"></th><th colspan="2">POPULATION STATUS</th><th colspan="2">LOW RECOLONIZATION POTENTIAL</th><th colspan="2">LOW REPRODUCTIVE CAPACITY</th><th colspan="2">ASSOCIATION WITH SEDIMENT</th><th></th></tr>
<tr><th>PHYLUM</th><th>CLASS</th><th>ORDER[1]</th><th>ZONE</th><th>COMMON NAME[2]</th><th>EXAMPLES OF TAXA</th><th>SCORE</th><th>SOURCE</th><th>SCORE</th><th>SOURCE</th><th>SCORE</th><th>SOURCE</th><th>SCORE</th><th>SOURCE</th><th>TOTAL</th></tr>
<tr><td>SIPUNCULA</td><td>-</td><td>(4)</td><td>I</td><td>Sipuncula with low recolonization potential</td><td>Golfingia margaritacea</td><td>1'</td><td>CESCC 2016
COSEWIC 2016
Gouv. du Québec 2016
IUCN 2016</td><td>1</td><td>WoRMS 2016
Amor 1993</td><td>1*</td><td>Amor 1993
Gibbs 1975
Giese and Pearse 1975a</td><td>1</td><td>Amor 1993
Ruppert and Barnes 1994</td><td>4</td></tr>
<tr><td rowspan="5">ANNELIDA</td><td rowspan="5">POLYCHAETA (ERRANTIA/SEDENTARIA)</td><td>(1)</td><td>GEP</td><td>Polychaete</td><td>Tomopteris cavallii</td><td>1'</td><td>CESCC 2016
COSEWIC 2016
Gouv. du Québec 2016
IUCN 2016</td><td>0</td><td>Rouse and Pleijel 2001
WoRMS 2016</td><td>1'</td><td>N/A</td><td>0*</td><td>Rouse and Pleijel 2001</td><td>2</td></tr>
<tr><td rowspan="4">(209)</td><td>M</td><td>Spirorbis spirorbis</td><td>Serpulidae: Spirorbis spirorbis</td><td>1'</td><td>CESCC 2016
COSEWIC 2016
Gouv. du Québec 2016
IUCN 2016</td><td>1</td><td>Dirnberger 1993
WoRMS 2016</td><td>0*</td><td>Rouse and Pleijel 2001</td><td>0</td><td>Rouse and Pleijel 2001</td><td>2</td></tr>
<tr><td>M</td><td>Nicomache lumbricalis</td><td>Maldanidae: Nicomache lumbricalis</td><td>1'</td><td>CESCC 2016
COSEWIC 2016
Gouv. du Québec 2016
IUCN 2016</td><td>1*</td><td>Fetzer and Arntz 2008
WoRMS 2016</td><td>1*</td><td>Fetzer and Arntz 2008</td><td>1</td><td>Rouse and Pleijel 2001</td><td>4</td></tr>
<tr><td>M</td><td>Arenicola marina</td><td>Arenicolidae: Arenicola marina
Cirratulidae: Cirratulus cirratus
Nereidae: Hediste diversicolor</td><td>1'</td><td>CESCC 2016
COSEWIC 2016
Gouv. du Québec 2016
IUCN 2016</td><td>1*</td><td>Breton et al. 2003
Hardege et al. 1998
Olive 1970
WoRMS 2016</td><td>0*</td><td>Dales 1950
De Wilde and Berghuis 1979
Hardege et al. 1998
Olive 1970
Rouse and Pleijel 2001</td><td>1</td><td>Olive 1970
Queirós et al. 2013
Rouse and Pleijel 2001</td><td>3</td></tr>
</table>

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
ANNELIDA	**POLYCHAETA (ERRANTIA/SEDENTARIA)**	**(209)**	**M**	***Pectinaria gouldii***	Pectinariidae: *Pectinaria gouldii*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Rouse and Pleijel 2001 WoRMS 2016	0*	Busch and Loveland 1975 Rouse and Pleijel 2001	1	Queirós et al. 2013 Rouse and Pleijel 2001	2
			M	***Harmothoe imbricata***	Pholoidae: *Pholoe minuta* Phyllodocidae: *Phyllodoce* Polynoidae: *Harmothoe imbricata* Spionidae: *Polydora*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Blake 1969 Daly 1972 Rouse and Pleijel 2001 WoRMS 2016	1*	Blake 1969 Daly 1972 Rouse and Pleijel 2001 Wildish and Peer 1983	1	Blake 1969 Nygren et al. 2011 Pleijel 1983 Queirós et al. 2013 Rouse and Pleijel 2001 Watson et al. 2000	3
			M	***Nephtys caeca***	Capitellidae: *Capitella capitata* Nephtyidae: *Nephtys caeca*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Caron et al. 1995 Rouse and Pleijel 2001 WoRMS 2016	0*	Caron et al. 1995 Qian and Chia 1991 Rouse and Pleijel 2001	1	Caron et al. 1995 Rouse and Pleijel 2001	2
			M/I	***Alitta, Eteone* and *Glycera***	Glyceridae: *Glycera capitata, Glycera aculateate* Goniadidae: *Goniada aculate* Nereididae: *Alitta succinea, Alitta virens* Phyllodocidae: *Eteone longa*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Breton et al. 2003 Carpelan and Linsley 1961 Lacalli 1981 Simpson 1962a Rouse and Pleijel 2001 WoRMS 2016	1*	Carpelan and Linsley 1961 Creaser 1973 Hébert Chatelain et al. 2008 Lacalli 1981 Olive 1975 Olive et al. 1998 Simpson 1962b Rouse and Pleijel 2001	1	Queirós et al. 2013 Michaelis and Vennemann 2005 Rouse and Pleijel 2001	3

PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	RESILIENCE CRITERIA: POPULATION STATUS SCORE	POPULATION STATUS SOURCE	LOW RECOLONIZATION POTENTIAL SCORE	LOW RECOLONIZATION POTENTIAL SOURCE	LOW REPRODUCTIVE CAPACITY SCORE	LOW REPRODUCTIVE CAPACITY SOURCE	ASSOCIATION WITH SEDIMENT SCORE	ASSOCIATION WITH SEDIMENT SOURCE	TOTAL
ANNELIDA	POLYCHAETA (ERRANTIA/SEDENTARIA)	(209)	I	**Hard-substrate-dwelling polychaete**	Phyllodocidae: *Eulalia viridis* Serpulidae: *Circeis spirillum* Syllidae: *Autolytus emertoni, Proceraea cornuta, Syllis gracilis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Olive 1975 Reitzel et al. 2004 Rouse and Pleijel 2001 Scheltema 1984 WoRMS 2016 Franke 1999 Alldredge and King 1985	0*	Franke 1999 Olive 1975 Reitzel et al. 2004 Rouse and Pleijel 2001 Schiedges 1979	0*	Emson 1977 Knight-Jones et al. 1991 Olive 1975 Rouse and Pleijel 2001 Schiedges 1979 Maltagliati et al. 2000 Queirós et al. 2013	1
			I	***Melinna cristata***	Ampharetidae: *Melinna cristata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Hutchings 1973 Rouse and Pleijel 2001	0*	Hutchings 1973 Rouse and Pleijel 2001	1	Hutchings 1973 Rouse and Pleijel 2001	3
			I	**Sediment-associated polychaete with low reproductive capacity**	Chrysopetalidae: *Dysponetus pygmaeus* Orbiniidae: *Scoloplos armiger*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Kruse et al. 2004 Rouse and Pleijel 2001 WoRMS 2016	1*	Kruse et al. 2004 Rouse and Pleijel 2001	1	Gibbs 1968 Queirós et al. 2013 Rouse and Pleijel 2001 Tzetlin et al. 2002	3
			I	***Maldane sarsi***	Maldanidae: *Maldane sarsi, Praxillella*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Kolbasova et al. 2013 Rouse and Pleijel 2001	0*	Kolbasova et al. 2013 Rouse and Pleijel 2001	1	Rouse and Pleijel 2001	2
			I	**Sediment-associated polychaete**	Dorvilleidae: *Parougia caeca* Sabellidae: *Chone duneri* Terebellidae: *Neoamphitrite figulus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	McHugh 1993 Mileikovsky 1973 Rouse and Pleijel 2001 WoRMS 2016	0*	McHugh 1993 Rouse and Pleijel 2001	1	Blake and Hilbig 1994 Queirós et al. 2013 Rouse and Pleijel 2001 Tovar-	2

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
													Hernandez et al. 2007	
ANNELIDA	**POLYCHAETA (ERRANTIA/SEDENTARIA)**	**(50)**	**CB**	**Sediment-associated polychaete with low reproductive capacity**	Lumbrineridae: *Lumbrineris latreilli* Nereididae: *Ceratocephale loveni*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Breton et al. 2003 Messina et al. 2005 Rouse and Pleijel 2001	1*	Rouse and Pleijel 2001	1	Rouse and Pleijel 2001 Ruppert and Barnes 1994	4
			CB	**Sediment-associated polychaete**	Eunicidae: *Eunice pennata* Euphrosinidae: *Euphrosine cirrata* Oweniidae: *Galathowenia oculata* Paraonidae: *Aricidea catherinae*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Bhaud 1983 Rouse and Pleijel 2001 WoRMS 2016	0*	Rouse and Pleijel 2001	1	Queirós et al. 2013 Rouse and Pleijel 2001 Ruppert and Barnes 1994	2
	POLYCHAETA (ECHIURA)	**(2)**	**I**	**Echiuran**	*Hamingia arctica*, *Pseudobonellia iraidii*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Giese and Pearse 1975b WoRMS 2016	0	Giese and Pearse 1975b Ruppert and Barnes 1994	1	Pilger 1978 Queirós et al. 2013	2
	CLITELLATA (OLIGOCHAETA)	**(7)**	**M**	**Oligochaete**	*Marionina*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Pilditch et al. 2015 Ruppert and Barnes 1994 WoRMS 2016	0*	Coates 1980 Giere and Pfannkuche 1982 Ruppert and Barnes 1994	1	Ruppert and Barnes 1994	2

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
			I	**Oligochaete**	*Limnodrilus, Potamothrix, Tubifex tubifex*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Pilditch et al. 2015 Ruppert and Barnes 1994 WoRMS 2016	1*	Coates 1980 Giere and Pfannkuche 1982 Ruppert and Barnes 1994	1	Ruppert and Barnes 1994	3
ANNELIDA	CLITELLATA (OLIGOCHAETA)	(7)	CB	**Oligochaete**	*Tubificoides bruneli*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Erseus 1989 Ruppert and Barnes 1994	1*	Coates 1980 Giere and Pfannkuche 1982 Ruppert and Barnes 1994	1	Ruppert and Barnes 1994	4
HEMICHORDATA	ENTEROPNEUSTA	(1)	CB	**Enteropneust**	*Stereobalanus canadensis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Cameron 2002 Giese and Pearse 1975a Ruppert and Barnes 1994 WoRMS 2016	0*	Cameron 2002 Giese and Pearse 1975a Ruppert and Barnes 1994	1	Cameron 2002	3

[1] The numbers in brackets correspond to the number of species recorded in the study area (Appendix 6) that belong to this ORDER.

[2] Common names in bold correspond to the names used in the vulnerability matrix. They represent the other taxa of their group.

5.2.3. Mollusca

Exposure potential

Assessment of Mollusca taxa groups in the St. Lawrence ARP study area on the basis of exposure potential criteria

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
MOLLUSCA	CAUDOFOVEATA	CHAETODERMATIDA (2)	I	***Chaetoderma***	*Chaetoderma*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	3
	POLYPLACOPHORA	CHITONIDA (4)	M	Chiton	*Tonicella*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Eernisse 2007	1	Giese and Pearse 1979 Ruppert and Barnes 1994	4
			I	Chiton	*Amicula vestita, Stenosemus albus*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Eernisse 2007	1	Giese and Pearse 1979 Ruppert and Barnes 1994	3
	GASTROPODA (PATELLOGASTROPODA)	(3)	M	Limpet	*Testudinalia testudinalis*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Lord et al. 2011	1	Lord et al. 2011	4
			I	Limpet	*Lepeta caeca*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Croll 1983	3

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
MOLLUSCA	GASTROPODA (VETIGASTROPODA)	(8)	I	Vetigastropoda with low recolonization potential: ***Margarites***	*Margarites*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Holyoak 1988	3
				Vetigastropoda: **diluvian puncturella**	*Puncturella noachina*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	3
	GASTROPODA (CAENOGASTROPODA)	(4)	I	Littorinimorpha: **Turritsnail**	*Tachyrhynchus erosus*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Allmon 2011	3
		LITTORINIMORPHA (26)	M	**Common periwinkle**	*Littorina littorea*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	0	Bourget 1997 Croll 1983 Davies and Beckwith 1999	3
			M	Direct-developing periwinkle: **Rough periwinkle**	*Littorina saxatilis*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Rolan-Alvarez 2007	0*	Chabot and Rossignol 2003 Davies and Beckwith 1999	3
			M	Aggregating Littorinimorpha: **Minute hydrobe**	*Ecrobia truncata*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Chabot and Rossignol 2003 Martini and Morrison 1987	4
			M	Littorinimorpha: **Moonsnail**	*Euspira*	1	Brunel et al. 1998 Chabot and Rossignol 2003	1	Brunel et al. 1998 Chabot and Rossignol 2003	1	Ruppert and Barnes 1994	1	Chabot and Rossignol 2003 Kenchington et al. 1998	4
			I	Low-fecundity Littorinimorpha: **Pelicanfoot**	*Arrhoges occidentalis*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	3
			CB	**Littorinimorpha**	*Frigidoalvania janmayeni*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	2

PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	EXPOSURE POTENTIAL CRITERIA: LITTORAL ZONE USE SCORE	LITTORAL ZONE USE SOURCE	SEA SURFACE INTERACTING SCORE	SEA SURFACE INTERACTING SOURCE	LIMITED CAPACITY FOR MOVEMENT SCORE	LIMITED CAPACITY FOR MOVEMENT SOURCE	AGGREGATION POTENTIAL SCORE	AGGREGATION POTENTIAL SOURCE	TOTAL
MOLLUSCA	GASTROPODA (CAENOGASTROPODA)	NEOGASTROPODA (41)	**M**	Neogastropod: **Common northern lacuna**	*Lacuna vincta*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1	Smith 1973	4
			M	Neogastropod with low reproductive capacity and low recolonization potential: **Atlantic dogwinkle**	*Nucella lapillus*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1	Chabot and Rossignol 2003 Feare 1971	4
			M	Neogastropod with wide distribution and low recolonization potential: **Whelk**	*Buccinum, Buccinum undatum*[C]	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	0	Chabot and Rossignol 2003 Croll 1983	3
			I	Neogastropod with low recolonization potential: **Pale lacuna**	*Lacuna pallidula*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1	Smith 1973	3
			I	Sediment-associated neogastropod: ***Oenopota***	*Oenopota*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	3
			CB	**Neogastropod**	*Ptychatractus ligatus*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	2

PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	EXPOSURE POTENTIAL CRITERIA: LITTORAL ZONE USE SCORE	LITTORAL ZONE USE SOURCE	SEA SURFACE INTERACTING SCORE	SEA SURFACE INTERACTING SOURCE	LIMITED CAPACITY FOR MOVEMENT SCORE	LIMITED CAPACITY FOR MOVEMENT SOURCE	AGGREGATION POTENTIAL SCORE	AGGREGATION POTENTIAL SOURCE	TOTAL
MOLLUSCA	GASTROPODA (HETEROBRANCHIA)	CEPHALASPIDEA (8)	I	**Bubble snail with low recolonization potential**	*Retusa obtusa*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Croll 1983	3
MOLLUSCA	GASTROPODA (HETEROBRANCHIA)	CEPHALASPIDEA (8)	I	**Bubble snail**	*Acteocina canaliculata, Cylichna alba, Philine lima*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Croll 1983	3
MOLLUSCA	GASTROPODA (HETEROBRANCHIA)	CEPHALASPIDEA (8)	CB	**Bubble snail**	*Diaphana minuta*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Croll 1983	2
MOLLUSCA	GASTROPODA (HETEROBRANCHIA)	NUDIBRANCHIA (10)	M	**Nudibranch**	*Aeolidia papillosa, Dendronotus frondosus, Flabellina, Onchidoris bilamellata*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Hamel et al. 2008 Todd 1979	4
MOLLUSCA	GASTROPODA (HETEROBRANCHIA)	NUDIBRANCHIA (10)	I	**Nudibranch**	*Ancula gibbosa, Palio dubia*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Hamel et al. 2008 Todd 1979	3
MOLLUSCA	GASTROPODA (HETEROBRANCHIA)	GYMNOSOMATA (1) THECOSOMATA (1)	UEP	**Sea Butterfly**	*Clione limacina, Thielea helicoides*	1	Mileikovsky 1970 Newman and Corey 1984	1	Bathmann et al. 1991 Newman and Corey 1984 Mileikovsky 1970	1	Redfield 1939 Satterlie et al. 1985	1*	Bathmann et al. 1991 Mileikovsky 1970 Newman and Corey 1984 Redfield 1939	4
MOLLUSCA	BIVALVIA (PROTOBRANCHIA)	(16)	I	Protobranch bivalve: **Nutclams and yoldias**	*Ennucula tenuis, Nuculana minuta, Yoldia limatula*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Giese and Pearse 1979	3
MOLLUSCA	BIVALVIA (PROTOBRANCHIA)	(16)	CB	Protobranch bivalve: **Broad yoldia**	*Megayoldia thraciaeformis*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Giese and Pearse 1979	2

						EXPOSURE POTENTIAL CRITERIA: LITTORAL ZONE USE		EXPOSURE POTENTIAL CRITERIA: SEA SURFACE INTERACTING		EXPOSURE POTENTIAL CRITERIA: LIMITED CAPACITY FOR MOVEMENT		EXPOSURE POTENTIAL CRITERIA: AGGREGATION POTENTIAL		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
MOLLUSCA	**BIVALVIA (PTERIOMORPHIA)**	**MYTILIDA (9)**	**M**	Hard-substrate-dwelling mytilid: **Blue mussel**	*Mytilus*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1	Seed 1969	4
			I	Sediment-associated mytilid: **Black mussel**	*Musculus*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Giese and Pearse 1979	3
		PECTINIDA (4)	**I**	**Scallop**	*Chlamys islandica*[C], *Placopecten magellanicus*[C], *Anomia simplex*	1	Brunel et al. 1998 Giguère et al. 1995 DFO 2013	0	Brunel et al. 1998 Giguère et al. 1995 DFO 2013	1	Ruppert and Barnes 1994	1	Giese and Pearse 1979 Giguère et al. 1990 DFO 2013	3
		(5)	**CB**	**Pteriomorphia**	*Bathyarca, Dacrydium vitreum*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Giese and Pearse 1979	2
	BIVALVIA (HETERODONTA)	**(51)**	**M**	Heterodonta: **Softshell clam**	*Ensis leei, Hiatella arctica, Limecola balthica, Mesodesma, Mya arenaria*[C]*, M. truncata, Siliqua costata, Zirfaea crispata*	1	Bourdages et al. 2012 Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1	Bourdages et al. 2012 Bourget 1997 Giese and Pearse 1979 Giguère et al. 2008 Martini and Morrison 1987	4
			I	Solitary heterodonta: **Ocean quahog**	*Arctica islandica*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	0	Ridgway and Richardson 2011	2
			I	Long-lived heterodonta: **Stimpson's surfclam**	*Cyrtodaria siliqua, Mactromeris polynyma*[C]	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Bourdages et al. 2012 Giese and Pearse 1979	3
			I	Heterodonta: **Greenland smoothcockle**	*Panomya norvegica, Serripes groenlandicus, Pandora*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Bourdages et al. 2012 Giese and Pearse 1979	3
			I	Brooding heterodonta: **Astarte**	*Astarte, Cyclocardia borealis, Lyonsia arenosa*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Chabot and Rossignol 2003 Giese and Pearse 1979	3

PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	EXPOSURE POTENTIAL CRITERIA: LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		TOTAL
						SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	
MOLLUSCA	BIVALVIA (HETERODONTA)	(51)	CB	Wood-boring heterodonta: ***Xylophaga atlantica***	*Xylophaga atlantica*	0	Brunel et al. 1998 Gaudron et al. 2016 Miller and Nozères 2016	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Giese and Pearse 1979	2
			CB	**Heterodonta**	*Macoma crassula, Thyasira*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Giese and Pearse 1979	2
	CEPHALOPODA	(2)	CB	**Cephalopod**	*Bathypolypus bairdii*	0	Brunel et al. 1998 Wood 2000	0	Brunel et al. 1998	1	Wood 2000	0	Wood 2000	1
	SCAPHOPODA		I	**Scaphopoda**	*Antalis occidentalis*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	3
			CB	**Scaphopoda**	*Siphonodentalium lobatum*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	2

1 The numbers in brackets correspond to the number of species recorded in the study area (Appendix 6) that belong to this ORDER.

2 Common names in bold correspond to the names used in the vulnerability matrix. They represent the other taxa of their group.

C Commercial species caught in directed fisheries.

Resilience

Assessment of Mollusca taxa groups in the St. Lawrence ARP study area on the basis of resilience criteria

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
MOLLUSCA	CAUDOFOVEATA	CHAETODERMATIDA (2)	I	**Chaetoderma**	*Chaetoderma*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Nielsen et al. 2007 WoRMS 2016	1*	Giese and Pearse 1979 Nielsen et al. 2007	1	Ruppert and Barnes 1994	3
MOLLUSCA	POLYPLACOPHORA	CHITONIDA (4)	M	**Chiton**	*Tonicella*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Eernisse 2007 WoRMS 2016	0	Eernisse 2007 Giese and Pearse 1979	0	Eernisse 2007	1
MOLLUSCA	POLYPLACOPHORA	CHITONIDA (4)	I	**Chiton**	*Amicula vestita, Stenosemus albus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Eernisse 2007 WoRMS 2016	0	Eernisse 2007 Giese and Pearse 1979	0	Eernisse 2007	1

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
MOLLUSCA	**GASTROPODA (PATELLOGASTROPODA)**	**(3)**	**M**	**Limpet**	*Testudinalia testudinalis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Giese and Pearse 1977 Kolbin 2006 WoRMS 2016	0*	Espinosa et al. 2006 Giese and Pearse 1977 Kolbin 2006	0	Bourget 1997 Lord et al. 2011	1
			I	**Limpet**	*Lepeta caeca*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Giese and Pearse 1977 Kolbin 2006 WoRMS 2016	0*	Espinosa et al. 2006 Giese and Pearse 1977 Kolbin 2006	1	Bourdages et al. 2012 Wlodarska-Kowalczuk and Pearson 2004	2
	GASTROPODA (VETIGASTROPODA)	**(8)**	**I**	Vetigastropoda with low recolonization potential: ***Margarites***	*Margarites*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Holyoak 1988 WoRMS 2016	0	Holyoak 1988 Lindberg and Dobberteen 1981	0	Bousfield 1964	2
			I	Vetigastropoda: **diluvian puncturella**	*Puncturella noachina*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Reynoso-Granados et al. 2007 WoRMS 2016	0*	Creese 1980 Giese and Pearse 1977 Reynoso-Granados et al. 2007 Wildish and Peer 1983	0	Abbott et al.1982 Herbert 1991	1
	GASTROPODA (CAENOGASTROPODA)	**(4)**	**I**	Littorinimorpha: **Turritsnail**	*Tachyrhynchus erosus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Allmon 2011 WoRMS 2016	0*	Allmon 2011	1	Allmon 2011	2

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
MOLLUSCA	**GASTROPODA (CAENOGASTROPODA)**	**LITTORINIMORPHA (26)**	**M**	**Common periwinkle**	*Littorina littorea*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Chabot and Rossignol 2003 WoRMS 2016	0	Buschbaum and Reise 1999 Chabot and Rossignol 2003 Giese and Pearse 1977	1	Fontaine 2006	2
			M	Direct-developing periwinkle: **Rough periwinkle**	*Littorina saxatilis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Lassen 1979 Rolan-Alvarez 2007 WoRMS 2016	1	Rolan-Alvarez 2007	0	Chabot and Rossignol 2003 Rolan-Alvarez 2007	3
			M	Aggregating Littorinimorpha: **Minute hydrobe**	*Ecrobia truncata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Lassen 1979 Martini and Morrison 1987 WoRMS 2016	1	Drake and Arias 1995 Kabat and Hershler 1993 Lassen 1979	1	Bourget 1997 Chabot and Rossignol 2003	3
			M	Littorinimorpha: **Moonsnail**	*Euspira*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Chabot and Rossignol 2003 Kenchington et al. 1998 WoRMS 2016	0	Chabot and Rossignol 2003 Kenchington et al. 1998	1	Chabot and Rossignol 2003	2
			I	Low-fecundity Littorinimorpha: **Pelicanfoot**	*Arrhoges occidentalis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Perron 1978 WoRMS 2016	1	Giese and Pearse 1977 Perron 1978	1	Chabot and Rossignol 2003 Perron 1978	3

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
MOLLUSCA	**GASTROPODA (CAENOGASTROPODA)**	**LITTORINIMORPHA (26)**	**CB**	**Littorinimorpha**	*Frigidoalvania janmayeni*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Warén 1996 WoRMS 2016	1*	Thiriot-Quievreux 1982 Warén 1996	0	Warén 1996	2
			M	Neogastropod: **Common northern lacuna**	*Lacuna vincta*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Martel and Chia 1991 Smith 1973 WoRMS 2016	0	Martel and Chia 1991 Smith 1973	0	Smith 1973	1
			M	Neogastropod with low reproductive capacity and low recolonization potential: **Atlantic dogwinkle**	*Nucella lapillus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Chabot and Rossignol 2003 Crothers 1985 WoRMS 2016	1	Chabot and Rossignol 2003 Crothers 1985	0	Chabot and Rossignol 2003 Crothers 1985	3
			M	Neogastropod with wide distribution and low recolonization potential: **Whelk**	*Buccinum, Buccinum undatum*[C]	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Chabot and Rossignol 2003 Valentinsson 2002 WoRMS 2016	0	Chabot and Rossignol 2003 Giese and Pearse 1977 Valentinsson 2002	0	Chabot and Rossignol 2003 Valentinsson 2002	2

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
MOLLUSCA	**GASTROPODA (CAENOGASTROPODA)**	**NEOGASTROPODA (41)**	**I**	Neogastropod with low recolonization potential: **Pale lacuna**	*Lacuna pallidula*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Smith 1973 WoRMS 2016	0	Smith 1973	0	Smith 1973	2
			I	Sediment-associated neogastropod: ***Oenopota***	*Oenopota*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Shimek 1983	0*	Shimek 1983	1	Chabot and Rossignol 2003 Shimek 1983	2
			CB	**Neogastropod**	*Ptychatractus ligatus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Giese and Pearse 1977	0*	Giese and Pearse 1977	1	Giese and Pearse 1977	3
	GASTROPODA (HETEROBRANCHIA)	**CEPHALASPIDEA (8)**	**I**	**Bubble snail with low recolonization potential**	*Retusa obtusa*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Franz 1971 WoRMS 2016	0*	Franz 1971 Giese and Pearse 1977	1	Quintin 2003	3
			I	**Bubble snail**	*Acteocina canaliculata, Cylichna alba, Philine lima*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Franz 1971 WoRMS 2016	0	Franz 1971 Giese and Pearse 1977	1	Quintin 2003	2

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
MOLLUSCA	GASTROPODA (HETEROBRANCHIA)	CEPHALASPIDEA (8)	CB	**Bubble snail**	*Diaphana minuta*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Franz 1971 WoRMS 2016	0	Franz 1971 Giese and Pearse 1977	1	Quintin 2003	2
		NUDIBRANCHIA (10)	M	**Nudibranch**	*Aeolidia papillosa, Dendronotus frondosus, Flabellina, Onchidoris bilamellata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Hamel et al. 2008 Mercier and Hamel 2010 WoRMS 2016	0	Hall and Todd 1986 Longley and Longley 1984 Watt and Aiken 2003	0	Fontaine 2006 Hall and Todd 1986 Watt and Aiken 2003	1
			I	**Nudibranch**	*Ancula gibbosa, Palio dubia*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Clark 1975 Hamel et al. 2008 Mercier and Hamel 2010 WoRMS 2016	0	Clark 1975 Hall and Todd 1986 Hamel et al. 2008 Longley and Longley 1984 Watt and Aiken 2003	0	Clark 1975 Fontaine 2006 Hamel et al. 2008	1
		GYMNOSOMATA (1) THECOSOMATA (1)	UEP	**Sea Butterfly**	*Clione limacina, Thielea helicoides*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Brunel et al. 1998 WoRMS 2016	0	Dadon and Cider 1992 Kallevik 2013 Lalli and Conover 1973 Lalli and Wells 1978	0	Dadon and de Cidre 1992 Lalli and Conover 1973	1

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
MOLLUSCA	**BIVALVIA (PROTOBRANCHIA)**	**(16)**	**I**	Protobranch bivalve: **Nutclams and yoldias**	*Ennucula tenuis, Nuculana minuta, Yoldia limatula*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Giese and Pearse 1979 Nakaoka 1994 WoRMS 2016	0*	Giese and Pearse 1979 Nakaoka 1994	1	Bourdages et al. 2012 Bousfield 1964	2
MOLLUSCA	**BIVALVIA (PROTOBRANCHIA)**	**(16)**	**CB**	Protobranch bivalve: **Broad yoldia**	*Megayoldia thraciaeformis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Giese and Pearse 1979 Nakaoka 1994 WoRMS 2016	0*	Giese and Pearse 1979 Nakaoka 1994	1	Bourdages et al. 2012 Bousfield 1964	2
MOLLUSCA	**BIVALVIA (PROTOBRANCHIA)**	**MYTILIDA (9)**	**M**	Hard-substrate-dwelling mytilid: **Blue mussel**	*Mytilus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Seed 1969 WoRMS 2016	0	Seed 1969 Sukhotin et al. 2007 Thompson 1979	0	Lambert and Prefontaine 1995 Chabot and Rossignol 2003	1
MOLLUSCA	**BIVALVIA (PROTOBRANCHIA)**	**MYTILIDA (9)**	**I**	Sediment-associated mytilid: **Black mussel**	*Musculus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Giese and Pearse 1979 WoRMS 2016	0*	Giese and Pearse 1979 Seed 1969 Sukhotin et al. 2007 Thompson 1979	1	Bousfield 1964	3
MOLLUSCA	**BIVALVIA (PROTOBRANCHIA)**	**PECTINIDA (4)**	**I**	**Scallop**	*Chlamys islandica*[C], *Placopecten magellanicus*[C], *Anomia simplex*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Eckman 1987 Kenchington et al. 2006 DFO 2013 WoRMS 2017	0	Giese and Pearse 1979 Kenchington et al. 2006 DFO 2013 Vahl 1981 Wildish and Peer 1983	0	Eckman 1987 Giguère et al. 1995 Lambert and Prefontaine 1995 Queirós et al. 2013	1

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
MOLLUSCA	BIVALVIA (PTERIOMORPHIA)	(5)	CB	**Pteriomorphia**	*Bathyarca, Dacrydium vitreum*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Giese and Pearse 1979 Seed 1969 WoRMS 2016	0*	Giese and Pearse 1979 Seed 1969 Sukhotin et al. 2007 Thompson 1979 Wildish and Peer 1983	1	Dalcourt et al. 1992 Gaillard et al. 2015	2
	BIVALVIA (HETERODONTA)	(51)	M	Heterodonta: **Softshell clam**	*Ensis leei, Hiatella arctica, Limecola balthica, Mesodesma, Mya arenaria*[C]*, M. truncata, Siliqua costata, Zirfaea crispata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Brulotte et al. 2012 Giese and Pearse 1979 Gollasch et al. 2015 Martini and Morrison 1987 Oberlechner 2008 Pinn et al. 2005 WoRMS 2016	0*	Brêthes et al.1986 Brulotte et al. 2012 Giese and Pearse 1979 Honkoop and Van der Meer 1997 Gollasch et al. 2015 Kilada et al. 2009 Pinn et al. 2005	1	Chabot and Rossignol 2003	2
			I	Solitary heterodonta: **Ocean quahog**	*Arctica islandica*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Ridgway and Richardson 2011 WoRMS 2016	1	DFO 2007 Ridgway and Richardson 2011	1	Chabot and Rossignol 2003	3
			I	Long-lived heterodonta: **Stimpson's surfclam**	*Cyrtodaria siliqua, Mactromeris polynyma*[C]	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Giese and Pearse 1979 Kilada et al. 2009 DFO 2012a WoRMS 2016	1	Giese and Pearse 1979 Kilada et al. 2009 DFO 2012a	1	Chabot and Rossignol 2003	3

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
MOLLUSCA	**BIVALVIA (HETERODONTA)**	**(51)**	**I**	Heterodonta: **Greenland cockle**	*Panomya norvegica, Serripes groenlandicus, Pandora*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Allen 1961 Giese and Pearse 1979 Kilada et al. 2007 WoRMS 2016	0*	Allen 1961 Giese and Pearse 1979 Kilada et al. 2007 Kilada et al. 2009	1	Bourdages et al. 2012 Bousfield 1964 Chabot and Rossignol 2003	2
			I	Brooding heterodonta: **Astarte**	*Astarte, Cyclocardia borealis, Lyonsia arenosa*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Allen 1961 Gardner and Thompson 1999 Giese and Pearse 1979 Thomas 1996 WoRMS 2016	1*	Gardner and Thompson 1999 Giese and Pearse 1979 Thomas 1996	1	Bourdages et al. 2012 Chabot and Rossignol 2003 Fontaine 2006 Giese and Pearse 1979	4
			CB	Wood-boring heterodonta: ***Xylophaga atlantica***	*Xylophaga atlantica*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Culliney and Turner 1976 Tyler et al. 2007 WoRMS 2016	0	Gaudron et al. 2016 Tyler et al. 2007 Voight 2015	0	Romey et al. 1994	1
			CB	**Heterodonta**	*Macoma crassula, Thyasira*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Giese and Pearse 1979 WoRMS 2016	1'	N/A	1	Bourdages et al. 2012	4

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
MOLLUSCA	**CEPHALOPODA**	**(2)**	**CB**	**Cephalopod**	*Bathypolypus bairdii*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Wood 2000 WoRMS 2016	1	Wood 2000	1	Wood 2000	4
	SCAPHOPODA		**I**	**Scaphopoda**	*Antalis occidentalis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Reynolds 2002 WoRMS 2016	0*	Giese and Pearse 1979 Ruppert and Barnes 1994	1	Reynolds 2002	2
			CB	**Scaphopoda**	*Siphonodentalium lobatum*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Reynolds 2002 WoRMS 2016	0*	Giese and Pearse 1979 Ruppert and Barnes 1994	1	Reynolds 2002	2

[1] The numbers in brackets correspond to the number of species recorded in the study area (Appendix 6) that belong to this ORDER.

[2] Common names in bold correspond to the names used in the vulnerability matrix. They represent the other taxa of their group.

[C] Commercial species caught in directed fisheries.

5.2.4. Arthropoda

Exposure potential

Assessment of Arthropoda taxa groups in the St. Lawrence ARP study area on the basis of exposure potential criteria

PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	EXPOSURE POTENTIAL CRITERIA: LITTORAL ZONE USE SCORE	LITTORAL ZONE USE SOURCE	SEA SURFACE INTERACTING SCORE	SEA SURFACE INTERACTING SOURCE	LIMITED CAPACITY FOR MOVEMENT SCORE	LIMITED CAPACITY FOR MOVEMENT SOURCE	AGGREGATION POTENTIAL SCORE	AGGREGATION POTENTIAL SOURCE	TOTAL
ARTHROPODA CRUSTACEA	BRANCHIOPODA	(CLADOCERA) (4)	UEP	**Water flea**	*Bosmina (Eubosmina) coregoni, Evadne, Pleopis polyphaemoides*	1*	Brunel et al. 1998 Gieskes 1970	1*	Ackefors 1971 Brunel et al. 1998 Gieskes 1970	1	Ruppert and Barnes 1994	1*	Gieskes 1970	4
	OSTRACODA	(2)	GEP	**Ostracod**	*Discoconchoecia elegans, Obtusoecia obtusata*	0*	Angel 1993 Brunel et al. 1998	0	Angel 1993 Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Heip 1975	2
		(10)	I	**Ostracod**	N/A	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994 Schram 1986	1*	Heip 1975	3
	(COPEPODA)	CALANOIDA (34), CYCLOPOIDA (3) HARPACTICOIDA (1), POECILOSTOMATOIDA (4)	UEP	**Neritic copepod**	Calanoida: *Acartia, Pseudocalanus, Eurytemora, Temora longicornis* Harpacticoida: *Parathalestris cronii* Cyclopoida: *Oithona atlantica, O. similis*	1	Dvoretsky and Dvoretsky 2009 Horner and Murphy 1985 Ingólfsson and Ólafsson 1997 Maps et al. 2005 Plourde et al. 2002 Walkusz et al. 2013	1	Plourde et al. 2002 Walkusz et al. 2013	1	Ruppert and Barnes 1994	1*	Heip 1975	4

PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	EXPOSURE POTENTIAL CRITERIA: LITTORAL ZONE USE SCORE	LITTORAL ZONE USE SOURCE	SEA SURFACE INTERACTING SCORE	SEA SURFACE INTERACTING SOURCE	LIMITED CAPACITY FOR MOVEMENT SCORE	LIMITED CAPACITY FOR MOVEMENT SOURCE	AGGREGATION POTENTIAL SCORE	AGGREGATION POTENTIAL SOURCE	TOTAL
ARTHROPODA CRUSTACEA	(COPEPODA)	CALANOIDA (34), CYCLOPOIDA (3), HARPACTICOIDA (1), POECILOSTOMATOIDA (4)	**UEP**	**Oceanic copepod**	Calanoida: Aetideidae, *Scolecithricella minor* Poecilostromatoida : *Triconia borealis*	0*	Plourde et al. 2002 Shih et al. 1981 Walkusz et al. 2013 Yamaguchi et al. 1999	0*	Shih et al. 1981 Walkusz et al. 2013 Yamaguchi et al. 1999	1	Ruppert and Barnes 1994	1*	Heip 1975	2
			UEP	**Surface-interacting oceanic copepod**	Calanoida: *Microcalanus, Calanus finmarchicus, C. hyperboreus, Metridia longa, M. lucens*	0	Auel and Hagen 2002 Hays 1995 Head et al. 1984 Horner and Murphy 1985 Plourde et al. 2002 Walkusz et al. 2013	1	Auel and Hagen 2002 Hays 1995 Plourde et al. 2002	1	Ruppert and Barnes 1994	1*	Heip 1975	3
		HARPACTICOIDA (76)	**M**	**Harpacticoid**	N/A	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994 Schram 1986	0*	Heip 1975 Huys et al. 1996	3
		CYCLOPOIDA (2)	**I**	**Cyclopoid**	*Cyclopina laurentica, C. vachoni*	1	Brunel et al. 1998	0*	Brunel et al. 1998 Horner and Murphy 1985	1	Ruppert and Barnes 1994 Schram 1986	1*	Heip 1975	3
		(THORACICA) SESSILIA (5)	**M**	**Barnacle**	*Balanus balanus, Semibalanus balanoides*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1	Schram 1986 Veliz et al. 2006	4
			I	**Barnacle**	*Amphibalanus improvisus, Balanus crenatus*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1	Schram 1986 Veliz et al. 2006	3

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
ARTHROPODA CRUSTACEA		(THORACICA) SESSILIA (5)	CB	**Barnacle**	*Chirona hameri*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1	Schram 1986 Veliz et al. 2006	2
	MALACOSTRACA	LEPTOSTRACA (1)	I	**Nebaliacean**	*Nebalia bipes*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994 Schram 1986	0*	Vetter 1996	2
		MYSIDA (17)	M	**Mysid**	*Mysis gaspensis*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Lasley-Rasher et al. 2015	1*	Pezzack and Corey 1979 Ritz et al. 2011	4
			I	**Mysid**	*Meterythrops robustus, Mysis litoralis, M. oculata, M. stenolepis, Neomysis americana*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Lasley-Rasher et al. 2015	1	Pezzack and Corey 1979 Ritz et al. 2011	3
			CB	**Mysid**	*Amblyops, Boreomysis arctica, B. tridens, Erythrops, Mysidetes farrani, M. mixta, Parerythrops, Pseudomma*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Lasley-Rasher et al. 2015	1*	Pezzack and Corey 1979 Ritz et al. 2011	2

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
		CUMACEA (31)	M	Cumacean	*Diastylis rathkei, D. sculpta, Lamprops quadriplicata*	1*	Brunel et al. 1998 Consultaiton of DFO experts 2016[3]	1	Brunel et al. 1998	1	Schram 1986	1*	Johnson et al. 2001	4
ARTHROPODA CRUSTACEA	MALACOSTRACA	CUMACEA (31)	I	Cumacean	*Eudorella emarginata, Leucon nasica, Petalosarsia declivis*	1*	Brunel et al. 1998 Consultation of DFO experts 2016[3]	0	Brunel et al. 1998	1	Schram 1986	1*	Johnson et al. 2001	3
			CB	Cumacean	*Campylaspis horrida, Cumella (Cumella) carinata*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Schram 1986	1*	Johnson et al. 2001	2
		TANAIDACEA (7)	I	Tanaid	*Akanthophoreus gracilis, Pseudonototanais filum, Pseudotanais, Pseudosphyrapus anomalus*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Schram 1986	1'	N/A	3
		ISOPODA (35)	M	Isopod	*Jaera, Idotea balthica, I. phosphorea*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Schram 1986	1*	Johnson et al. 2001	4
			I	Wood-boring isopod	*Limnora*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Schram 1986	1*	Johnson et al. 2001	3
				Isopod	*Calathura brachiata*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Schram 1986	1*	Johnson et al. 2001	3
			CB	Isopod	*Janira alta, Munna*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Schram 1986	1*	Johnson et al. 2001	2
		AMPHIPODA (HYPERIIDEA) (4)	UEP	Hyperiid	*Themisto*	0	Dalpadado et al. 2008	1	Brunel et al. 1998 Dalpadado et al. 2008 Prokopowicz 2011	1	Kraft et al. 2012	1	Berge and Nahrgang 2013 Kraft et al. 2012	3

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
			MP	**Hyperiid**	*Scina borealis*	0	Brunel et al. 1998	0	Brunel et al. 1998 Macquart-Moulin 1993	1	Kraft et al. 2012 Macquart-Moulin 1993	1'	N/A	2
ARTHROPODA CRUSTACEA	**MALACOSTRACA**	**AMPHIPODA (suprabenthic) (23)**	**M**	**Suprabenthic amphipod**	Calliopiidae: *Calliopius laeviusculus* Eusiridae: *Eusirus propinquus* Pontogeneiidae: *Pontogeneia inermis*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Bousfield 1973 Schram 1986	1*	Bousfield 1973 Johnson et al. 2001	4
			I	**Suprabenthic amphipod**	Caprellidae: *Caprella linearis, Caprella septentrionalis* Eusiridae: *Rhachotropis oculata*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Bousfield 1973 Schram 1986	1*	Bousfield 1973 Johnson et al. 2001	3
			CB	**Suprabenthic amphipod**	Calliopioidea: *Amphithopsis longicaudata* Caprellidae: *Caprella rinki*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Bousfield 1973 Schram 1986	1*	Bousfield 1973 Johnson et al. 2001	2

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
		AMPHIPODA (benthic) (155)	**M**	**Benthic amphipod with low recolonization potential**: Northern big-eyed sandhopper	Talitridae: *Americorchestia megalophthalma*	1	Brunel et al. 1998 Consultation of DFO experts 2016[3]	1	Brunel et al. 1998	1	Bousfield 1973 Schram 1986	1*	Bousfield 1973 Johnson et al. 2001	4
ARTHROPODA CRUSTACEA	**MALACOSTRACA**	**AMPHIPODA (benthic) (155)**	**M**	**Benthic amphipod**	Ampeliscidae: *Ampelisca macrocephala* Bathyporeiidae: *Amphiporeia lawrenciana* Corophiidae: *Crassicorophium bonelli* Gammarellidae: *Gammarellus* Gammaridae: *Gammarus* Hyalidae: *Apohyale prevostii* Ischyroceridae: *Ischyrocerus anguipes* Lysianassidae: *Orchomenella minuta, O. pinguis* Oedicerotidae: *Ameroculodes edwardsi* Phoxocephalidae: *Phoxocephalus holbolli* Uristidae: *Anonyx sarsi*	1	Brunel et al. 1998 Consultation of DFO experts 2016[3]	1	Brunel et al. 1998	1	Bousfield 1973 Schram 1986	1*	Bousfield 1973 Johnson et al. 2001	4

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
ARTHROPODA CRUSTACEA	**MALACOSTRACA**	**AMPHIPODA (benthic) (155)**	**I**	**Benthic amphipod**	Ampeliscidae: *Haploops laevis* Ischyroceridae: *Ericthonius rubricornis* Lysianassidae: *Hippomedon propinqvus, Psammonyx* Maeridae: *Maera danae, M. loveni* Melitidae: *Megamoera dentata* Oedicerotidae: *Deflexilodes intermedius* Photidae: *Photis reinhardi* Phoxocephalidae: *Harpinia propinqua, Paraphoxus oculatus* Stenothoidae: *Metopa alderi, Metopella angusta* Unciolidae: *Unciola irrorata* Uristidae: *Anonyx lilljeborgi*	1	Brunel et al. 1998 Consultation of DFO experts 2016[3]	0	Brunel et al. 1998	1	Bousfield 1973 Schram 1986	1*	Bousfield 1973 Johnson et al. 2001	3

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
ARTHROPODA CRUSTACEA	MALACOSTRACA	AMPHIPODA (benthic) (155)	CB	**Benthic amphipod**	Amphilochidae: *Gitanopsis inermis* Corophiidae: *Protomedeia grandimana* Epimeriidae: *Paramphithoe hystrix* Oedicerotidae: *Bathymedon obtusifrons* Phoxocephalidae: *Harpinia serrata* Stegocephalidae: *Andaniopsis nordlandica* Stenothoidae: *Metopa borealis* Stilipedidae: *Astyra abyssi* Uristidae: *Anonyx ochoticus*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Bousfield 1973 Schram 1986	1*	Bousfield 1973 Johnson et al. 2001	2
		EUPHAUSIACEA (4)	UEP	**Euphausiid**	*Thysanoessa, Meganyctiphanes norvegica*	0	Mauchline 1984	1	Brunel et al. 1998 Cuzin-Roudy 2010 Hanamura et al. 1989 Mauchline 1984 Plourde et al. 2013	1	Cuzin-Roudy et al. 2004 Lasley-Rasher et al. 2015	1	Cuzin-Roudy 2010 Mauchline 1984 Ritz et al. 2011	3

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
ARTHROPODA CRUSTACEA	MALACOSTRACA	DECAPODA (CARIDEA), PASIPHAEIDEA (2)	MP	***Pasiphaea***	*Pasiphaea*	0	Brunel et al. 1998	0	Apollonio 1969 Brunel et al. 1998	1	Agguzi et al. 2007	1*	Agguzi et al. 2007	2
		DECAPODA (CARIDEA) CRANGONIDAE (6)	I	**Crangon shrimp**	*Crangon septemspinosa*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Lasley-Rasher et al. 2015 Schram 1986	1'	N/A	3
			I	Crangon shrimp with low reproductive capacity: **Sculptured shrimp**	*Sclerocrangon boreas*	0	Brunel et al. 1998 Consultation of DFO experts 2016[3]	0	Brunel et al. 1998	1	Lasley-Rasher et al. 2015 Schram 1986	1*	Sainte-Marie et al. 2006	2
			CB	**Crangon shrimp**	*Argis dentata, Pontophilus norvegicus, Sabinea septemcarinata*	0	Brunel et al. 1998 Consultation of DFO experts 2016[3] Savard and Nozères 2012	0	Brunel et al. 1998	1	Lasley-Rasher et al. 2015 Schram 1986	1'	N/A	2
		DECAPODA (CARIDEA), HIPPOLYTIDAE (8)	M	**Hippolytidae**	*Spirontocaris spinus*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Birkely and Gulliksen 2003 Williams 1984	1'	N/A	4
			I	**Hippolytidae**	*Eualus fabricii, Lebbeus*	1	Brunel et al. 1998 Consultation of DFO experts 2016[3] Savard and	0	Brunel et al. 1998	1	Birkely and Gulliksen 2003 Williams 1984	1'	N/A	3

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
							Nozères 2012							
ARTHROPODA CRUSTACEA	**MALACOSTRACA**		CB	**Hippolytidae**	*Eualus gaimardii, E. macilentus, Spirontocaris liljeborgii*	0	Brunel et al. 1998 Consultation of DFO experts 2016[3] Savard and Nozères 2012	0	Brunel et al. 1998	1	Birkely and Gulliksen 2003 Williams 1984	1'	N/A	2
		DECAPODA (CARIDEA), PANDALIDAE (3)	CB	Pandalid shrimp: **Striped and northern shrimp**	*Pandalus borealis*[C], *Pandalus montagui*[C]	0	Brunel et al. 1998 Consultation of DFO experts 2016[3] Savard and Nozères 2012	0	Brunel et al. 1998	1	Apollonio et al. 1986 Lasley-Rasher et al. 2015	1*	Apollonio et al. 1986 Savard and Bourdages 2010	2
		DECAPODA (ASTACIDEA) (1)	I	**American lobster**	*Homarus americanus*[C]	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Hardy et al. 2008 Munro and Therriault 1983	1	Consultation of DFO experts 2016[3]	3
		DECAPODA (AXIIDEA) (1)	CB	**Lobster shrimp**	*Calocaris templemani*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Gagnon et al. 2013	1*	Gagnon et al. 2013	2

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
		DECAPODA (ANOMURA) (5)	I	**Hermit crab**	*Pagurus*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Hazlett 1981	1	Rittschof et al. 1992	3
			CB	**Northern stone crab**	*Lithodes maja*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Sloan 1985	1	DFO 1998	2
ARTHROPODA CHELICERATA	MALACOSTRACA			**Bent-nosed squat lobster**	*Munidopsis curvirostra*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Thiel and Lovrich 2011	1	Thiel and Lovrich 2011	2
		DECAPODA (BRACHYURA) (4)	M	**Rock crab**	*Cancer irroratus* [C]	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Rebach 1987	1	Gendron and Savard 2013	4
			I	**Toad crab**	*Hyas*[C]	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	3
			I	**Snow crab**	*Chionoecetes opilio*[C]	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ernst et al. 2005 Lovrich et al. 1995	1	Sainte-Marie and Hazel 1992	3
	ARACHNIDA	TROMBIDIFORMES, HALACARIDAE (3)	M	**Mite**	*Halacarus*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Bartsch 2004	0*	Bartsch 2004	3
			I	**Mite**	*Copidognathus biodomus, Isobactrus setosus*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Bartsch 2004	0*	WoRMS 2016 Bartsch 2004	2
ARTHROPODA CHELICERATA	PYCNOGONIDA	(8)	I	**Pycnogonid**	*Nymphon*	0	Brunel et al. 1998 Consultation of DFO experts 2016[3]	1	Brunel et al. 1998	1	Mercier et al. 2015	1*	Burris 2013 Mercier et al. 2015	3

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
ARTHROPODA HEXAPODA	INSECTA	HEMIPTERA, CORIXIDAE (1)	M	**Hemipteran**	*Trichocorixa verticalis*	1	Brunel et al. 1998	1	Kelts 1979	0	Simonis 2013	1*	Simonis 2013	3

[1] The numbers in brackets correspond to the number of species recorded in the study area (Appendix 6) that belong to this ORDER.

[2] Common names in bold correspond to the names used in the vulnerability matrix. They represent the other taxa of their group.

[3] The experts consulted are listed in Appendix 3.

[C] Commercial species caught in directed fisheries.

Resilience

Assessment of Arthropoda taxa groups in the St. Lawrence ARP study area on the basis of resilience criteria

PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	RESILIENCE CRITERIA: POPULATION STATUS: SCORE	POPULATION STATUS: SOURCE	LOW RECOLONIZATION POTENTIAL: SCORE	LOW RECOLONIZATION POTENTIAL: SOURCE	LOW REPRODUCTIVE CAPACITY: SCORE	LOW REPRODUCTIVE CAPACITY: SOURCE	ASSOCIATION WITH SEDIMENT: SCORE	ASSOCIATION WITH SEDIMENT: SOURCE	TOTAL
ARTHROPODA CRUSTACEA	BRANCHIOPODA	(CLADOCERA) (4)	UEP	Water flea	*Bosmina (Eubosmina) coregoni, Evadne, Pleopis polyphaemoides, Podon*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Ruppert and Barnes 1994 WoRMS 2016	0*	Gieskes 1970 Ruppert and Barnes 1994	0*	Gieskes 1970 Ruppert and Barnes 1994	1
ARTHROPODA CRUSTACEA	OSTRACODA	(2)	GEP	Ostracod	*Discoconchoecia elegans, Obtusoecia obtusata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Cohen and Morin 1990 WoRMS 2016	1*	Angel 1993 Ikeda 1992	0*	Kaeriyama and Ikeda 2002	2
ARTHROPODA CRUSTACEA	OSTRACODA	(10)	I	Ostracod	N/A	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Commito and Tita 2002 Macfarlane et al. 2013 WoRMS 2016	1*	Angel 1993 Ikeda 1992 Schram 1986 Vandekerkhove et al. 2007	1	Bourget and Lacroix 1973 Ruppert and Barnes 1994	3

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
ARTHROPODA CRUSTACEA	(COPEPODA)	CALANOIDA (34), CYCLOPOIDA (3), HARPACTICOIDA (1), POECILOSTOMATOIDA (4)	UEP	**Neritic copepod**	Calanoida: *Acartia, Pseudocalanus, Eurytemora, Temora longicornis* Harpacticoida: *Parathalestris cronii* Cyclopoida: *Oithona atlantica, O. similis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Dahms 1995 WoRMS 2016	0*	Beyrend-Dur et al. 2009 Corkett and McLaren 1969 Dahms 1995 Dutz 1998 Dvoretsky and Dvoretsky 2009 Huys et al. 1996 Maps et al. 2005	0	Rose 1970	1
			UEP	**Oceanic copepod**	Calanoida: Aetideidae, *Scolecithricella minor* Poecilostromatoida: *Triconia borealis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Dahms 1995 WoRMS 2016	0*	Dahms 1995 Gislason 2003 Kosobokova et al. 2007 Yamaguchi et al. 1999	0	Rose 1970	1
			UEP	**Surface-interacting oceanic copepod**	Calanoida: *Microcalanus, Calanus finmarchicus, C. hyperboreus, Metridia longa, M. lucens*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Dahms 1995 WoRMS 2016	0*	Dahms 1995 Hopcroft et al. 2005 Melle and Skjoldal 1998 Plourde and Runge 1993	0	Rose 1970	1
		HARPACTICOIDA (76)	M	**Harpacticoid**	N/A	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Commito and Tita 2002 Handschumacher et al. 2010 Ingólfsson and Ólafsson 1997 Macfarlane et al. 2013 WoRMS 2016	0*	Huys et al. 1996	1	Huys et al. 1996	2

PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	RESILIENCE CRITERIA: POPULATION STATUS SCORE	POPULATION STATUS SOURCE	LOW RECOLONIZATION POTENTIAL SCORE	LOW RECOLONIZATION POTENTIAL SOURCE	LOW REPRODUCTIVE CAPACITY SCORE	LOW REPRODUCTIVE CAPACITY SOURCE	ASSOCIATION WITH SEDIMENT SCORE	ASSOCIATION WITH SEDIMENT SOURCE	TOTAL
ARTHROPODA CRUSTACEA	(COPEPODA)	CYCLOPOIDA (2)	I	**Cyclopoid**	*Cyclopina laurentica, C. vachoni*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Horner and Murphy 1985 WoRMS 2016	0*	Dvoretsky and Dvoretsky 2009	1'	N/A	2
	-	(THORACICA) SESSILIA (5)	M	**Barnacle**	*Balanus balanus, Semibalanus balanoides*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Zullo 1979 WoRMS 2016	0	Veliz et al. 2006 Ruppert and Barnes 1994 Wildish and Peer 1983	0	Zullo 1979	1
			I	**Barnacle**	*Amphibalanus improvisus, Balanus crenatus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Zullo 1979 WoRMS 2016	0	Veliz et al. 2006 Ruppert and Barnes 1994 Wildish and Peer 1983	0	Zullo 1979	1
			CB	**Barnacle**	*Chirona hameri*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Zullo 1979 WoRMS 2016	0	Veliz et al. 2006 Ruppert and Barnes 1994 Wildish and Peer 1983	0	Zullo 1979	1
	MALACOSTRACA	LEPTOSTRACA (1)	I	**Nebaliacean**	*Nebalia bipes*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Mauchline 1984 WoRMS 2016	1	Mauchline 1984 Vetter 1996	1	Schram 1986	4

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
ARTHROPODA CRUSTACEA	**MALACOSTRACA**	**MYSIDA (17)**	**M**	**Mysid**	*Mysis gaspensis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Lavoie et al. 2000 Winkler and Greve 2002 WoRMS 2016	1*	Johnson et al. 2001 De Ladurantaye and Lacroix 1980 Pezzack and Corey 1979 Schram 1986 Winkler and Greve 2002	1*	Schram 1986	3
			I	**Mysid**	*Meterythrops robustus, Mysis litoralis, M. oculata, M. stenolepis, Neomysis americana*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2017	0	Lavoie et al. 2000 Winkler and Greve 2002 WoRMS 2017	1	Johnson et al. 2001 De Ladurantaye and Lacroix 1980 Pezzack and Corey 1979 Schram 1986 Winkler and Greve 2002	1*	Schram 1986	3
			CB	**Mysid**	*Amblyops, Boreomysis arctica, B. tridens, Erythrops, Mysidetes farrani, M. mixta, Parerythrops, Pseudomma*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Lavoie et al. 2000 Winkler and Greve 2002 WoRMS 2017	1*	Johnson et al. 2001 De Ladurantaye and Lacroix 1980 Pezzack and Corey 1979 Schram 1986 Winkler and Greve 2002	1*	Schram 1986	3
		CUMACEA (31)	**M**	**Cumacean**	*Diastylis rathkei, D. sculpta, Lamprops quadriplicata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Anger and Valentin 1976 Armonies 1994 Corey 1981 Drolet et al. 2012 Schram 1986 WoRMS 2016	1	Corey 1981 Johnson et al. 2001	1	Ruppert and Barnes 1994	3

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
ARTHROPODA CRUSTACEA	MALACOSTRACA	CUMACEA (31)	I	Cumacean	*Eudorella emarginata, Leucon nasica, Petalosarsia declivis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Corey 1981 Schram 1986 WoRMS 2016	1	Corey 1981 Johnson et al. 2001	1	Ruppert and Barnes 1994	4
			CB	Cumacean	*Campylaspis horrida, Cumella (Cumella) carinata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Corey 1981 Schram 1986 WoRMS 2016	1*	Corey 1981 Johnson et al. 2001	1	Ruppert and Barnes 1994	4
		TANAIDACEA (7)	I	Tanaid	*Akanthophoreus gracilis, Pseudonototanais filum, Pseudotanais, Pseudosphyrapus anomalus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Alldredge and King 1985 Drolet et al. 2012 Schram 1986 WoRMS 2016	1	Johnson et al. 2001 Schram 1986	1*	Johnson et al. 2001	3
		ISOPODA (35)	M	Isopod	*Jaera, Idotea balthica, I. phosphorea*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Armonies 1994 Locke and Corey 1989 Naylor and Haahtela 1996 Robertson and Mann 1980 Schram 1986 WoRMS 2016	1	Johnson et al. 2001 Schram 1986	0	Naylor and Haahtela 1966 Robertson and Mann 1980 Ruppert and Barnes 1994	2

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
ARTHROPODA CRUSTACEA	**MALACOSTRACA**	**ISOPODA (35)**	**I**	**Wood-boring isopod**	*Limnora*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Miranda and Thiel 2008 Schram 1986 WoRMS 2016	1	Johnson et al. 2001 Schram 1986	0	Miranda and Thiel 2008	3
			I	**Isopod**	*Calathura brachiata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Brandt and Negoescu 1997	1	Johnson et al. 2001 Schram 1986	1*	Brandt and Negoescu 1997	4
			CB	**Isopod**	*Janira alta, Munna*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Brunel et al. 1998 Schram 1986 WoRMS 2016	1	Johnson et al. 2001 Schram 1986	1*	Wildish and Peer 1983	4
		AMPHIPODA (HYPERIIDEA) (4)	**UEP**	**Hyperiid**	*Themisto*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Prokopowicz 2011 WoRMS 2016	0	Percy 1993 Prokopowicz 2011 Yamada et al. 2004	0	Berge and Nahrgang 2013 Dalpadado et al. 2008	1
			MP	**Hyperiid**	*Scina borealis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Prokopowicz 2011 WoRMS 2016	0*	Percy 1993 Prokopowicz 2011 Yamada et al. 2004	0*	Berge and Nahrgang 2013 Dalpadado et al. 2008	1

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
ARTHROPODA CRUSTACEA	**MALACOSTRACA**	**AMPHIPODA (suprabenthic) (23)**	**M**	**Suprabenthic amphipod**	Calliopiidae: *Calliopius laeviusculus* Eusiridae: *Eusirus propinquus* Pontogeneiidae: *Pontogeneia inermis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Bousfield 1973 Schram 1986 WoRMS 2016	1	Bousfield 1973 Sainte-Marie 1991 Schram 1986	0	Bousfield 1973	2
			I	**Suprabenthic amphipod**	Caprellidae: *Caprella linearis, Caprella septentrionalis* Eusiridae: *Rhachotropis oculata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Bousfield 1973 Schram 1986 Thiel et al. 2003 Tzetlin et al. 1997 WoRMS 2016	1	Sainte-Marie 1991 Schram 1986	0	Bousfield 1973	2
			CB	**Suprabenthic amphipod**	Calliopioidea: *Amphithopsis longicaudata* Caprellidae: *Caprella rinki*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Schram 1986 WoRMS 2016	1	Sainte-Marie 1991 Schram 1986	0	Ruppert and Barnes 1994	3
		AMPHIPODA (benthic) (155)	**M**	**Benthic amphipod with low recolonization potential**: Northern big-eyed sandhopper	Talitridae: *Americorchestia megalophthalma*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Schram 1986 WoRMS 2016	1	Bousfield 1973 Sainte-Marie 1991 Schram 1986	1	Bousfield 1973	4

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
ARTHROPODA CRUSTACEA	**MALACOSTRACA**	**AMPHIPODA (benthic) (155)**	**M**	**Benthic amphipod**	Ampeliscidae: *Ampelisca macrocephala* Bathyporeiidae: *Amphiporeia lawrenciana* Corophiidae: *Crassicorophium bonelli* Gammarellidae: *Gammarellus* Gammaridae: *Gammarus* Hyalidae: *Apohyale prevostii* Ischyroceridae: *Ischyrocerus anguipes* Lysianassidae: *Orchomenella minuta, O. pinguis* Oedicerotidae: *Ameroculodes edwardsi* Phoxocephalidae: *Phoxocephalus holbolli* Uristidae: *Anonyx sarsi*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Drolet et al. 2012 Locke and Corey 1989 Schram 1986 WoRMS 2016	1	Bousfield 1973 Sainte-Marie 1991 Schram 1986	1*	Bousfield 1973 Sainte-Marie and Brunel 1985	3

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
ARTHROPODA CRUSTACEA	MALACOSTRACA	AMPHIPODA (benthic) (155)	I	**Benthic amphipod**	Ampeliscidae: *Haploops laevis* Ischyroceridae: *Ericthonius rubricornis* Lysianassidae: *Hippomedon propinqvus, Psammonyx* Maeridae: *Maera danae, M. loveni* Melitidae: *Megamoera dentata* Oedicerotidae: *Deflexilodes intermedius* Photidae: *Photis reinhardi* Phoxocephalidae: *Harpinia propinqua, Paraphoxus oculatus* Stenothoidae: *Metopa alderi, Metopella angusta* Unciolidae: *Unciola irrorata* Uristidae: *Anonyx lilljeborgi*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Schram 1986 WoRMS 2016	1	Bousfield 1973 Sainte-Marie 1991 Schram 1986	1*	Bousfield 1973 Sainte-Marie and Brunel 1985	4

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
ARTHROPODA CRUSTACEA	**MALACOSTRACA**	**AMPHIPODA (benthic) (155)**	**CB**	**Benthic amphipod**	Amphilochidae: *Gitanopsis inermis* Corophiidae: *Protomedeia grandimana* Epimeriidae: *Paramphithoe hystrix* Oedicerotidae: *Bathymedon obtusifrons* Phoxocephalidae: *Harpinia serrata* Stegocephalidae: *Andaniopsis nordlandica* Stenothoidae: *Metopa borealis* Stilipedidae: *Astyra abyssi* Uristidae: *Anonyx ochoticus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Schram 1986 WoRMS 2016	1	Bousfield 1973 Sainte-Marie 1991 Schram 1986	1*	Bousfield 1973 Sainte-Marie and Brunel 1985	4
		EUPHAUSIACEA (4)	**UEP**	**Euphausiid**	*Thysanoessa, Meganyctiphanes norvegica*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Schram 1986 WoRMS 2016	0	Cuzin-Roudy 2010 Mauchline 1984 Plourde et al. 2011	1	Cleary et al. 2012	2
		DECAPODA (CARIDEA), PASIPHAEIDEA (2)	**MP**	***Pasiphaea***	*Pasiphaea*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Aguzzi et al. 2007 WoRMS 2016	0	Apollonio 1969 Matthews and Pinnoi 1973	1	Cartes 1993	1

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
ARTHROPODA CRUSTACEA	**MALACOSTRACA**	**DECAPODA (CARIDEA), CRANGONIDAE (6)**	**I**	**Crangon shrimp**	*Crangon septemspinosa*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Pedersen 1998 Perkins 1994 Squires 1965 WoRMS 2016	0*	Lacoursière-Roussel and Sainte-Marie 2009 Locke et al. 2005	1	Squires 1990	1
			I	Crangon shrimp with low reproductive capacity: **Sculptured shrimp**	*Sclerocrangon boreas*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Guay et al. 2011 WoRMS 2016	1	Lacoursière-Roussel and Sainte-Marie 2009	1	Sainte-Marie et al. 2006	3
			CB	**Crangon shrimp**	*Argis dentata, Pontophilus norvegicus, Sabinea septemcarinata*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2017	0	Pedersen 1998 Perkins 1994 Squires 1965 WoRMS 2017	0*	Lacoursière-Roussel and Sainte-Marie 2009 Locke et al. 2005	1	Squires 1990	1
		DECAPODA (CARIDEA), HIPPOLYTIDAE (8)	**M**	**Hippolytidae**	*Spirontocaris spinus*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Haynes 1985 Perkins 1994 WoRMS 2016	1'	N/A	1*	Birkely and Gulliksen 2003 Squires 1990	2
			I	**Hippolytidae**	*Eualus fabricii, Lebbeus*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Haynes 1985 Perkins 1994 WoRMS 2016	1'	N/A	1*	Birkely and Gulliksen 2003 Squires 1990	2

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
ARTHROPODA CRUSTACEA	MALACOSTRACA	**DECAPODA (CARIDEA), HIPPOLYTIDAE (8)**	**CB**	**Hippolytidae**	*Eualus gaimardii, E. macilentus, Spirontocaris liljeborgii*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Haynes 1985 Perkins 1994 WoRMS 2016	1'	N/A	1*	Birkely and Gulliksen 2003 Squires 1990	2
		DECAPODA (CARIDEA), PANDALIDAE (3)	**CB**	Pandalid shrimp: **Striped and northern shrimp**	*Pandalus borealis*[C], *Pandalus montagui*[C]	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Haynes 1985 WoRMS 2016	0*	Burukovsky and Sudnik 1997 DFO 2015a	1	Warren and Sheldon 1967	1
		DECAPODA (ASTACIDEA) (1)	**I**	**American lobster**	*Homarus americanus*[C]	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Gendron and Savard 2012 WoRMS 2016	0	Gendron and Savard 2012	1	Gendron and Savard 2012	1
		DECAPODA (AXIIDEA) (1)	**CB**	**Lobster shrimp**	*Calocaris templemani*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Squires 1990 WoRMS 2016	1	Mileikovsky 1971 Squires 1990	1	Gagnon et al. 2013	4

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
ARTHROPODA CRUSTACEA	**MALACOSTRACA**	**DECAPODA (ANOMURA) (5)**	**I**	**Hermit crab**	*Pagurus*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Hazlett 1981 WoRMS 2016	0	Hazlett 1981 Squires 1990 Wildish and Peer 1983	1	Kellogg 1977	1
			CB	**Northern stone crab**	*Lithodes maja*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Anger 1996 WoRMS 2016	0	DFO 1998	1	Squires 1990	1
			CB	**Bent-nosed squat lobster**	*Munidopsis curvirostra*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Wilkens et al. 1990 WoRMS 2016	1	Wenner 1982	1	Squires 1990	4
		DECAPODA (BRACHYURA) (4)	**M**	**Rock crab**	*Cancer irroratus* [C]	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Gendron et al. 1998 WoRMS 2016	0	Gendron et al. 1998	1	Gendron et al. 1998	1
			I	**Toad crab**	*Hyas*[C]	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Anger 1983 Walther et al. 2010 WoRMS 2016	0	Dufour and Bernier 1994	0	Markowska et al. 2008	0

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
ARTHROPODA CRUSTACEA	**MALACOSTRACA**	**DECAPODA (BRACHYURA) (4)**	**I**	**Snow crab**	*Chionoecetes opilio*[C]	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Puebla et al. 2008 WoRMS 2016	0	Sainte-Marie 1993	1	Hooper 1986 Dionne et al. 2003	1
ARTHROPODA CHELICERATA	**ARACHNIDA**	**TROMBIDIFORMES, HALACARIDAE (3)**	**M**	**Mite**	*Halacarus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Bartsch 2004 Commito and Tita 2002 WoRMS 2016	1	Bartsch 2004	1	Bartsch 2004	3
ARTHROPODA CHELICERATA	**ARACHNIDA**	**TROMBIDIFORMES, HALACARIDAE (3)**	**I**	**Mite**	*Copidognathus biodomus, Isobactrus setosus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Bartsch 2004 WoRMS 2016	1	Bartsch 2004	1	Bartsch 2004	4
ARTHROPODA CHELICERATA	**PYCNOGONIDA**	**(8)**	**I**	**Pycnogonid**	*Nymphon*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Burris 2011 WoRMS 2016	1	Burris 2011 Mercier et al. 2015	0	Burris 2011 Queirós et al. 2013	3

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
ARTHROPODA HEXAPODA	INSECTA	HEMIPTERA, CORIXIDAE (1)	M	**Hemipteran**	*Trichocorixa verticalis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Simonis 2013 WoRMS 2016	0	Aiken and Malatestinic 1995 Kelts 1979	1	Kelts 1979	2

[1] The numbers in brackets correspond to the number of species recorded in the study area (Appendix 6) that belong to this ORDER.

[2] Common names in bold correspond to the names used in the vulnerability matrix. They represent the other taxa of their group.

[3] The experts consulted are listed in Appendix 3.

[C] Commercial species caught in directed fisheries.

5.2.5. Echinodermata

Exposure potential

Assessment of Echinodermata taxa groups in the St. Lawrence ARP study area on the basis of exposure potential criteria.

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
ECHINODERMATA	ASTEROIDEA	(14)	M	**Common sea star**	*Asterias rubens*	1	Brunel et al. 1998 Himmelman and Dutil 1991	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	0*	Dare 1982 Fontaine 2006 Gaymer et al. 2004 Himmelman and Dutil 1991	3
			M	Brooding sea star: **Polar six-rayed star**	*Leptasterias polaris*	1	Brunel et al. 1998 Himmelman and Dutil 1991	1	Brunel et al. 1998 Himmelman and Dutil 1991	1	Ruppert and Barnes 1994	0*	Bourget 1997 Dare 1982 Gaymer et al. 2004 Himmelman and Dutil 1991	3
			I	**Sun star**	*Crossaster papposus, Henricia perforata, H. spongiosa, Solaster endeca*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	0*	Fontaine 2006 Gaymer et al. 2004 Himmelman and Dutil 1991	2
			I	Brooding **sea star**	*Leptasterias littoralis*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	0*	Bourget 1997 Dare 1982 Gaymer et al. 2004 Himmelman and Dutil 1991	2
			CB	Brooding sea star: **Cushion star**	*Hippasteria phrygiana, Pteraster*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	0*	Foltz et al. 2013 Haedrich and Maunder 1985	1

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
ECHINODERMATA	OPHIUROIDEA	EURYALIDA (1)	I	**Basket star**	*Gorgonocephalus arcticus*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Rosenberg et al. 2005	3
		OPHIURIDA (12)	I	***Ophiura robusta***	*Ophiura robusta*	1	Begin et al. 2004 Brunel et al. 1998 Himmelman et al. 2008	0	Begin et al. 2004 Brunel et al. 1998 Himmelman et al. 2008	1	Ruppert and Barnes 1994	1'	N/A	3
			I	***Stegophiura nodosa***	*Amphipholis squamata, Ophiacantha bidentata, Stegophiura*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Chabot et al. 2007	3
			I	**Daisy brittle star**	*Ophiopholis aculeata*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Chabot et al. 2007	3
			CB	**Notched brittle star**	*Amphiura, Ophiura sarsii*	0	Brunel et al. 1998 Mark et al. 2010 Packer et al. 1994	0	Brunel et al. 1998 Mark et al. 2010 Packer et al. 1994	1	Ruppert and Barnes 1994	1'	N/A	2
	ECHINOIDEA	(4)	M	**Sea urchin**	*Strongylocentrotus*[C]	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1	Bernstein et al. 1983 Dumont and Himmelman 2008 Sainte-Marie et al. 2012	4
			I	**Sand dollar**	*Echinarachnius parma*	1	Brunel et al. 1998 Cabanac and Himmelman 1996	0	Brunel et al. 1998 Cabanac and Himmelman 1996	1	Ruppert and Barnes 1994	1*	Stanley and James 1971 Steimle 1990	3

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
ECHINODERMATA	ECHINOIDEA	(4)	CB	***Brisaster fragilis***	*Brisaster fragilis*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	2
	HOLOTHUROIDEA	(8)	M	***Cucumaria frondosa***	*Cucumaria frondosa*[C]	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1	Chabot et al. 2007 Dallaire et al. 2013	4
				Pentamera calcigera	*Pentamera calcigera*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Dallaire et al. 2013	4
				Chiridota laevis	*Chiridota laevis, Psolus phantapus*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	0*	Coady 1973	3
			I	***Psolus fabricii***	*Psolus fabricii*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Chabot et al. 2007 Coady 1973 Dallaire et al. 2013	3
			CB	***Molpadia***	*Molpadia*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Rhoads and Young 1971	2

[1] The numbers in brackets correspond to the number of species recorded in the study area (Appendix 6) that belong to this ORDER.

[2] Common names in bold correspond to the names used in the vulnerability matrix. They represent the other taxa of their group.

[C] Commercial species caught in directed fisheries.

Resilience

Assessment of Echinodermata taxa groups in the St. Lawrence ARP study area on the basis of resilience criteria

PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	RESILIENCE CRITERIA								TOTAL
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
						SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	
ECHINODERMATA	ASTEROIDEA	(14)	M	**Common sea star**	*Asterias rubens*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Mercier and Hamel 2010 WoRMS 2016	0	Eaves and Palmer 2003 Himmelman and Dutil 1991 Mercier and Hamel 2010 Ruppert and Barnes 1994 Wildish and Peer 1983	1	Bourget 1997 Fontaine 2006	2
			M	Brooding sea star: **Polar six-rayed star**	*Leptasterias polaris*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Bingham et al. 2004 Mercier and Hamel 2010 WoRMS 2016	0*	Bingham et al. 2004 Eaves and Palmer 2003 Hamel and Mercier 1995	1	Bourget 1997 Fontaine 2006 Meinkoth 1981	3
			I	**Sun star** and Blood Sea star	*Crossaster papposus, Solaster endeca, Henricia perforata, H. spongiosa*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Mercier and Hamel 2010 WoRMS 2016	0	Carlson and Pfister 1999 Eaves and Palmer 2003 Mercier and Hamel 2010 Ruppert and Barnes 1994	0	Fontaine 2006 Meinkoth 1981	1

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
ECHINODERMATA	**ASTEROIDEA**	**(14)**	**I**	Brooding **sea star**	*Leptasterias littoralis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Bingham et al. 2004 Mercier and Hamel 2010 WoRMS 2016	0*	Bingham et al. 2004 Eaves and Palmer 2003 Hamel and Mercier 1995	0	Bourget 1997 Fontaine 2006 Meinkoth 1981	2
			CB	Brooding sea star: **Cushion star**	*Hippasteria phrygiana, Pteraster*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Foltz et al. 2013 McClary and Mladenov 1989 Mercier and Hamel 2010 WoRMS 2016	0*	Eaves and Palmer 2003 Foltz et al. 2013 McClary and Mladenov 1989 Ruppert and Barnes 1994	0	Fontaine 2006 Meinkoth 1981	1
	OPHIUROIDEA	**EURYALIDA (1)**	**I**	**Basket star**	*Gorgonocephalus arcticus*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	McEdward and Miner 2001 WoRMS 2016	0*	Eaves and Palmer 2003 McEdward and Miner 2001 Patent 1969 Ruppert and Barnes 1994	0	Emson et al. 1991	2
		OPHIURIDA (12)	**I**	***Ophiura robusta***	*Ophiura robusta*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	McEdward and Miner 2001 Mercier and Hamel 2010 WoRMS 2016	0*	Balser 1998 Eaves and Palmer 2003 Himmelman et al. 2008 Wildish and Peer 1983	1	Chabot et al. 2007 Schneider et al. 1987	2
			I	***Stegophiuranod osa***	*Amphipholis squamata, Ophiacantha bidentata, Stegophiura*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	McEdward and Miner 2001 WoRMS 2016	0*	Balser 1998 Eaves and Palmer 2003 McEdward and Miner 2001 Wildish and Peer 1983	1*	Fontaine 2006 Queirós et al. 2013	3

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
ECHINODERMATA	**OPHIUROIDEA**	**OPHIURIDA (12)**	**I**	**Daisy brittle star**	*Ophiopholis aculeata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Mercier and Hamel 2010 WoRMS 2016	0	Balser 1998 Eaves and Palmer 2003 Himmelman et al. 2008 Wildish and Peer 1983	0	Chabot et al. 2007 Fontaine 2006	1
			CB	**Notched brittle star**	*Amphiura, Ophiura sarsii*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	McEdward and Miner 2001 WoRMS 2016	0*	Balser 1998 Eaves and Palmer 2003 McEdward and Miner 2001 Wildish and Peer 1983	1*	Himmelman 1991 Queirós et al. 2013	3
	ECHINOIDEA	**(4)**	**M**	**Sea urchin**	*Strongylocentrotus*[C]	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Mercier and Hamel 2010 Sainte-Marie et al. 2012 WoRMS 2016	0	Allen et al. 2015 Sainte-Marie et al. 2012 Wildish and Peer 1983	0	Dumont and Himmelman 2008	0
			I	**Sand dollar**	*Echinarachnius parma*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	McEdward and Miner 2001 WoRMS 2016	0	Allen et al. 2015 Hamel and Himmelman 1992 Wildish and Peer 1983	1	Steimle 1990	1
			CB	***Brisaster fragilis***	*Brisaster fragilis*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	McEdward and Miner 2001 WoRMS 2016	0*	Allen et al. 2015 Eaves and Palmer 2003 Ruppert and Barnes 1994 Wildish and Peer 1983	1	Walker and Gagnon 2014 Wildish and Peer 1983	1

PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	RESILIENCE CRITERIA: POPULATION STATUS – SCORE	SOURCE	LOW RECOLONIZATION POTENTIAL – SCORE	SOURCE	LOW REPRODUCTIVE CAPACITY – SCORE	SOURCE	ASSOCIATION WITH SEDIMENT – SCORE	SOURCE	TOTAL
ECHINODERMATA	HOLOTHUROIDEA	(8)	M	***Cucumaria frondosa***	*Cucumaria frondosa*[C]	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Hamel and Mercier 1996 WoRMS 2016	0	Dallaire et al. 2013 Eaves and Palmer 2003 Hamel and Mercier 1996	0	Dallaire et al. 2013	0
			M	***Pentamera calcigera***	*Pentamera calcigera*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Reitzel et al. 2004 WoRMS 2016	0*	Eaves and Palmer 2003 Hamel and Mercier 1996 Reitzel et al. 2004 Ruppert and Barnes 1994	1	Provencher and Nozère 2013	1
			M	***Chiridota laevis***	*Chiridota laevis, Psolus phantapus*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Mercier and Hamel 2010 Medeiros-Bergen et al. 1995 WoRMS 2016	0*	Eaves and Palmer 2003 Hamel and Mercier 1996 Medeiros-Bergen et al. 1995 Ruppert and Barnes 1994	1	Coady 1973 Fontaine 2006	1
			I	***Psolus fabricii***	*Psolus fabricii*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Mercier and Hamel 2010 WoRMS 2016	0*	Eaves and Palmer 2003 Hamel et al. 1993 Hamel and Mercier 1996 Ruppert and Barnes 1994	0	Fontaine 2006	0

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
ECHINODERMATA	**HOLOTHUROIDEA**	**(8)**	**CB**	***Molpadia***	*Molpadia*	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Drozdov et al. 2012 WoRMS 2016	0	Drozdov et al. 2012	1	Chabot et al. 2007 Rhoads and Young 1971	1

[1] The numbers in brackets correspond to the number of species recorded in the study area (Appendix 6) that belong to this ORDER.

[2] Common names in bold correspond to the names used in the vulnerability matrix. They represent the other taxa of their group.

[C] Commercial species caught in directed fisheries.

5.2.6. Other Phyla

Exposure potential

Assessment of other invertebrate phyla taxa groups in the St. Lawrence ARP study area on the basis of exposure potential criteria

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
ENTOPROCTA	-	(2)	M	Entoproct	*Pedicellina*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	4
ENTOPROCTA	-	(2)	I	Entoproct	*Barentsia*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	3
BRYOZOA	-	(40)	M	Bryozoan	*Aquiloniella scabra, Alcyonidium gelatinosum, Crisia eburnea, Flustrellidra hispida, Serratiflustra serrulata, Tegella armifera*	1	Brunel et al. 1998 Bourget 1997	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	4
BRYOZOA	-	(40)	I	Bryozoan	*Arctonula arctica, Bugulina flabellata, Dendrobeania murrayana, Disporella hispida, Eucratea loricata, Schizoporella unicornis*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	3
BRYOZOA	-	(40)	CB	Bryozoan	*Bathysoecia polygonalis, Plagioecia patina*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	2

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
BRACHIOPODA	-	(1)	I	**Brachiopod**	*Hemithiris psittacea*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Thayer 1975	3
CHAETOGNATHA		(3)	UEP	**Neritic chaetognath**	*Parasagitta elegan*	1	Brunel et al. 1998 Thuesen et al. 1993	1	Brunel et al. 1998 Thuesen et al. 1993	1	Ruppert and Barnes 1994	1'	N/A	4
			UEP	**Oceanic chaetognath**	*Eukrohnia hamata*	0	Brunel et al. 1998 Thuesen et al. 1993	1	Brunel et al. 1998 Thuesen et al. 1993	1	Ruppert and Barnes 1994	1'	N/A	3
			MP	**Chaetognath**	*Pseudosagitta maxima*	0	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	2
CHORDATA	APPENDICULARIA	COPELATA (2)	UEP	**Larvacean**	*Fritillaria borealis, Oikopleura labradoriensis*	0	Tomita et al. 2003	1*	Brunel et al. 1998 Tomita et al. 2003	1	Selander and Tiselius 2003	1'	N/A	3
	ASCIDIACEA	(25)	M	**Tunicate**	*Boltenia echinata*	1	Brunel et al. 1998	1	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	4

						EXPOSURE POTENTIAL CRITERIA								
						LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
CHORDATA	**ASCIDIACEA**	**(25)**	**I**	Tunicate: **Sea potato**	*Boltenia ovifera, Dendrodoa carnea, Halocynthia pyriformis, Molgula, Styela rustica*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1*	Armsworthy et al. 2001 Francis et al. 2014 Murillo et al. 2016 Yakovis et al. 2008	3
			I	**Colonial tunicate**	*Didemnum albidum*	1	Brunel et al. 1998	0	Brunel et al. 1998	1	Ruppert and Barnes 1994	1'	N/A	3

[1] The numbers in brackets correspond to the number of species recorded in the study area (Appendix 6) that belong to this ORDER.

[2] Common names in bold correspond to the names used in the vulnerability matrix. They represent the other taxa of their group.

Resilience

Assessment of other invertebrate phyla taxa groups in the St. Lawrence ARP study area on the basis of resilience criteria.

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
ENTOPROCTA	-	(2)	M	Entoproct	*Pedicellina*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Giese and Pearse 1975a Ruppert and Barnes 1994 WoRMS 2016	0	Giese and Pearse 1975a Ruppert and Barnes 1994 Wasson 1997	0	Ruppert and Barnes 1994	2
			I	Entoproct	*Barentsia*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Giese and Pearse 1975a WoRMS 2016	0	Giese and Pearse 1975a Ruppert and Barnes 1994 Wasson 1997	0	Ruppert and Barnes 1994	2
BRYOZOA		(40)	M	Bryozoan	*Aquiloniella scabra, Alcyonidium gelatinosum, Crisia eburnea, Flustrellidra hispida, Serratiflustra serrulata, Tegella armifera*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Hayward and Ryland 2005 Ruppert and Barnes 1994 WoRMS 2016	0*	Ruppert and Barnes 1994	0	Hayward and Ryland 2005 Meinkoth 1981	2

PHYLUM	CLASS	ORDER[1]	ZONE	COMMON NAME[2]	EXAMPLES OF TAXA	RESILIENCE CRITERIA: POPULATION STATUS SCORE	POPULATION STATUS SOURCE	LOW RECOLONIZATION POTENTIAL SCORE	LOW RECOLONIZATION POTENTIAL SOURCE	LOW REPRODUCTIVE CAPACITY SCORE	LOW REPRODUCTIVE CAPACITY SOURCE	ASSOCIATION WITH SEDIMENT SCORE	ASSOCIATION WITH SEDIMENT SOURCE	TOTAL
BRYOZOA	-	(40)	I	**Bryozoan**	*Arctonula arctica, Bugulina flabellata, Dendrobeania murrayana, Disporella hispida, Eucratea loricata, Schizoporella unicornis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Hayward and Ryland 2005 Ruppert and Barnes 1994 WoRMS 2016	0*	Ruppert and Barnes 1994	0	Hayward and Ryland 2005	2
			CB	**Bryozoan**	*Bathysoecia polygonalis, Plagioecia patina*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Hayward and Ryland 2005 Ruppert and Barnes 1994 WoRMS 2016	0*	Ruppert and Barnes 1994	0	Hayward and Ryland 2005	2
BRACHIOPODA		(1)	I	**Brachiopod**	*Hemithiris psittacea*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Reitzel et al. 2004 Ruppert and Barnes 1994 WoRMS 2016	1*	Reitzel et al. 2004 Thayer 1975	0	Ruppert and Barnes 1994 Suchanek and Levinton 1974	3
CHAETOGNATHA		(3)	UEP	**Neritic chaetognath**	*Parasagitta elegan*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Ruppert and Barnes 1994 WoRMS 2016	0	Alvarino 1990 Dallot 1968 Pierrot-Bults and Chidgey 1988	0	Ruppert and Barnes 1994	1
			UEP	**Oceanic chaetognath**	*Eukrohnia hamata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Ruppert and Barnes 1994 WoRMS 2016	0	Alvarino 1990 Dallot 1968 Pierrot-Bults and Chidgey 1988	0	Ruppert and Barnes 1994	1

						RESILIENCE CRITERIA								
						POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
PHYLUM	**CLASS**	**ORDER[1]**	**ZONE**	**COMMON NAME[2]**	**EXAMPLES OF TAXA**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
CHAETOGNATHA	-	(3)	**MP**	**Chaetognath**	*Pseudosagitta maxima*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Ruppert and Barnes 1994 WoRMS 2016	0	Alvarino 1990 Dallot 1968 Pierrot-Bults and Chidgey 1988	0	Ruppert and Barnes 1994	1
CHORDATA	**APPENDICULARIA**	**COPELATA (2)**	**UEP**	**Larvacean**	*Fritillaria borealis, Oikopleura labradoriensis*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Selander and Tiselius 2003 WoRMS 2016	0	Paffenhöfer 1976 Presta et al. 2015	0	Martí-Solans et al. 2015	1
CHORDATA	**ASCIDIACEA**	(25)	**M**	**Tunicate**	*Boltenia echinata*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Lacalli 1981 Millar 1970 WoRMS 2016	0	Francis et al. 2014 Millar 1970 Ruppert and Barnes 1994	0	Meinkoth 1981	1
CHORDATA	**ASCIDIACEA**	(25)	**I**	Tunicate: **Sea potato**	*Boltenia ovifera, Dendrodoa carnea, Halocynthia pyriformis, Molgula, Styela rustica*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Lacalli 1981 Mercier and Hamel 2010 Millar 1970 Svane and Young 1989 Yakovis et al. 2013 WoRMS 2016	0	Frame and McCann 1971 Francis et al. 2014 Millar 1970 Ruppert and Barnes 1994	0	Fontaine 2006 Francis et al. 2014 Meinkoth 1981	1
CHORDATA	**ASCIDIACEA**	(25)	**I**	**Colonial tunicate**	*Didemnum albidum*	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Ruppert and Barnes 1994 Millar 1970 WoRMS 2016	0	Millar 1970 Ruppert and Barnes 1994	0	Fontaine 2006	2

[1] The numbers in brackets correspond to the number of species recorded in the study area (Appendix 6) that belong to this ORDER.

[2] Common names in bold correspond to the names used in the vulnerability matrix. They represent the other taxa of their group.

5.2.7. References: Marine and estuarine invertebrates

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5.3. MARINE, ESTUARINE AND DIADROMOUS FISH

5.3.1. Exposure potential

Asssessment of marine, estuarine and diadromous fish taxa in the St. Lawrence ARP study area on the basis of exposure potential criteria

		EXPOSURE POTENTIAL CRITERIA								
		LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
LIFESTYLE	**TAXON**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
DIADROMOUS	American shad (*Alosa sapidissima*)	1	Collette and Klein-MacPhee 2002 Massicotte et al. 1990	1	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	3
	American eel (*Anguilla rostrata*)	1	Jacoby et al. 2014	0	Jacoby et al. 2014 Nilo and Fortin 2001	0	Collette and Klein-MacPhee 2002 Jacoby et al. 2014	1	Jacoby et al. 2014	2
	Striped bass (*Morone saxatilis*)	1	Nellis et al. 2012	1	COSEWIC 2012a	0	Collette and Klein-MacPhee 2002 COSEWIC 2012a	1	COSEWIC 2012a Robitaille et al. 2011	3
	White perch (*Morone americana*)	1	Collette and Klein-MacPhee 2002 Massicotte et al. 1990	1	Scott and Crossman 1974	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002 Scott and Crossman 1974	3
	Rainbow smelt (*Osmerus mordax*)	1	Massicotte et al. 1990 Nellis et al. 2012	1	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	3
	Ninespine stickleback (*Pungitius pungitius*)	1	Massicotte et al. 1990 Nellis et al. 2012	1	Wootton 1984	1	Collette and Klein-MacPhee 2002	0	Wootton 1984	3
	Fourspine stickleback (*Apeltes quadracus*)	1	Calderon 1996 Nellis et al. 2012	1	Wootton 1984	1	Collette and Klein-MacPhee 2002	0	Wootton 1984	3
	Threespine Stickleback (*Gasterosteus aculeatus*)	1	Grant and Provencher 2007 Le Breton and Pédrot 2012 Massicotte et al. 1990	1	Wootton 1984	1	Collette and Klein-MacPhee 2002	0	Wootton 1984	3
	Blackspotted stickleback (*Gasterosteus wheatlandii*)	1	Grant and Provencher 2007 Le Breton and Pédrot 2012	1	Wootton 1984	1	Collette and Klein-MacPhee 2002	0	Wootton 1984	3
	Atlantic sturgeon (*Acipenser oxyrinchus*)	1	Massicotte et al. 1990 Tremblay 1995	0	Collette and Klein-MacPhee 2002 Hatin and Caron 2003	0	Collette and Klein-MacPhee 2002 Hatin and Caron 2003	1	Hatin and Caron 2003	2

		EXPOSURE POTENTIAL CRITERIA								
		LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
LIFESTYLE	TAXON	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
DIADROMOUS	Alewife (*Alosa pseudoharengus*)	1	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002 DFO 2007	1	Collette and Klein-MacPhee 2002 DFO 2007	2
	Sea lamprey (*Petromyzon marinus*)	1	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1	Scott and Crossman 1974	3
	Greenland cod (*Gadus ogac*)	1	Grant and Provencher 2007 Morin et al. 1991	0	Morin et al. 1991	1	Knickle and Rose 2014 Mikhail and Welch 1989	0	Mikhail and Welch 1989	2
	Brook trout (*Salvelinus fontinalis*)	1	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	3
	Atlantic tomcod (*Microgadus tomcod*)	1	Massicotte et al. 1990 Nellis et al. 2012	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002 Scott and Crossman 1974	1	Couillard 2009 Couillard et al. 2011	2
	Atlantic salmon (*Salmo salar*)	1	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1	Riley et al. 2014	3
PELAGIC	Capelin (*Mallotus villosus*)	1	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	0	Davoren and Halden 2014	1	Collette and Klein-MacPhee 2002	3
	Lumpfish (*Cyclopterus lumpus*)[C]	1	Grant and Provencher 2007 Nellis et al. 2012	1	Collette and Klein-MacPhee 2002 DFO 2016	0	Collette and Klein-MacPhee 2002 Kennedy et al. 2015 DFO 2016	0	Pampoulie et al. 2014	2
	Atlantic herring (*Clupea harengus*)[C]	1	Massicotte et al. 1990 Nellis et al. 2012	1	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	3
	Greenland shark (*Somniosus microcephalus*)	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	0	Campana et al. 2015	0	Stokesbury et al. 2005	0
	American sand lance (*Ammodytes americanus*)	1	Collette and Klein-MacPhee 2002 Scott and Scott 1988	1	Collette and Klein-MacPhee 2002 Scott and Scott 1988	0	Meyer et al. 1979	1	Collette and Klein-MacPhee 2002	3
	Northern sand lance (*Ammodytes dubius*)	0	Collette and Klein-MacPhee 2002 Scott and Scott 1988	0	Collette and Klein-MacPhee 2002 Scott and Scott 1988	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	1

		EXPOSURE POTENTIAL CRITERIA								
		LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
LIFESTYLE	TAXON	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
PELAGIC	White barracudina (*Arctozenus risso*)	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	0	Scott and Scott 1988	0	Moore et al. 2015	0
	Atlantic mackerel (*Scomber scombrus*)[C]	1	Collette and Klein-MacPhee 2002 Studholme et al. 1999	1	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	3
	Porbeagle (*Lamna nasus*)	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	0	Kohler et al. 2002	0	Kohler et al. 2002	1
	Silver hake (*Merluccius bilinearis*)	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	2
	Atlantic soft pout (*Melanostigma atlanticum*)	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1	Silverberg and Bossé 1994	1	Silverberg et al. 1987	2
	Basking shark (*Cetorhinus maximus*)	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1
	Redfish (*Sebastes fasciatus/mentella*)[C]	0	DFO 2011	0	Collette and Klein-MacPhee 2002	0	COSEWIC 2010a	1	Gauthier and Rose 2002	1
DEMERSAL	Atlantic poacher (*Leptagonus decagonus*)	0	Mecklenburg et al. 2016	0	Mecklenburg et al. 2016	1'	N/A	0*	Bourdages and Ouellet 2011 Wienerroither et al. 2011	1
	Black dogfish (*Centroscyllium fabricii*)	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002 DFO 1996	1
	Monkfish (*Lophius americanus*)	0	Grégoire 1998	0	Grégoire 1998	0	Farina et al. 2008 Grégoire 1998	0	Collette and Klein-MacPhee 2002 Steimle et al. 1999	0
	Shorthorn sculpin (*Myoxocephalus scorpius*)	1	Grant and Provencher 2007 Massicotte et al. 1990	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	0	Pavlov and Kasumyan 2000	2
	Grubby (*Myoxocephalus aenaeus*)	1	Grant and Provencher 2007 Massicotte et al. 1990	1	Collette and Klein-MacPhee 2002 Lazzari et al. 1989	1	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	3
	Moustache sculpin (*Triglops murrayi*)	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1'	N/A	0*	Bourdages and Ouellet 2011	1

		EXPOSURE POTENTIAL CRITERIA								
		LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
LIFESTYLE	TAXON	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
DEMERSAL	Atlantic halibut (*Hippoglossus hippoglossus*)[C]	0	Collette and Klein-MacPhee 2002 Miller et al. 1991 Scott and Scott 1988	0	Collette and Klein-MacPhee 2002	0	Armsworthy et al. 2014	0	Collette and Klein-MacPhee 2002	0
DEMERSAL	Greenland halibut (*Reinhardtius hippoglossoides*)[C]	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	0	Bowering 1984	0	Youcef et al. 2012	0
DEMERSAL	Marlin-spike (*Nezumia bairdii*)	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1*	Middleton and Musick 1986	0*	Bourdages and Ouellet 2011	1
DEMERSAL	Atlantic hookear sculpin (*Artediellus atlanticus*)	0	Collette and Klein-MacPhee 2002	0	Scott and Scott 1988	1	Van Guelpen 1986	0	Van Guelpen 1986	1
DEMERSAL	Sea raven (*Hemitripterus americanus*)	1	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002 Scott and Scott 1988	1	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	3
DEMERSAL	Twohorn sculpin (*Icelus bicornis*)	0	Mecklenburg et al. 2016 Scott and Scott 1988	0	Mecklenburg et al. 2016 Scott and Scott 1988	1'	N/A	0*	Bourdages and Ouellet 2011 Wienerroither et al. 2011	1
DEMERSAL	Spatulate sculpin (*Icelus spatula*)	0	Mecklenburg et al. 2016 Tokranov and Orlov 2005	0	Mecklenburg et al. 2016	1'	N/A	0*	Bourdages and Ouellet 2011 Wienerroither et al. 2011	1
DEMERSAL	Atlantic seasnail (*Liparis atlanticus*)	1	Able and Irion 1985 Massicotte et al. 1990	1	Collette and Klein-MacPhee 2002	1*	Stein et al. 2006	0*	Stein et al. 2006	3
DEMERSAL	Variegated snailfish (*Liparis gibbus*)[1]	0	Bourdages and Ouellet 2011 Mecklenburg et al. 2016	0	Mecklenburg et al. 2016	1*	Stein et al. 2006	0*	Stein et al. 2006	1
DEMERSAL	Snailfish spp. (*Paraliparis: P. calidus, P. copei copei*)	0	Able and Irion 1985	0	Able and Irion 1985	1*	Stein et al. 2006	0*	Stein et al. 2006	1
DEMERSAL	Yellowtail flounder (*Limanda ferruginea*)	0	Bourdages and Ouellet 2011 Scott and Scott 1988	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1	Bourdages and Ouellet 2011 Collette and Klein-MacPhee 2002	1
DEMERSAL	Daubed shanny (*Leptoclinus maculatus*)	1	Mecklenburg et al. 2016 Scott and Scott 1988	0	Scott and Scott 1988	1'	N/A	0*	Wienerroither et al. 2011	2
DEMERSAL	Snakeblenny (*Lumpenus lampretaeformis*)	0	Atkinson et al. 1987 Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1*	Gordon and Duncan 1979	0*	Wienerroither et al. 2011	1

		EXPOSURE POTENTIAL CRITERIA								
		LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
LIFESTYLE	**TAXON**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
	Ocean pout (*Zoarces americanus*)	1	Le Breton and Pédrot 2012 Nellis et al. 2012	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	3
	Atlantic wolffish (*Anarhichas lupus*)	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	0	Templeman 1984	0	Collette and Klein-MacPhee 2002	0
	Spotted wolffish (*Anarhichas minor*)	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	0	Templeman 1984 Wienerroither et al. 2011	0	Collette and Klein-MacPhee 2002	0
	Eelpout spp. (*Lycenchelys: L. verrillii, L. paxillus*) (*Lycodes: L. esmarkii, L. lavalaei, L. polaris, L. terraenovae, L. vahlii*)	0	Collette and Klein-MacPhee 2002 Scott and Scott 1988	0	Collette and Klein-MacPhee 2002 Scott and Scott 1988	1'	N/A	0*	Bourdages and Ouellet 2011 Wienerroither et al. 2011	1
	Longfin hake (*Phycis chesteri*)	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	0	Sedberry and Musick 1978	0	Bourdages and Ouellet 2011 Wenner 1983	0
	White hake (*Urophycis tenuis*)	1	Grant and Provencher 2007 Nellis et al. 2012	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	0	Bourdages and Ouellet 2011 Collette and Klein-MacPhee 2002	1
	Atlantic cod (*Gadus morhua*)[C]	1	Massicotte et al. 1990 Nellis et al. 2012	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	0	Consultation of DFO experts 2016[2]	1
	Fourbeard rockling (*Enchelyopus cimbrius*)	0	Aubry et al. 2009 Collette and Klein-MacPhee 2002 Wienerroither et al. 2011	0	Wienerroither et al. 2011	1	Aubry et al. 2009 Wienerroither et al. 2011	0*	Bourdages and Ouellet 2011 Wienerroither et al. 2011	1
	Atlantic hagfish (*Myxine glutinosa*)	0	DFO 2009	0	DFO 2009	1	Grant 2015	0	Collette and Klein-MacPhee 2002 DFO 2009	1
	Sea tadpole (*Careproctus reinhardti*)	0	Able and Irion 1985	0	Able and Irion 1985	1*	Stein et al. 2006	0*	Stein et al. 2006	1
DEMERSAL	Atlantic spiny lumpsucker (*Eumicrotremus spinosus*)[1]	1	Mecklenburg et al. 2016 Nellis et al. 2012	0	Mecklenburg et al. 2016	1	Wienerroither et al. 2011	0*	Bourdages and Ouellet 2011	2

		EXPOSURE POTENTIAL CRITERIA								
		LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
LIFESTYLE	TAXON	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
	American plaice (*Hippoglossoides platessoides*)	0	Scott and Scott 1988	0	Collette and Klein-MacPhee 2002	1	COSEWIC 2009b Scott and Scott 1988	0	Bourdages and Ouellet 2011 Colette and Klein-MacPhee 2002 Scott and Scott 1988	1
	Witch flounder (*Glyptocephalus cynoglossus*)	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1	Swain et al. 2012	1	Swain et al. 2012	2
	Smooth flounder (*Pleuronectes putnami*)	1	Hanson and Courtenay 1997 Le Breton and Pédrot 2012 Massicotte et al. 1990	1	Collette and Klein-MacPhee 2002 Hanson and Courtenay 1997	1*	Armstrong and Starr 1994	1	Calderon 1996	4
	Winter flounder (*Pseudopleuronectes americanus*)	1	Collette and Klein-MacPhee 2002 Nellis et al. 2012 Vaillancourt et al. 1985	1	Collette and Klein-MacPhee 2002	1*	Colette and Klein-MacPhee 2002 Fairchild et al. 2013 Howe and Coates 1975	1	Pereira et al. 1999 Vaillancourt et al. 1985	4
	Alligatorfish (*Aspidophoroides monopterygius*)	0	Arbour et al. 2010 Collette and Klein-MacPhee 2002	0	Arbour et al. 2010 Collette and Klein-MacPhee 2002	1'	N/A	0*	Bourdages and Ouellet 2011	1
	Fourline snakeblenny (*Eumesogrammus praecisus*)	0	Scott and Scott 1988	0	Scott and Scott 1988	1'	N/A	0*	Bourdages and Ouellet 2011	1
	Spinytail skate (*Bathyraja spinicauda*)	0	Wienerroither et al. 2011	0	Wienerroither et al. 2011	0	Wienerroither et al. 2011	0	Bourdages and Ouellet 2011	0
	Thorny skate (*Amblyraja radiata*)	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	0	Hurlbut and Benoît 2001	0	Bourdages and Ouellet 2011	0
	Smooth or smooth-tailed skate (*Malacoraja senta*)	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	0	Hurlbut and Benoît 2001	0	Bourdages and Ouellet 2011 COSEWIC 2012c Kulka et al. 2006	0
	Arctic cod (*Boreogadus saida*)	0	Mecklenburg et al. 2016	1	Bouchard 2014 Mecklenburg et al. 2016	0	Bouchard 2014	1	Bouchard 2014	2
DEMERSAL	Rock gunnel (*Pholis gunnellus*)	1	Grant and Provencher 2007 Massicotte et al. 1990	1	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	4

		EXPOSURE POTENTIAL CRITERIA								
		LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
LIFESTYLE	**TAXON**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
	Arctic shanny (*Stichaeus punctatus punctatus*)	1	Brown and Green 1976 Nellis et al. 2012	0	Brown and Green 1976	1	Brown and Green 1976	0	Brown and Green 1976	2
	Wrymouth (*Cryptacanthodes maculatus*)	1	Beal et al. 2016	1	Beal et al. 2016	1	Beal et al. 2016	0	Beal et al. 2016 Collette and Klein-MacPhee 2002	3
	Arctic staghorn sculpin (*Gymnocanthus tricuspis*)	0	Mecklenburg et al. 2016	0	Wienerroither et al. 2011	1'	N/A	0	Bourdages and Ouellet 2011 Collette and Klein-MacPhee 2002	1
	Radiated shanny (*Ulvaria subbifurcata*)	1	Collette and Klein-MacPhee 2002 LeDrew and Green 1975	1	LeDrew and Green 1975	1	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	3
	Fish doctor (*Gymnelus viridis*)[1]	1	Mecklenburg et al. 2016 Scott and Scott 1988	1	Mecklenburg et al. 2016 Scott and Scott 1988	1'	N/A	0*	Bourdages and Ouellet 2011	3

[1] Species name currently under review.

[2] The experts consulted are listed in Appendix 3.

[C] Commercial species caught in directed fisheries.

5.3.2. Resilience

Assessment of marine, estuarine and diadromous fish taxa in the St. Lawrence ARP study area on the basis of resilience criteria

		RESILIENCE CRITERIA								
		POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
LIFESTYLE	TAXON	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
DIADROMOUS	American shad (*Alosa sapidissima*)	1	Robitaille 1997 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	American Shad Recovery Team 2001	0	Collette and Klein-MacPhee 2002 American Shad Recovery Team 2001	0	Collette and Klein-MacPhee 2002	2
	American eel (*Anguilla rostrata*)	1	COSEWIC 2012f COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Jacoby et al. 2014 Nilo and Fortin 2001	0*	Collette and Klein-MacPhee 2002 Jacoby et al. 2014 Nilo and Fortin 2001	1	Collette and Klein-MacPhee 2002 Nilo and Fortin 2001	2
	Striped bass (*Morone saxatilis*)	1	COSEWIC 2012a COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	COSEWIC 2012a Morissette et al. 2016 Pelletier et al. 2011 Robitaille et al. 2011	0	Collette and Klein-MacPhee 2002 COSEWIC 2012a	0	Collette and Klein-MacPhee 2002	1
	White perch (*Morone americana*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002 Kerr and Secor 2012 Scott and Crossman 1974	0	Collette and Klein-MacPhee 2002 Scott and Crossman 1974	0	Collette and Klein-MacPhee 2002 Scott and Crossman 1974	0
	Rainbow smelt (*Osmerus mordax*)	1	Quebec Rainbow Smelt Recovery Team 2008 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Quebec Rainbow Smelt Recovery Team 2008 Scott and Crossman 1974	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1

		RESILIENCE CRITERIA								
		POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
LIFESTYLE	TAXON	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
DIADROMOUS	Ninespine stickleback (*Pungitius pungitius*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002 Wootton 1984	1	Wootton 1984	1	Collette and Klein-MacPhee 2002 Wootton 1984	2
	Fourspine stickleback (*Apeltes quadracus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002 Wootton 1984	1	Wootton 1984	1	Collette and Klein-MacPhee 2002 Wootton 1984	2
	Threespine stickleback (*Gasterosteus aculeatus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002 Wootton 1984	1	Wootton 1984	1	Collette and Klein-MacPhee 2002 Wootton 1984	2
	Blackspotted stickleback (*Gasterosteus wheatlandi*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002 Wootton 1984	1	Wootton 1984	1	Collette and Klein-MacPhee 2002 Wootton 1984	2
	Atlantic sturgeon (*Acipenser oxyrinchus*)	1	COSEWIC 2011a COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	COSEWIC 2011a	1	COSEWIC 2011a Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	4
	Alewife (*Alosa pseudoharengus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Scott and Crossman 1974	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	0
	Sea lamprey (*Petromyzon marinus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002 Scott and Crossman 1974	0	Collette and Klein-MacPhee 2002	1

		RESILIENCE CRITERIA								
		POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
LIFESTYLE	TAXON	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
DIADROMOUS	Greenland cod (*Gadus ogac*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Morin et al. 1991	0	Morin et al. 1991 Scott and Scott 1988	1	Knickle and Rose 2014 Morin et al. 1991	1
	Brook trout (*Salvelinus fontinalis*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Collette and Klein-MacPhee 2002	0	Lesueur 1993	0	Collette and Klein-MacPhee 2002	1
	Atlantic tomcod (*Microgadus tomcod*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Couillard 2009	0	Scott and Crossman 1974 Scott and Scott 1988	1	Collette and Klein-MacPhee 2002	2
	Atlantic salmon (*Salmo salar*)	1	COSEWIC 2010c COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Collette and Klein-MacPhee 2002	0	COSEWIC 2010c	0	Collette and Klein-MacPhee 2002	2
PELAGIC	Capelin (*Mallotus villosus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Grégoire 2004 Ouellet et al. 2013	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	1
	Lumpfish (*Cyclopterus lumpus*)[C]	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Kennedy et al. 2015 DFO 2016 Pampoulie et al. 2014	1	Collette and Klein-MacPhee 2002 DFO 2016	1	Collette and Klein-MacPhee 2002 Kennedy et al. 2015 DFO 2016	3
	Atlantic herring (*Clupea harengus*)[C]	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Munro et al. 1998	0	Collette and Klein-MacPhee 2002 DFO 2014b	0	Collette and Klein-MacPhee 2002 Munro et al. 1998	1

		RESILIENCE CRITERIA								
		POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
LIFESTYLE	TAXON	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
PELAGIC	Greenland shark (*Somniosus microcephalus*)	1	Kyne et al. 2006 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002 Yano et al. 2007	0	Yano et al. 2007	2
	American sand lance (*Ammodytes americanus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	1
	Northern sand lance (*Ammodytes dubius*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002 Nelson and Ross 1991	1	Collette and Klein-MacPhee 2002	1
	White barracudina (*Arctozenus risso*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Acevedo et al. 2002 Hutchings 2002	0*	Scott and Scott 1988	0	Moore et al. 2015	0
	Atlantic mackerel (*Scomber scombrus*)[C]	1*	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002 DFO 2014a	0	Collette and Klein-MacPhee 2002	1
	Porbeagle (*Lamna nasus*)	1	COSEWIC 2014 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002	1	Jensen et al. 2002	0	Collette and Klein-MacPhee 2002	2
	Silver hake (*Merluccius bilinearis*)	1	Carpenter 2015 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1

		RESILIENCE CRITERIA								
		POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
LIFESTYLE	TAXON	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
PELAGIC	Atlantic soft pout (*Melanostigma atlanticum*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Silverberg and Bossé 1994	1	Collette and Klein-MacPhee 2002 Silverberg et al. 1987	1	Collette and Klein-MacPhee 2002 Silverberg et al. 1987	3
PELAGIC	Basking shark (*Cetorhinus maximus*)	1	COSEWIC 2009a COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	2
PELAGIC	Redfish (*Sebastes fasciatus/mentella*)[C]	1	COSEWIC 2010a COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	COSEWIC 2010a	1	Collette and Klein-MacPhee 2002 COSEWIC 2010a	0	Collette and Klein-MacPhee 2002	2
DEMERSAL	Atlantic poacher (*Leptagonus decagonus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Bourdages and Ouellet 2011 Eriksen et al. 2012	0	Wienerroither et al. 2011	1	Heggland et al. 2015 Scott and Scott 1988 Wienerroither et al. 2011	1
DEMERSAL	Black dogfish (*Centroscyllium fabricii*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Baker et al. 2009 DFO 1996	1	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002 Punzon and Herrera 2000	1
DEMERSAL	Monkfish (*Lophius americanus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Chikarmane et al. 2000 Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002 Scott and Scott 1988	1	Collette and Klein-MacPhee 2002	1
DEMERSAL	Shorthorn sculpin (*Myoxocephalus scorpius*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002 Ennis 1970 Luksenburg et al. 2004	1	Collette and Klein-MacPhee 2002 Ennis 1970 Luksenburg et al. 2004	1	Collette and Klein-MacPhee 2002	2

		RESILIENCE CRITERIA								
		POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
LIFESTYLE	**TAXON**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
DEMERSAL	Grubby (*Myoxocephalus aenaeus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002 Lazzari et al. 1989 Roseman et al. 2005	1	Lazzari et al. 1989 Roseman et al. 2005	1	Collette and Klein-MacPhee 2002	2
	Moustache sculpin (*Triglops murrayi*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Blood and Matarese 2010 Wienerroither et al. 2011	1	Ottesen 2004 Wienerroither et al. 2011	1	Collette and Klein-MacPhee 2002	2
	Atlantic halibut (*Hippoglossus hippoglossus*)[C]	1	COSEWIC 2011b COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016 Sobel 1996	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002 COSEWIC 2011b	0	Collette and Klein-MacPhee 2002	1
	Greenland halibut (*Reinhardtius hippoglossoides*)[C]	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002 Dominguez-Petit et al. 2013	0	Collette and Klein-MacPhee 2002	0
	Marlin-spike (*Nezumia bairdii*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002 Middleton and Musick 1986	1'	N/A	1	Coggan et al. 1999 Collette and Klein-MacPhee 2002	2
	Atlantic hookear sculpin (*Artediellus atlanticus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Van Guelpen 1986	1	Collette and Klein-MacPhee 2002 Scott and Scott 1988	1	Collette and Klein-MacPhee 2002	2

		RESILIENCE CRITERIA								
		POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
LIFESTYLE	TAXON	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
DEMERSAL	Sea raven (*Hemitripterus americanus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Busby et al. 2012 Fuiman 1976	0*	Collette and Klein-MacPhee 2002 Scott and Scott 1988	1	Collette and Klein-MacPhee 2002	2
	Twohorn sculpin (*Icelus bicornis*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Bourdages and Ouellet 2011 Mecklenburg et al. 2016	1	Scott and Scott 1988 Wienerroither et al. 2011	1	Scott and Scott 1988 Wienerroither et al. 2011	3
	Spatulate sculpin (*Icelus spatula*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Bourdages and Ouellet 2011 Mecklenburg et al. 2016	0	Tokranov and Orlov 2005 Wienerroither et al. 2011	1	Scott and Scott 1988 Tokranov and Orlov 2005 Wienerroither et al. 2011	2
	Atlantic seasnail (*Liparis atlanticus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Able and Irion 1985 Able et al. 1986	1	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002 Scott and Scott 1988	2
	Variegated snailfish (*Liparis gibbus*)[1]	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Able and Irion 1985 Able et al. 1986 Scott and Scott 1988	1*	Collette and Klein-MacPhee 2002	1*	Walkusz et al. 2016	2
	Snailfish spp. (*Paraliparis: P. calidus, P. copei copei*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Able and Irion 1985 Able et al. 1986	1*	Scott and Scott 1988	1*	Walkusz et al. 2016	3
	Yellowtail flounder (*Limanda ferruginea*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002 Scott and Scott 1988	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	1

		RESILIENCE CRITERIA								
		POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
LIFESTYLE	TAXON	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
DEMERSAL	Daubed shanny (*Leptoclinus maculatus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Ottesen et al. 2011 Wienerroither et al. 2011	1	Collette and Klein-MacPhee 2002 Gordon and Duncan 1979 Wienerroither et al. 2011	1	Scott and Scott 1988 Wienerroither et al. 2011	2
	Snakeblenny (*Lumpenus lampretaeformis*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002 Gordon and Duncan 1979	1	Atkinson et al. 1987 Collette and Klein-MacPhee 2002	2
	Ocean pout (*Zoarces americanus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	3
	Atlantic wolffish (*Anarhichas lupus*)	1	COSEWIC 2012d COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Baker et al. 2009 Collette and Klein-MacPhee 2002 McCusker and Bentzen 2010	1	Collette and Klein-MacPhee 2002 COSEWIC 2012d McCusker and Bentzen 2010	1	Collette and Klein-MacPhee 2002 COSEWIC 2012d	4
	Spotted wolffish (*Anarhichas minor*)	1	COSEWIC 2012e COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Collette and Klein-MacPhee 2002 McCusker and Bentzen 2010	1	Collette and Klein-MacPhee 2002 COSEWIC 2012e McCusker and Bentzen 2010	1	COSEWIC 2012e	4
	Eelpout spp. (*Lycenchelys: L. verrillii, L. paxillus*) (*Lycodes: L. esmarkii, L. lavalaei, L. polaris, L. terraenovae, L. vahlii*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1*	Baker et al. 2009	1	Baker et al. 2009 Collette and Klein-MacPhee 2002 Scott and Scott 1988	1	Collette and Klein-MacPhee 2002 Mecklenburg et al. 2016 Scott and Scott 1988	3
	Longfin hake (*Phycis chesteri*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002 Methven and McKelvie 1986	0	Collette and Klein-MacPhee 2002	0	Methven and McKelvie 1986	0

		RESILIENCE CRITERIA								
		POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
LIFESTYLE	TAXON	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
DEMERSAL	White hake (*Urophycis tenuis*)	1	COSEWIC 2013 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Simon and Cook 2013	0	Simon and Cook 2013	0	Collette and Klein-MacPhee 2002	1
	Atlantic cod (*Gadus morhua*)[C]	1	COSEWIC 2010b COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1
	Fourbeard rockling (*Enchelyopus cimbrius*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Wienerroither et al. 2011	0	Wienerroither et al. 2011	1	Collette and Klein-MacPhee 2002 Wienerroither et al. 2011	1
	Atlantic hagfish (*Myxine glutinosa*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Collette and Klein-MacPhee 2002 Ellis et al. 2015 DFO 2009	1	Collette and Klein-MacPhee 2002 Grant 2015 Scott and Scott 1988	1	Collette and Klein-MacPhee 2002	3
	Sea tadpole (*Careproctus reinhardti*)	1'	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Scott and Scott 1988	1	Able and Irion 1985	0	Falk-Petersen et al. 1988	3
	Atlantic spiny lumpsucker (*Eumicrotremus spinosus*)[1]	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Berge and Nahrgang 2013 Mecklenburg et al. 2016	1	Mecklenburg et al. 2016	0	Berge and Nahrgang 2013	1
	American plaice (*Hippoglossoides platessoides*)	1	COSEWIC 2009b COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Scott and Scott 1988	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	2

		RESILIENCE CRITERIA								
		POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
LIFESTYLE	**TAXON**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
DEMERSAL	Witch flounder (*Glyptocephalus cynoglossus*)	1*	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	2
	Smooth flounder (*Pleuronectes putnami*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Scott and Scott 1988	0	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002 Hanson and Courtenay 1997	1
	Winter flounder (*Pseudopleuronectes americanus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002 Pereira et al. 1999	0	Collette and Klein-MacPhee 2002 Pereira et al. 1999	1	Collette and Klein-MacPhee 2002 Pereira et al. 1999	1
	Alligatorfish (*Aspidophoroides monopterygius*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Arbour et al. 2010	0	Arbour et al. 2010	0	Arbour et al. 2010 Collette and Klein-MacPhee 2002	0
	Fourline snakeblenny (*Eumesogrammus praecisus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0*	Bourdages and Ouellet 2011 Mecklenburg et al. 2016	0	Hutchings 2002	1	Hutchings 2002	1
	Spinytail skate (*Bathyraja spinicauda*)	1	Kulka et al. 2009 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Wienerroither et al. 2011	1	Baker et al. 2009 McPhie and Campana 2009	1	Kulka et al. 2009	3
	Spinytail skate (*Amblyraja radiata*)	1	COSEWIC 2012b COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	COSEWIC 2012b	1	COSEWIC 2012b McPhie and Campana 2009	1	Collette and Klein-MacPhee 2002	3

		RESILIENCE CRITERIA								
		POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
LIFESTYLE	**TAXON**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
DEMERSAL	Smooth or smooth-tailed skate (*Malacoraja senta*)	1	COSEWIC 2012c COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	COSEWIC 2012c	1	McPhie and Campana 2009	0	Collette and Klein-MacPhee 2002 COSEWIC 2012c	2
	Arctic cod (*Boreogadus saida*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Bouchard 2014	0	Bouchard 2014 Wienerroither et al. 2011	0	Bouchard 2014 Scott and Scott 1988	0
	Rock gunnel (*Pholis gunnellus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002 Koop and Gibson 1991	1	Collette and Klein-MacPhee 2002	1	Collette and Klein-MacPhee 2002	2
	Arctic shanny (*Stichaeus punctatus punctatus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002 Scott and Scott 1988	0*	Collette and Klein-MacPhee 2002 Scott and Scott 1988	1	Collette and Klein-MacPhee 2002 Brown and Green 1976	1
	Wrymouth (*Cryptacanthodes maculatus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Beal et al. 2016 Collette and Klein-MacPhee 2002	1'	N/A	1	Beal et al. 2016 Collette and Klein-MacPhee 2002	2
	Arctic staghorn sculpin (*Gymnocanthus tricuspis*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Wienerroither et al. 2011	0	Wienerroither et al. 2011	1	Wienerroither et al. 2011	1
	Radiated shanny (*Ulvaria subbifurcata*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Collette and Klein-MacPhee 2002 LeDrew and Green 1975 Pepin et al. 2002	1	Collette and Klein-MacPhee 2002 LeDrew and Green 1975 Scott and Scott 1988	1	Collette and Klein-MacPhee 2002 LeDrew and Green 1975	2
DEMERSAL	Fish doctor (*Gymnelus viridis*)[1]	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	1	Bourdages and Ouellet 2011 Mecklenburg et al. 2016	1	Anderson 1982 Scott and Scott 1988	1	Anderson 1982 Scott and Scott 1988	3

[1] *Species name currently under review*

[C] *Commercial species caught in directed fisheries.*

5.3.3. References: Marine, estuarine and diadromous fish

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5.4. MARINE MAMMALS

5.4.1. Exposure potential

Assessment of marine mammal species in the St. Lawrence ARP study area on the basis of exposure potential criteria

			EXPOSURE POTENTIAL CRITERIA								
			LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
INFRAORDER	TAXONOMIC DIVISION	TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
CETACEA	ODONTOCETI	Beluga whale (*Delphinapterus leucas*)	1	Mosnier et al. 2010	1	Fontaine 2005	0	Fontaine 2005	1	Mosnier et al. 2010	3
		Sperm whale (*Physeter macrocephalus*)	0	Lesage et al. 2007	1	Fontaine 2005	0	Fontaine 2005	0	Lesage et al. 2007	1
		Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	0	Lesage et al. 2007	1	Fontaine 2005	0	Fontaine 2005	1	Biorex 1999	2
		Harbour porpoise (*Phocoena phocoena*)	0	Biorex 1999	1	Fontaine 2005	0	Fontaine 2005	0	Biorex 1999	1
	MYSTICETI	North Atlantic right whale (*Eubalaena glacialis*)	0	COSEWIC 2013	1	Fontaine 2005	0	Fontaine 2005	0	COSEWIC 2013	1
		Common minke whale (*Balaenoptera acutorostrata*)	1	Naud et al. 2003 Consultation of DFO experts 2016	1	Fontaine 2005	0	Fontaine 2005	0	Biorex 1999	2

			EXPOSURE POTENTIAL CRITERIA								
			LITTORAL ZONE USE		SEA SURFACE INTERACTING		LIMITED CAPACITY FOR MOVEMENT		AGGREGATION POTENTIAL		
INFRAORDER	TAXONOMIC DIVISION	TAXA	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
CETACEA	MYSTICETI	Humpback whale (*Megaptera novaeangliae*)	0	Lesage et al. 2007	1	Fontaine 2005	0	Fontaine 2005	0	Lesage et al. 2007	1
		Blue whale (*Balaenoptera musculus*)	0	Biorex 1999	1	Fontaine 2005	0	Fontaine 2005	0	Biorex 1999	1
		Fin whale (*Balaenoptera physalus*)	0	Biorex 1999	1	Fontaine 2005	0	Fontaine 2005	0	Biorex 1999	1
PINNIPEDS	PHOCIDS	Hooded seal (*Cystophora cristata*)	0	Lesage et al. 2007	1	Fontaine 2005	0	Fontaine 2005	0	Lesage et al. 2007	1
		Harbour seal (*Phoca vitulina*)	1	Lesage et al. 1995	1	Fontaine 2005	0	Fontaine 2005	1	Lesage et al. 1995	3
		Harp seal (*Pagophilus groenlandicus*)[C]	0	Lesage et al. 2007	1	Fontaine 2005	0	Fontaine 2005	0	Lesage et al. 2007	1
		Grey seal (*Halichoerus grypus*)[C]	1	Lesage et al. 1995	1	Fontaine 2005	0	Fontaine 2005	1	Lesage et al. 1995	3

[C] Commercial species caught in directed fisheries.

5.4.2. Resilience

Assessment of marine mammal species in the St. Lawrence ARP study area on the basis of resilience criteria.

			RESILIENCE CRITERIA								
			POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
LIFESTYLE		TAXON	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	SCORE	SOURCE	TOTAL
CETACEA	ODONTOCETI	Beluga whale (*Delphinapterus leucas*)	1	COSEWIC 2014, 2016 Gouv. du Québec 2016 IUCN 2016	1	Mosnier et al. 2010	1	COSEWIC 2014	1	Mosnier et al. 2010	4
CETACEA	ODONTOCETI	Sperm whale (*Physeter macrocephalus*)	1	COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016 Taylor et al. 2008	0	Taylor et al. 2008	1	Taylor et al. 2008	0	Fontaine 2005	2
CETACEA	ODONTOCETI	Atlantic white-sided dolphin (*Lagenorhynchus acutus*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Lesage et al. 2007	1	Fontaine 2005	0	Tuerk et al. 2005	1
CETACEA	ODONTOCETI	Harbour porpoise (*Phocoena phocoena*)	1	COSEWIC 2006, 2016 Gouv. du Québec 2016 IUCN 2016	0	COSEWIC 2006	1	COSEWIC 2006	0	Biorex 1999	2
CETACEA	MYSTICETI	North Atlantic right whale (*Eubalaena glacialis*)	1	COSEWIC 2013, 2016 Gouv. du Québec 2016 IUCN 2016	1	COSEWIC 2013	1	COSEWIC 2013	0	COSEWIC 2013	3
CETACEA	MYSTICETI	Common minke whale (*Balaenoptera acutorostrata*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Biorex 1999	1	Biorex 1999	0	Biorex 1999	1
CETACEA	MYSTICETI	Humpback whale (*Megaptera novaeangliae*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	COSEWIC 2003	1	COSEWIC 2003	0	Fontaine 2005	1
CETACEA	MYSTICETI	Blue whale (*Balaenoptera musculus*)	1	COSEWIC 2002, 2012, 2016 Gouv. du Québec 2016 IUCN 2016	0	COSEWIC 2002	1	COSEWIC 2002	0	Biorex 1999	2
CETACEA	MYSTICETI	Fin whale (*Balaenoptera physalus*)	1	COSEWIC 2005, 2016 Gouv. du Québec 2016 IUCN 2016	0	COSEWIC 2005	1	COSEWIC 2005	0	Biorex 1999	2
PINNIPEDS	PHOCIDS	Hooded seal (*Cystophora cristata*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Lesage et al. 2007	1	Fontaine 2005	0	Kapel 1995	1

			RESILIENCE CRITERIA								
			POPULATION STATUS		LOW RECOLONIZATION POTENTIAL		LOW REPRODUCTIVE CAPACITY		ASSOCIATION WITH SEDIMENT		
LIFESTYLE		**TAXON**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**SCORE**	**SOURCE**	**TOTAL**
		Harbour seal (*Phoca vitulina*)	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Lesage et al. 2004	1	Biorex 1999	1	Tollit et al. 1998	2
		Harp seal (*Pagophilus groenlandicus*)[C]	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	Biorex 1999	1	Biorex 1999	0	Beck et al. 1993	1
		Grey seal (*Halichoerus grypus*)[C]	0	CESCC 2016 COSEWIC 2016 Gouv. du Québec 2016 IUCN 2016	0	DFO 2014	1	DFO 2014	1	Murie and Lavigne 1992	2

[C] Commercial species caught in directed fisheries.

5.4.3. References: Marine mammals

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APPENDIX 6. LIST OF MARINE AND ESTUARINE INVERTEBRATE TAXA

Taxonomic list of marine and estuarine invertebrates in the St. Lawrence ARP study area by phylum or group of phyla. Names: [World Register of Marine Species]() accessed January 2025.

PORIFERA, CNIDARIA AND CTENOPHORA

Phylum	Class	Family	Genus Species
Porifera	Calcarea	Grantiidae	*Grantia canadensis*
Porifera	Demospongiae	Axinellidae	*Phakellia*
Porifera	Demospongiae	Chalinidae	*Haliclona (Reniera) cinerea*
Porifera	Demospongiae	Chalinidae	*Haliclona oculata*
Porifera	Demospongiae	Chalinidae	*Haliclona urceolus*
Porifera	Demospongiae	Halichondriidae	*Halichondria panicea*
Porifera	Demospongiae	Halichondriidae	*Halichondria sitiens*
Cnidaria	Hydrozoa	Boreohydridae	*Plotocnide borealis*
Cnidaria	Hydrozoa	Bougainvilliidae	*Bougainvillia*
Cnidaria	Hydrozoa	Bythotiaridae	*Calycopsis birulai*
Cnidaria	Hydrozoa	Candelabridae	*Candelabrum phrygium*
Cnidaria	Hydrozoa	Corymorphidae	*Corymorpha pendula*
Cnidaria	Hydrozoa	Corymorphidae	*Euphysa tentaculata*
Cnidaria	Hydrozoa	Corynidae	*Coryne pusilla*
Cnidaria	Hydrozoa	Eudendriidae	*Eudendrium ramosum*
Cnidaria	Hydrozoa	Hydractiniidae	*Clava multicornis*
Cnidaria	Hydrozoa	Hydractiniidae	*Hydractinia polyclina*
Cnidaria	Hydrozoa	Pandeidae	*Halitholus pauper*
Cnidaria	Hydrozoa	Pandeidae	*Leuckartiara octona*
Cnidaria	Hydrozoa	Tubulariidae	*Ectopleura larynx*
Cnidaria	Hydrozoa	Tubulariidae	*Tubularia regalis*
Cnidaria	Hydrozoa	Campanulariidae	*Clytia hemisphaerica*
Cnidaria	Hydrozoa	Campanulariidae	*Gonothyraea loveni*
Cnidaria	Hydrozoa	Campanulariidae	*Hartlaubella gelatinosa*
Cnidaria	Hydrozoa	Campanulariidae	*Laomedea flexuosa*
Cnidaria	Hydrozoa	Campanulariidae	*Obelia dichotoma*
Cnidaria	Hydrozoa	Campanulariidae	*Obelia geniculata*
Cnidaria	Hydrozoa	Campanulariidae	*Obelia longissima*
Cnidaria	Hydrozoa	Campanulariidae	*Orthopyxis integra*
Cnidaria	Hydrozoa	Campanulariidae	*Rhizocaulus verticillatus*
Cnidaria	Hydrozoa	Campanulinidae	*Calycella syringa*
Cnidaria	Hydrozoa	Campanulinidae	*Opercularella lacerata*
Cnidaria	Hydrozoa	Haleciidae	*Halecium minutum*

Phylum	Class	Family	Genus Species
Cnidaria	Hydrozoa	Haleciidae	*Halecium muricatum*
Cnidaria	Hydrozoa	Haleciidae	*Halecium scutum*
Cnidaria	Hydrozoa	Lafoeidae	*Grammaria abietina*
Cnidaria	Hydrozoa	Laodiceidae	*Ptychogena lactea*
Cnidaria	Hydrozoa	Laodiceidae	*Staurostoma mertensii*
Cnidaria	Hydrozoa	Sertulariidae	*Abietinaria filicula*
Cnidaria	Hydrozoa	Sertulariidae	*Abietinaria pulchra*
Cnidaria	Hydrozoa	Sertulariidae	*Abietinaria turgida*
Cnidaria	Hydrozoa	Sertulariidae	*Dynamena pumila*
Cnidaria	Hydrozoa	Sertulariidae	*Hydrallmania falcata*
Cnidaria	Hydrozoa	Sertulariidae	*Sertularella polyzonias*
Cnidaria	Hydrozoa	Sertulariidae	*Sertularia latiuscula*
Cnidaria	Hydrozoa	Sertulariidae	*Symplectoscyphus tricuspidatus*
Cnidaria	Hydrozoa	Sertulariidae	*Thuiaria carica*
Cnidaria	Hydrozoa	Sertulariidae	*Thuiaria thuja*
Cnidaria	Hydrozoa (Trachylinae)	Cuninidae	*Solmissus incisa*
Cnidaria	Hydrozoa (Trachylinae)	Rhopalonematidae	*Aglantha digitale*
Cnidaria	Hydrozoa	Agalmatidae	*Nanomia cara*
Cnidaria	Hydrozoa	Diphyidae	*Dimophyes arctica*
Cnidaria	Hydrozoa	Physophoridae	*Physophora hydrostatica*
Cnidaria	Scyphozoa	Periphyllidae	*Periphylla periphylla*
Cnidaria	Scyphozoa	Cyaneidae	*Cyanea capillata*
Cnidaria	Staurozoa	Craterolophidae	*Craterolophus convolvulus*
Cnidaria	Staurozoa	Haliclystidae	*Haliclystus octoradiatus*
Cnidaria	Anthozoa (Octocorallia)	Nephtheidae	*Gersemia rubiformis*
Cnidaria	Anthozoa (Octocorallia)	Pennatulidae	*Pennatula aculeata*
Cnidaria	Anthozoa (Octocorallia)	Pennatulidae	*Pennatula grandis*
Cnidaria	Anthozoa (Octocorallia)	Pennatulidae	*Anthoptilum grandiflorum*
Cnidaria	Anthozoa (Octocorallia)	Pennatulidae	*Halipteris finmarchica*
Cnidaria	Anthozoa (Hexacorallia)	Actiniidae	*Aulactinia stella*
Cnidaria	Anthozoa (Hexacorallia)	Actiniidae	*Urticina crassicornis*
Cnidaria	Anthozoa (Hexacorallia)	Actiniidae	*Urticina felina*
Cnidaria	Anthozoa (Hexacorallia)	Actinostolidae	*Actinostola callosa*
Cnidaria	Anthozoa (Hexacorallia)	Actinostolidae	*Stomphia coccinea*
Cnidaria	Anthozoa (Hexacorallia)	Edwardsiidae	
Cnidaria	Anthozoa (Hexacorallia)	Halcampidae	*Halcampa duodecimcirrata*
Cnidaria	Anthozoa (Hexacorallia)	Hormathiidae	*Actinauge cristata*
Cnidaria	Anthozoa (Hexacorallia)	Hormathiidae	*Hormathia nodosa*

Phylum	Class	Family	Genus Species
Cnidaria	Anthozoa (Hexacorallia)	Hormathiidae	*Stephanauge nexilis*
Cnidaria	Anthozoa (Hexacorallia)	Liponematidae	*Liponema multicorne*
Cnidaria	Anthozoa (Hexacorallia)	Metridiidae	*Metridium dianthus*
Cnidaria	Anthozoa (Ceriantharia)	Cerianthidae	*Pachycerianthus borealis*
Ctenophora	Nuda	Beroidae	*Beroe*
Ctenophora	Tentaculata	Mertensiidae	*Mertensia ovum*
Ctenophora	Tentaculata	Pleurobrachiidae	*Pleurobrachia pileus*

VERMIFORM PHYLA

Phylum	Class	Family	Genus Species
Xenacoelomorpha	-	Acoela (Ordre)	-
Platyhelminthes	Rhabditophora	Pleioplanidae	*Pleioplana atomata*
Nemertea	Palaeonemertea	Carinomidae	*Carinoma*
Nemertea	Anopla (Heteronemertea)	Lineidae	*Micrura*
Nemertea	Enopla (Hoplonemertea)	Amphiporidae	*Amphiporus angulatus*
Nemertea	Enopla (Hoplonemertea)	Amphiporidae	*Amphiporus lactifloreus*
Nemertea	Enopla (Hoplonemertea)	Tetrastemmatidae	*Tetrastemma*
Cephalorhyncha	Priapulida	Priapulidae	*Priapulus caudatus*
Nematoda	Chromadorea	Axonolaimidae	*Axonolaimus*
Nematoda	Chromadorea	Comesomatidae	*Metacomesoma*
Nematoda	Chromadorea	Comesomatidae	*Sabatieria*
Nematoda	Chromadorea	Diplopeltidae	*Araeolaimus*
Nematoda	Chromadorea	Chromadoridae	*Chromadora axi*
Nematoda	Chromadorea	Chromadoridae	*Chromadora nudicapitata*
Nematoda	Chromadorea	Chromadoridae	*Chromadorina*
Nematoda	Chromadorea	Chromadoridae	*Chromadorita*
Nematoda	Chromadorea	Chromadoridae	*Dichromadora*
Nematoda	Chromadorea	Chromadoridae	*Hypodontolaimus balticus*
Nematoda	Chromadorea	Chromadoridae	*Innocuonema*
Nematoda	Chromadorea	Chromadoridae	*Neochromadora*
Nematoda	Chromadorea	Chromadoridae	*Prochromadorella*
Nematoda	Chromadorea	Chromadoridae	*Steineridora loricata*
Nematoda	Chromadorea	Cyatholaimidae	*Cyatholaimus*
Nematoda	Chromadorea	Cyatholaimidae	*Nannolaimoides effilatus*
Nematoda	Chromadorea	Desmodoridae	*Metachromadora*
Nematoda	Chromadorea	Microlaimidae	*Microlaimus*
Nematoda	Chromadorea	Monoposthiidae	*Monoposthia costata*
Nematoda	Chromadorea	Monoposthiidae	*Nudora*

Phylum	Class	Family	Genus Species
Nematoda	Chromadorea	Cyartonematidae	*Cyartonema*
Nematoda	Chromadorea	Linhomoeidae	*Paralinhomoeus*
Nematoda	Chromadorea	Monhysteridae	*Halomonhystera disjuncta*
Nematoda	Chromadorea	Monhysteridae	*Monhystera*
Nematoda	Chromadorea	Sphaerolaimidae	*Sphaerolaimus*
Nematoda	Chromadorea	Xyalidae	*Daptonema*
Nematoda	Chromadorea	Xyalidae	*Scaptrella*
Nematoda	Chromadorea	Xyalidae	*Steineria*
Nematoda	Chromadorea	Xyalidae	*Theristus acer*
Nematoda	Chromadorea	Camacolaimidae	*Deontolaimus*
Nematoda	Chromadorea	Leptolaimidae	*Leptolaimus elegans*
Nematoda	Chromadorea	Rhabditidae	*Litoditis marina*
Nematoda	Enoplea	Anoplostomatidae	*Anoplostoma*
Nematoda	Enoplea	Enchelidiidae	*Belbolla tenuidens*
Nematoda	Enoplea	Enoplidae	*Enoplus*
Nematoda	Enoplea	Oncholaimidae	*Oncholaimidae*
Nematoda	Enoplea	Oncholaimidae	*Viscosia*
Nematoda	Enoplea	Oxystominidae	*Halalaimus*
Nematoda	Enoplea	Thoracostomopsidae	*Enoplolaimus*
Nematoda	Enoplea	Trefusiidae	*Cytolaimium*
Nematoda	Enoplea	Tripyloididae	*Bathylaimus*
Nematoda	Enoplea	Tripyloididae	*Tripyloides gracilis*
Phoronida	-	Phoronidae	*Phoronis*
Sipuncula	Phascolosomatidea	Aspidosiphonidae	-
Sipuncula	Sipunculidea	Golfingiidae	*Golfingia margaritacea*
Sipuncula	Sipunculidea	Phascolionidae	*Phascolion strombus*
Sipuncula	Sipunculidea	Sipunculidae	*Phascolopsis gouldii*
Annelida	Polychaeta (Errantia)	Euphrosinidae	*Euphrosine cirrata*
Annelida	Polychaeta (Errantia)	Dorvilleidae	*Parougia caeca*
Annelida	Polychaeta (Errantia)	Dorvilleidae	*Schistomeringos caeca*
Annelida	Polychaeta (Errantia)	Eunicidae	*Eunice pennata*
Annelida	Polychaeta (Errantia)	Lumbrineridae	*Lumbrinerides acuta*
Annelida	Polychaeta (Errantia)	Lumbrineridae	*Lumbrineris fauchaldi*
Annelida	Polychaeta (Errantia)	Lumbrineridae	*Lumbrineris latreilli*
Annelida	Polychaeta (Errantia)	Lumbrineridae	*Ninoe nigripes*
Annelida	Polychaeta (Errantia)	Lumbrineridae	*Paraninoe minuta*
Annelida	Polychaeta (Errantia)	Lumbrineridae	*Scoletoma fragilis*
Annelida	Polychaeta (Errantia)	Lumbrineridae	*Scoletoma impatiens*

Phylum	Class	Family	Genus Species
Annelida	Polychaeta (Errantia)	Lumbrineridae	*Scoletoma tenuis*
Annelida	Polychaeta (Errantia)	Lumbrineridae	*Scoletoma tetraura*
Annelida	Polychaeta (Errantia)	Oenonidae	*Arabella iricolor*
Annelida	Polychaeta (Errantia)	Oenonidae	*Drilonereis magna*
Annelida	Polychaeta (Errantia)	Onuphidae	*Hyalinoecia tubicola*
Annelida	Polychaeta (Errantia)	Onuphidae	*Nothria conchylega*
Annelida	Polychaeta (Errantia)	Onuphidae	*Onuphis eremita*
Annelida	Polychaeta (Errantia)	Onuphidae	*Onuphis opalina*
Annelida	Polychaeta (Errantia)	Onuphidae	*Paradiopatra quadricuspis*
Annelida	Polychaeta (Errantia)	Aphroditidae	*Laetmonice filicornis*
Annelida	Polychaeta (Errantia)	Chrysopetalidae	*Dysponetus pygmaeus*
Annelida	Polychaeta (Errantia)	Glyceridae	*Glycera americana*
Annelida	Polychaeta (Errantia)	Glyceridae	*Glycera capitata*
Annelida	Polychaeta (Errantia)	Glyceridae	*Glycera dibranchiata*
Annelida	Polychaeta (Errantia)	Glyceridae	*Glycera robusta*
Annelida	Polychaeta (Errantia)	Goniadidae	*Goniada maculata*
Annelida	Polychaeta (Errantia)	Goniadidae	*Goniada norvegica*
Annelida	Polychaeta (Errantia)	Goniadidae	*Goniadella*
Annelida	Polychaeta (Errantia)	Hesionidae	*Hesionidae*
Annelida	Polychaeta (Errantia)	Hesionidae	*Parahesione*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Aglaophamus circinata*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Aglaophamus malmgreni*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Bipalponephtys neotena*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Nephtys bucera*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Nephtys caeca*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Nephtys ciliata*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Nephtys discors*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Nephtys hystricis*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Nephtys incisa*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Nephtys longosetosa*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Nephtys paradoxa*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Alitta succinea*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Alitta virens*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Ceratocephale loveni*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Hediste diversicolor*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Nereis grayi*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Nereis pelagica*
Annelida	Polychaeta (Errantia)	Nephtyidae	*Nereis zonata*

Phylum	Class	Family	Genus Species
Annelida	Polychaeta (Errantia)	Pholoidae	*Pholoe longa*
Annelida	Polychaeta (Errantia)	Pholoidae	*Pholoe minuta*
Annelida	Polychaeta (Errantia)	Phyllodocidae	*Eteone barbata*
Annelida	Polychaeta (Errantia)	Phyllodocidae	*Eteone flava*
Annelida	Polychaeta (Errantia)	Phyllodocidae	*Eteone longa*
Annelida	Polychaeta (Errantia)	Phyllodocidae	*Eteone trilineata*
Annelida	Polychaeta (Errantia)	Phyllodocidae	*Eulalia bilineata*
Annelida	Polychaeta (Errantia)	Phyllodocidae	*Eulalia viridis*
Annelida	Polychaeta (Errantia)	Phyllodocidae	*Hypereteone heteropoda*
Annelida	Polychaeta (Errantia)	Phyllodocidae	*Phyllodoce groenlandica*
Annelida	Polychaeta (Errantia)	Phyllodocidae	*Phyllodoce maculata*
Annelida	Polychaeta (Errantia)	Phyllodocidae	*Phyllodoce mucosa*
Annelida	Polychaeta (Errantia)	Pilargidae	*Ancistrosyllis groenlandica*
Annelida	Polychaeta (Errantia)	Polynoidae	*Arcteobia anticostiensis*
Annelida	Polychaeta (Errantia)	Polynoidae	*Bylgides elegans*
Annelida	Polychaeta (Errantia)	Polynoidae	*Bylgides groenlandicus*
Annelida	Polychaeta (Errantia)	Polynoidae	*Bylgides sarsi*
Annelida	Polychaeta (Errantia)	Polynoidae	*Enipo gracilis*
Annelida	Polychaeta (Errantia)	Polynoidae	*Enipo torelli*
Annelida	Polychaeta (Errantia)	Polynoidae	*Eucranta villosa*
Annelida	Polychaeta (Errantia)	Polynoidae	*Eunoe nodosa*
Annelida	Polychaeta (Errantia)	Polynoidae	*Gattyana amondseni*
Annelida	Polychaeta (Errantia)	Polynoidae	*Gattyana cirrhosa*
Annelida	Polychaeta (Errantia)	Polynoidae	*Harmothoe extenuata*
Annelida	Polychaeta (Errantia)	Polynoidae	*Harmothoe fragilis*
Annelida	Polychaeta (Errantia)	Polynoidae	*Harmothoe imbricata*
Annelida	Polychaeta (Errantia)	Polynoidae	*Hartmania moorei*
Annelida	Polychaeta (Errantia)	Polynoidae	*Lepidonotus squamatus*
Annelida	Polychaeta (Errantia)	Polynoidae	*Nemidia microlepida*
Annelida	Polychaeta (Errantia)	Polynoidae	*Polynoe gracilis*
Annelida	Polychaeta (Errantia)	Sigalionidae	*Neoleanira tetragona*
Annelida	Polychaeta (Errantia)	Sphaerodoridae	*Sphaerodoridium*
Annelida	Polychaeta (Errantia)	Sphaerodoridae	*Sphaerodoropsis minuta*
Annelida	Polychaeta (Errantia)	Sphaerodoridae	*Sphaerodorum gracilis*
Annelida	Polychaeta (Errantia)	Syllidae	*Autolytus emertoni*
Annelida	Polychaeta (Errantia)	Syllidae	*Epigamia alexandri*
Annelida	Polychaeta (Errantia)	Syllidae	*Eusyllis blomstrandi*
Annelida	Polychaeta (Errantia)	Syllidae	*Exogone dispar*

Phylum	Class	Family	Genus Species
Annelida	Polychaeta (Errantia)	Syllidae	*Exogone verugera*
Annelida	Polychaeta (Errantia)	Syllidae	*Parapionosyllis longicirrata*
Annelida	Polychaeta (Errantia)	Syllidae	*Parexogone hebes*
Annelida	Polychaeta (Errantia)	Syllidae	*Proceraea cornuta*
Annelida	Polychaeta (Errantia)	Syllidae	*Proceraea prismatica*
Annelida	Polychaeta (Errantia)	Syllidae	*Salvatoria clavata*
Annelida	Polychaeta (Errantia)	Syllidae	*Syllis armillaris*
Annelida	Polychaeta (Errantia)	Syllidae	*Syllis cornuta*
Annelida	Polychaeta (Errantia)	Syllidae	*Syllis fasciata*
Annelida	Polychaeta (Errantia)	Syllidae	*Syllis gracilis*
Annelida	Polychaeta (Errantia)	Tomopteridae	*Tomopteris cavallii*
Annelida	Polychaeta	Dinophilidae	*Dinophilus gyrociliatus*
Annelida	Polychaeta	Nerillidae	*Nerilla*
Annelida	Polychaeta	Protodrilidae	*Protodrilus*
Annelida	Polychaeta (Sedentaria)	Fabriciidae	*Fabricia stellaris*
Annelida	Polychaeta (Sedentaria)	Oweniidae	*Galathowenia oculata*
Annelida	Polychaeta (Sedentaria)	Oweniidae	*Myriochele heeri*
Annelida	Polychaeta (Sedentaria)	Oweniidae	*Myriochele pygidialis*
Annelida	Polychaeta (Sedentaria)	Oweniidae	*Owenia fusiformis*
Annelida	Polychaeta (Sedentaria)	Sabellidae	*Bispira Chone duneri crassicornis*
Annelida	Polychaeta (Sedentaria)	Sabellidae	*Chone infundibuliformis*
Annelida	Polychaeta (Sedentaria)	Sabellidae	*Euchone analis*
Annelida	Polychaeta (Sedentaria)	Sabellidae	*Euchone elegans*
Annelida	Polychaeta (Sedentaria)	Sabellidae	*Euchone incolor*
Annelida	Polychaeta (Sedentaria)	Sabellidae	*Euchone papillosa*
Annelida	Polychaeta (Sedentaria)	Sabellidae	*Jasmineira elegans*
Annelida	Polychaeta (Sedentaria)	Sabellidae	*Laonome kroyeri*
Annelida	Polychaeta (Sedentaria)	Sabellidae	*Potamilla neglecta*
Annelida	Polychaeta (Sedentaria)	Sabellidae	*Pseudopotamilla reniformis*
Annelida	Polychaeta (Sedentaria)	Sabellidae	*Sabella pavonina*
Annelida	Polychaeta (Sedentaria)	Serpulidae	*Circeis spirillum*
Annelida	Polychaeta (Sedentaria)	Serpulidae	*Paradexiospira violacea*
Annelida	Polychaeta (Sedentaria)	Serpulidae	*Paradexiospira vitrea*
Annelida	Polychaeta (Sedentaria)	Serpulidae	*Spirorbis spirorbis*
Annelida	Polychaeta (Sedentaria)	Spionidae	*Dipolydora caulleryi*
Annelida	Polychaeta (Sedentaria)	Spionidae	*Dipolydora concharum*
Annelida	Polychaeta (Sedentaria)	Spionidae	*Dipolydora quadrilobata*
Annelida	Polychaeta (Sedentaria)	Spionidae	*Laonice cirrata*

Phylum	Class	Family	Genus Species
Annelida	Polychaeta (Sedentaria)	Spionidae	*Marenzelleria viridis*
Annelida	Polychaeta (Sedentaria)	Spionidae	*Microspio theeli*
Annelida	Polychaeta (Sedentaria)	Spionidae	*Polydora cornuta*
Annelida	Polychaeta (Sedentaria)	Spionidae	*Polydora websteri*
Annelida	Polychaeta (Sedentaria)	Spionidae	*Prionospio cirrifera*
Annelida	Polychaeta (Sedentaria)	Spionidae	*Prionospio steenstrupi*
Annelida	Polychaeta (Sedentaria)	Spionidae	*Pygospio elegans*
Annelida	Polychaeta (Sedentaria)	Spionidae	*Scolelepis squamata*
Annelida	Polychaeta (Sedentaria)	Spionidae	*Scolelepis tridentata*
Annelida	Polychaeta (Sedentaria)	Spionidae	*Spio filicornis*
Annelida	Polychaeta (Sedentaria)	Spionidae	*Spio setosa*
Annelida	Polychaeta (Sedentaria)	Spionidae	*Spiophanes kroyeri*
Annelida	Polychaeta (Sedentaria)	Trochochaetidae	*Trochochaeta carica*
Annelida	Polychaeta (Sedentaria)	Trochochaetidae	*Trochochaeta multisetosa*
Annelida	Polychaeta (Sedentaria)	Trochochaetidae	*Trochochaeta watsoni*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Amage auricula*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Ampharete acutifrons*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Ampharete arctica*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Ampharete baltica*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Ampharete borealis*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Ampharete finmarch*ica
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Ampharete goesi*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Ampharete lindstroemi*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Ampharete lineata*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Ampharete octocirrata*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Ampharete oculata*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Ampharete sibirica*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Amphicteis gunneri*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Anobothrus gracilis*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Auchenoplax crinita*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Glyphanostomum pallescens*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Lysippe labiata*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Melinna albicincta*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Melinna cristata*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Melinna elisabethae*
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Neosabellides ocea*nica
Annelida	Polychaeta (Sedentaria)	Ampharetidae	*Samytha sexcirrata*
Annelida	Polychaeta (Sedentaria)	Cirratulidae	*Aphelochaeta filiformis*

Phylum	Class	Family	Genus Species
Annelida	Polychaeta (Sedentaria)	Cirratulidae	*Chaetozone setosa*
Annelida	Polychaeta (Sedentaria)	Cirratulidae	*Cirratulus cirratus*
Annelida	Polychaeta (Sedentaria)	Cirratulidae	*Dodecaceria concharum*
Annelida	Polychaeta (Sedentaria)	Cirratulidae	*Tharyx acutus*
Annelida	Polychaeta (Sedentaria)	Flabelligeridae	*Brada inhabilis*
Annelida	Polychaeta (Sedentaria)	Flabelligeridae	*Brada villosa*
Annelida	Polychaeta (Sedentaria)	Flabelligeridae	*Diplocirrus hirsutus*
Annelida	Polychaeta (Sedentaria)	Flabelligeridae	*Diplocirrus longisetos*us
Annelida	Polychaeta (Sedentaria)	Flabelligeridae	*Pherusa affinis*
Annelida	Polychaeta (Sedentaria)	Flabelligeridae	*Pherusa plumosa*
Annelida	Polychaeta (Sedentaria)	Flabelligeridae	*Stylaroides*
Annelida	Polychaeta (Sedentaria)	Flabelligeridae	*Therochaeta flabellata*
Annelida	Polychaeta (Sedentaria)	Pectinariidae	*Cistenides gran*ulata
Annelida	Polychaeta (Sedentaria)	Pectinariidae	*Cistenides hyperborea*
Annelida	Polychaeta (Sedentaria)	Pectinariidae	*Pectinaria gouldii*
Annelida	Polychaeta (Sedentaria)	Sternaspidae	*Sternaspis scutata*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Amphitrite cirrata*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Amphitrite ornata*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Artacama proboscidea*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Axionice flexuosa*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Lanassa nordenskioldi*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Lanassa venusta*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Laphania boecki*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Leaena ebranchiata*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Lysilla loveni*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Neoamphitrite affinis*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Neoamphitrite figulus*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Neoamphitrite grayi*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Neoamphitrite groenlandica*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Nicolea venustula*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Nicolea zostericola*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Pista cristata*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Pista maculata*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Polycirrus eximius*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Polycirrus medusa*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Proclea graffii*
Annelida	Polychaeta (Sedentaria)	Terebellidae	*Thelepus cincinnatus*
Annelida	Polychaeta (Sedentaria)	Trichobranchidae	*Terebellides stroemii*

Phylum	Class	Family	Genus Species
Annelida	Polychaeta (Sedentaria)	Trichobranchidae	*Trichobranchus glacialis*
Annelida	Polychaeta (Sedentaria)	Arenicolidae	*Arenicola marina*
Annelida	Polychaeta (Sedentaria)	Capitellidae	*Capitella capitata*
Annelida	Polychaeta (Sedentaria)	Capitellidae	*Capitellides giardi*
Annelida	Polychaeta (Sedentaria)	Capitellidae	*Heteromastus filiformis*
Annelida	Polychaeta (Sedentaria)	Capitellidae	*Mediomastus ambiseta*
Annelida	Polychaeta (Sedentaria)	Capitellidae	*Notomastus latericeus*
Annelida	Polychaeta (Sedentaria)	Chaetopteridae	*Chaetopterus*
Annelida	Polychaeta (Sedentaria)	Chaetopteridae	*Spiochaetopterus typicus*
Annelida	Polychaeta (Sedentaria)	Cossuridae	*Cossura longocirrata*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Axiothella catenata*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Clymenella torquata*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Clymenella zonalis*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Clymenura borealis*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Clymenura polaris*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Lumbriclymene minor*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Maldane glebifex*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Maldane sarsi*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Microclymene*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Nicomache lumbricalis*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Nicomache personata*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Notoproctus oculatus*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Petaloproctus tenuis*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Praxillella affinis*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Praxillella gracilis*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Praxillella praetermissa*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Praxillura longissima*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Praxillura ornata*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Rhodine gracilior*
Annelida	Polychaeta (Sedentaria)	Maldanidae	*Rhodine loveni*
Annelida	Polychaeta (Sedentaria)	Opheliidae	*Armandia*
Annelida	Polychaeta (Sedentaria)	Opheliidae	*Ophelia limacina*
Annelida	Polychaeta (Sedentaria)	Opheliidae	*Ophelia verrilli*
Annelida	Polychaeta (Sedentaria)	Opheliidae	*Ophelina acuminata*
Annelida	Polychaeta (Sedentaria)	Opheliidae	*Ophelina breviata*
Annelida	Polychaeta (Sedentaria)	Opheliidae	*Ophelina cylindricaudata*
Annelida	Polychaeta (Sedentaria)	Opheliidae	*Travisia forbesii*
Annelida	Polychaeta (Sedentaria)	Orbiniidae	*Leitoscoloplos fragilis*

Phylum	Class	Family	Genus Species
Annelida	Polychaeta (Sedentaria)	Orbiniidae	*Naineris quadricuspida*
Annelida	Polychaeta (Sedentaria)	Orbiniidae	*Orbinia*
Annelida	Polychaeta (Sedentaria)	Orbiniidae	*Scoloplos acutus*
Annelida	Polychaeta (Sedentaria)	Orbiniidae	*Scoloplos armiger*
Annelida	Polychaeta (Sedentaria)	Paraonidae	*Aricidea (Aricidea) albatrossae*
Annelida	Polychaeta (Sedentaria)	Paraonidae	*Aricidea catherinae*
Annelida	Polychaeta (Sedentaria)	Paraonidae	*Aricidea quadrilobata*
Annelida	Polychaeta (Sedentaria)	Paraonidae	*Aricidea suecica*
Annelida	Polychaeta (Sedentaria)	Paraonidae	*Cirrophorus branchiatus*
Annelida	Polychaeta (Sedentaria)	Paraonidae	*Cirrophorus furcatus*
Annelida	Polychaeta (Sedentaria)	Paraonidae	*Levinsenia gracilis*
Annelida	Polychaeta (Sedentaria)	Paraonidae	*Paradoneis lyr*a
Annelida	Polychaeta (Sedentaria)	Paraonidae	*Paraonis fulgens*
Annelida	Polychaeta (Sedentaria)	Scalibregmatidae	*Polyphysia crassa*
Annelida	Polychaeta (Sedentaria)	Scalibregmatidae	*Scalibregma inflatu*m
Annelida	Polychaeta (Sedentaria)	Scalibregmatidae	*Sclerocheilus minu*tus
Annelida	Polychaeta (Sedentaria)	Scalibregmidae	*Polyphysia crassa*
Annelida	Polychaeta	Orbiniidae	*Leitoscoloplos robustus*
Annelida	Polychaeta (Sedentaria)	Scalibregmidae	*Scalibregma inflatum*
Annelida	Polychaeta (Sedentaria)	Travisiidae	*Travisia carnea*
Annelida	Polychaeta (Echiura)	Bonelliidae	*Hamingia arctica*
Annelida	Polychaeta (Echiura)	Bonelliidae	*Pseudobonellia iraidii*
Annelida	Clitellata (Oligochaeta)	Enchytraeidae	*Marionina*
Annelida	Clitellata (Oligochaeta)	Tubificidae	*Limnodrilus cervix*
Annelida	Clitellata (Oligochaeta)	Tubificidae	*Limnodrilus hoffmeisteri*
Annelida	Clitellata (Oligochaeta)	Tubificidae	*Limnodrilus udekemianus*
Annelida	Clitellata (Oligochaeta)	Tubificidae	*Potamothrix moldaviensis*
Annelida	Clitellata (Oligochaeta)	Tubificidae	*Tubifex tubifex*
Annelida	Clitellata (Oligochaeta)	Tubificidae	*Tubificoides*
Annelida	Clitellata (Oligochaeta)	Tubificidae	*Tubificoides bruneli*
Hemichordata	Enteropneusta	Harrimaniidae	*Stereobalanus canadensis*

MOLLUSCA

Phylum	Class	Family	Genus Species
Mollusca	Caudofoveata	Chaetodermatidae	*Chaetoderma canadense*
Mollusca	Caudofoveata	Chaetodermatidae	*Chaetoderma nitidulum*
Mollusca	Polyplacophora	Ischnochitonidae	*Stenosemus albus*
Mollusca	Polyplacophora	Mopaliidae	*Amicula vestita*

Phylum	Class	Family	Genus Species
Mollusca	Polyplacophora	Mopaliidae	*Tonicella marmorea*
Mollusca	Polyplacophora	Mopaliidae	*Tonicella rubra*
Mollusca	Gastropoda (Patellogastropoda)	Lepetidae	*Lepeta caeca*
Mollusca	Gastropoda (Patellogastropoda)	Lottiidae	*Erginus rubellus*
Mollusca	Gastropoda (Patellogastropoda)	Lottiidae	*Testudinalia testudinalis*
Mollusca	Gastropoda (Vetigastropoda)	Fissurellidae	*Puncturella noachina*
Mollusca	Gastropoda (Vetigastropoda)	Colloniidae	*Moelleria costulata*
Mollusca	Gastropoda (Vetigastropoda)	Margaritidae	*Margarites costalis*
Mollusca	Gastropoda (Vetigastropoda)	Margaritidae	*Margarites groenlandicus*
Mollusca	Gastropoda (Vetigastropoda)	Margaritidae	*Margarites helicinus*
Mollusca	Gastropoda (Vetigastropoda)	Margaritidae	*Margarites olivaceus*
Mollusca	Gastropoda (Vetigastropoda)	Solariellidae	*Solariella obscura*
Mollusca	Gastropoda (Vetigastropoda)	Solariellidae	*Solariella varicosa*
Mollusca	Gastropoda (Caenogastropoda)	Turritellidae	*Tachyrhynchus erosus*
Mollusca	Gastropoda (Caenogastropoda)	Turritellidae	*Tachyrhynchus reticulatus*
Mollusca	Gastropoda (Caenogastropoda)	Epitoniidae	*Acirsa borealis*
Mollusca	Gastropoda (Caenogastropoda)	Epitoniidae	*Boreoscala greenlandica*
Mollusca	Gastropoda (Caenogastropoda)	Aporrhaidae	*Arrhoges occidentalis*
Mollusca	Gastropoda (Caenogastropoda)	Capulidae	*Ariadnaria borealis*
Mollusca	Gastropoda (Caenogastropoda)	Eulimidae	*Haliella stenostoma*
Mollusca	Gastropoda (Caenogastropoda)	Hydrobiidae	*Ecrobia truncata*
Mollusca	Gastropoda (Caenogastropoda)	Littorinidae	*Lacuna pallidula*
Mollusca	Gastropoda (Caenogastropoda)	Littorinidae	*Lacuna vincta*
Mollusca	Gastropoda (Caenogastropoda)	Littorinidae	*Littorina littorea*
Mollusca	Gastropoda (Caenogastropoda)	Littorinidae	*Littorina obtusata*
Mollusca	Gastropoda (Caenogastropoda)	Littorinidae	*Littorina saxatilis*
Mollusca	Gastropoda (Caenogastropoda)	Naticidae	*Amauropsis islandica*
Mollusca	Gastropoda (Caenogastropoda)	Naticidae	*Cryptonatica affinis*
Mollusca	Gastropoda (Caenogastropoda)	Naticidae	*Euspira heros*
Mollusca	Gastropoda (Caenogastropoda)	Naticidae	*Euspira pallida*
Mollusca	Gastropoda (Caenogastropoda)	Naticidae	*Pseudopolinices nanus*
Mollusca	Gastropoda (Caenogastropoda)	Rissoidae	*Alvania moerchi*
Mollusca	Gastropoda (Caenogastropoda)	Rissoidae	*Alvania pseudoareolata*
Mollusca	Gastropoda (Caenogastropoda)	Rissoidae	*Alvania verrilli*
Mollusca	Gastropoda (Caenogastropoda)	Rissoidae	*Boreocingula globulus*
Mollusca	Gastropoda (Caenogastropoda)	Rissoidae	*Frigidoalvania cruenta*
Mollusca	Gastropoda (Caenogastropoda)	Rissoidae	*Frigidoalvania janmayeni*
Mollusca	Gastropoda (Caenogastropoda)	Rissoidae	*Frigidoalvania pelagica*

Phylum	Class	Family	Genus Species
Mollusca	Gastropoda (Caenogastropoda)	Rissoidae	*Onoba aculeus*
Mollusca	Gastropoda (Caenogastropoda)	Rissoidae	*Onoba mighelsii*
Mollusca	Gastropoda (Caenogastropoda)	Velutinidae	*Limneria undata*
Mollusca	Gastropoda (Caenogastropoda)	Velutinidae	*Onchidiopsis*
Mollusca	Gastropoda (Caenogastropoda)	Velutinidae	*Velutina velutina*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Aulacofusus brevicauda*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Beringius ossiania*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Beringius behringi*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Buccinum ciliatum*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Buccinum cyaneum*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Buccinum glaciale*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Buccinum plectrum*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Buccinum polare*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Buccinum scalariforme*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Buccinum undatum*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Colus islandicus*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Colus pubescens*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Colus stimpsoni*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Colus terraenovae*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Neptunea decemcostata*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Neptunea despecta*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Plicifusus kroeyeri*
Mollusca	Gastropoda (Caenogastropoda)	Buccinidae	*Volutopsius norwegicus*
Mollusca	Gastropoda (Caenogastropoda)	Columbellidae	*Astyris rosacea*
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Curtitoma decussata*
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Curtitoma finmarchia*
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Curtitoma hebes*
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Curtitoma incisula*
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Curtitoma trevelliana*
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Curtitoma violacea*
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Obesotoma simplex*
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Obesotoma woodiana*
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Oenopota elegans*
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Oenopota impressa*
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Oenopota pyramidalis*
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Propebela angulosa*
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Propebela cancellata*
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Propebela concinnula*

Phylum	Class	Family	Genus Species
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Propebela exarata*
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Propebela harpularia*
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Propebela nobilis*
Mollusca	Gastropoda (Caenogastropoda)	Mangeliidae	*Propebela turricula*
Mollusca	Gastropoda (Caenogastropoda)	Muricidae	*Boreotrophon clathratus*
Mollusca	Gastropoda (Caenogastropoda)	Muricidae	*Boreotrophon truncatus*
Mollusca	Gastropoda (Caenogastropoda)	Muricidae	*Nucella lapillus*
Mollusca	Gastropoda (Caenogastropoda)	Ptychatractidae	*Ptychatractus ligatus*
Mollusca	Gastropoda (Heterobranchia)	Acteocinidae	*Acteocina canaliculata*
Mollusca	Gastropoda (Heterobranchia)	Cylichnidae	*Cylichna alba*
Mollusca	Gastropoda (Heterobranchia)	Diaphanidae	*Diaphana minuta*
Mollusca	Gastropoda (Heterobranchia)	Haminoeidae	*Haminoea solitaria*
Mollusca	Gastropoda (Heterobranchia)	Philinidae	*Laona finmarchica*
Mollusca	Gastropoda (Heterobranchia)	Philinidae	*Philine lima*
Mollusca	Gastropoda (Heterobranchia)	Retusidae	*Retusa obtusa*
Mollusca	Gastropoda (Heterobranchia)	Scaphandridae	*Scaphander punctostriatus*
Mollusca	Gastropoda (Heterobranchia)	Aeolidiidae	*Aeolidia papillosa*
Mollusca	Gastropoda (Heterobranchia)	Dendronotidae	*Dendronotus frondosus*
Mollusca	Gastropoda (Heterobranchia)	Dotidae	*Doto coronata*
Mollusca	Gastropoda (Heterobranchia)	Flabellinidae	*Flabellina salmonacea*
Mollusca	Gastropoda (Heterobranchia)	Flabellinidae	*Flabellina verrucosa*
Mollusca	Gastropoda (Heterobranchia)	Goniodorididae	*Ancula gibbosa*
Mollusca	Gastropoda (Heterobranchia)	Onchidorididae	*Acanthodoris pilosa*
Mollusca	Gastropoda (Heterobranchia)	Onchidorididae	*Onchidoris bilamellata*
Mollusca	Gastropoda (Heterobranchia)	Onchidorididae	*Onchidoris diademata*
Mollusca	Gastropoda (Heterobranchia)	Polyceridae	*Palio dubia*
Mollusca	Gastropoda (Heterobranchia)	Clionidae	*Clione limacina*
Mollusca	Gastropoda (Heterobranchia)	Limacinidae	*Limacina*
Mollusca	Gastropoda (Heterobranchia)	Mathildidae	*Turritellopsis stimpsoni*
Mollusca	Bivalvia (Protobranchia)	Nuculanidae	*Nuculana minuta*
Mollusca	Bivalvia (Protobranchia)	Nuculanidae	*Nuculana pernula*
Mollusca	Bivalvia (Protobranchia)	Nuculanidae	*Nuculana tenuisulcata*
Mollusca	Bivalvia (Protobranchia)	Yoldiidae	*Megayoldia thraciaeformis*
Mollusca	Bivalvia (Protobranchia)	Yoldiidae	*Portlandia arctica*
Mollusca	Bivalvia (Protobranchia)	Yoldiidae	*Yoldia hyperborea*
Mollusca	Bivalvia (Protobranchia)	Yoldiidae	*Yoldia limatula*
Mollusca	Bivalvia (Protobranchia)	Yoldiidae	*Yoldia myalis*
Mollusca	Bivalvia (Protobranchia)	Yoldiidae	*Yoldia sapotilla*

Phylum	Class	Family	Genus Species
Mollusca	Bivalvia (Protobranchia)	Yoldiidae	*Yoldiella frigida*
Mollusca	Bivalvia (Protobranchia)	Yoldiidae	*Yoldiella inconspicua*
Mollusca	Bivalvia (Protobranchia)	Yoldiidae	*Yoldiella lucida*
Mollusca	Bivalvia (Protobranchia)	Yoldiidae	*Yoldiella nana*
Mollusca	Bivalvia (Protobranchia)	Nuculidae	*Ennucula delphinodonta*
Mollusca	Bivalvia (Protobranchia)	Nuculidae	*Ennucula tenuis*
Mollusca	Bivalvia (Protobranchia)	Nuculidae	*Nucula proxima*
Mollusca	Bivalvia (Pteriomorphia)	Arcidae	*Bathyarca glacialis*
Mollusca	Bivalvia (Pteriomorphia)	Arcidae	*Bathyarca pectunculoides*
Mollusca	Bivalvia (Pteriomorphia)	Limidae	*Limatula subovata*
Mollusca	Bivalvia (Pteriomorphia)	Mytilidae	*Crenella decussata*
Mollusca	Bivalvia (Pteriomorphia)	Mytilidae	*Crenella faba*
Mollusca	Bivalvia (Pteriomorphia)	Mytilidae	*Crenella pectinula*
Mollusca	Bivalvia (Pteriomorphia)	Mytilidae	*Dacrydium vitreum*
Mollusca	Bivalvia (Pteriomorphia)	Mytilidae	*Musculus discors*
Mollusca	Bivalvia (Pteriomorphia)	Mytilidae	*Musculus glacialis*
Mollusca	Bivalvia (Pteriomorphia)	Mytilidae	*Musculus niger*
Mollusca	Bivalvia (Pteriomorphia)	Mytilidae	*Mytilus edulis*
Mollusca	Bivalvia (Pteriomorphia)	Mytilidae	*Mytilus trossulus*
Mollusca	Bivalvia (Pteriomorphia)	Mytilidae	*Solamen glandula*
Mollusca	Bivalvia (Pteriomorphia)	Anomiidae	*Anomia simplex*
Mollusca	Bivalvia (Pteriomorphia)	Anomiidae	*Heteroanomia squamula*
Mollusca	Bivalvia (Pteriomorphia)	Pectinidae	*Chlamys islandica*
Mollusca	Bivalvia (Pteriomorphia)	Pectinidae	*Placopecten magellanicus*
Mollusca	Bivalvia (Heterodonta)	Astartidae	*Astarte arctica*
Mollusca	Bivalvia (Heterodonta)	Astartidae	*Astarte borealis*
Mollusca	Bivalvia (Heterodonta)	Astartidae	*Astarte castanea*
Mollusca	Bivalvia (Heterodonta)	Astartidae	*Astarte crenata*
Mollusca	Bivalvia (Heterodonta)	Astartidae	*Astarte elliptica*
Mollusca	Bivalvia (Heterodonta)	Astartidae	*Astarte montagui*
Mollusca	Bivalvia (Heterodonta)	Astartidae	*Astarte undata*
Mollusca	Bivalvia (Heterodonta)	Carditidae	*Cyclocardia borealis*
Mollusca	Bivalvia (Heterodonta)	Carditidae	*Cyclocardia novangliae*
Mollusca	Bivalvia (Heterodonta)	Cuspidariidae	*Cuspidaria arctica*
Mollusca	Bivalvia (Heterodonta)	Cuspidariidae	*Cuspidaria glacialis*
Mollusca	Bivalvia (Heterodonta)	Cuspidariidae	*Cuspidaria obesa*
Mollusca	Bivalvia (Heterodonta)	Lyonsiidae	*Lyonsia arenosa*
Mollusca	Bivalvia (Heterodonta)	Pandoridae	*Pandora glacialis*

Phylum	Class	Family	Genus Species
Mollusca	Bivalvia (Heterodonta)	Pandoridae	*Pandora gouldiana*
Mollusca	Bivalvia (Heterodonta)	Periplomatidae	*Periploma fragile*
Mollusca	Bivalvia (Heterodonta)	Periplomatidae	*Periploma papyratium*
Mollusca	Bivalvia (Heterodonta)	Thraciidae	*Thracia conradi*
Mollusca	Bivalvia (Heterodonta)	Thraciidae	*Thracia myopsis*
Mollusca	Bivalvia (Heterodonta)	Thraciidae	*Thracia septentrionalis*
Mollusca	Bivalvia (Heterodonta)	Hiatellidae	*Cyrtodaria siliqua*
Mollusca	Bivalvia (Heterodonta)	Hiatellidae	*Hiatella arctica*
Mollusca	Bivalvia (Heterodonta)	Hiatellidae	*Panomya norvegica*
Mollusca	Bivalvia (Heterodonta)	Pharidae	*Ensis leei*
Mollusca	Bivalvia (Heterodonta)	Pharidae	*Siliqua costata*
Mollusca	Bivalvia (Heterodonta)	Cardiidae	*Ciliatocardium ciliatum*
Mollusca	Bivalvia (Heterodonta)	Cardiidae	*Parvicardium pinnulatum*
Mollusca	Bivalvia (Heterodonta)	Cardiidae	*Serripes groenlandicus*
Mollusca	Bivalvia (Heterodonta)	Tellinidae	*Ameritella agilis*
Mollusca	Bivalvia (Heterodonta)	Tellinidae	*Limecola balthica*
Mollusca	Bivalvia (Heterodonta)	Tellinidae	*Macoma calcarea*
Mollusca	Bivalvia (Heterodonta)	Tellinidae	*Macoma crassula*
Mollusca	Bivalvia (Heterodonta)	Tellinidae	*Macoma loveni*
Mollusca	Bivalvia (Heterodonta)	Thyasiridae	*Axinopsida orbiculata*
Mollusca	Bivalvia (Heterodonta)	Thyasiridae	*Mendicula pygmaea*
Mollusca	Bivalvia (Heterodonta)	Thyasiridae	*Thyasira equalis*
Mollusca	Bivalvia (Heterodonta)	Thyasiridae	*Thyasira flexuosa*
Mollusca	Bivalvia (Heterodonta)	Thyasiridae	*Thyasira trisinuata*
Mollusca	Bivalvia (Heterodonta)	Myidae	*Mya arenaria*
Mollusca	Bivalvia (Heterodonta)	Myidae	*Mya pseudoarenaria*
Mollusca	Bivalvia (Heterodonta)	Myidae	*Mya truncata*
Mollusca	Bivalvia (Heterodonta)	Pholadidae	*Zirfaea crispat*a
Mollusca	Bivalvia (Heterodonta)	Teredinidae	*Teredo navalis*
Mollusca	Bivalvia (Heterodonta)	Xylophagidae	*Xylophaga atlantica*
Mollusca	Bivalvia (Heterodonta)	Arcticidae	*Arctica islandica*
Mollusca	Bivalvia (Heterodonta)	Veneridae	*Liocyma fluctuosa*
Mollusca	Bivalvia (Heterodonta)	Kelliidae	*Kellia suborbicularis*
Mollusca	Bivalvia (Heterodonta)	Mactridae	*Mactromeris polynyma*
Mollusca	Bivalvia (Heterodonta)	Mactridae	*Spisula solidissima*
Mollusca	Bivalvia (Heterodonta)	Mesodesmatidae	*Mesodesma arctatum*
Mollusca	Bivalvia (Heterodonta)	Mesodesmatidae	*Mesodesma deauratum*
Mollusca	Cephalopoda	Bathypolypodidae	*Bathypolypus bairdii*

Phylum	Class	Family	Genus Species
Mollusca	Cephalopoda	Sepiolidae	*Rossia*
Mollusca	Scaphopoda	Dentaliidae	*Antalis occidentalis*
Mollusca	Scaphopoda	Pulsellidae	*Siphonodentalium lobatum*

ARTHROPODA

Phylum	Class	Family	Genus Species
Arthropoda (Crustacea)	Branchiopoda	Bosminidae	*Bosmina (Eubosmina) coregoni*
Arthropoda (Crustacea)	Branchiopoda	Podonidae	*Evadne nordmanni*
Arthropoda (Crustacea)	Branchiopoda	Podonidae	*Evadne spinifera*
Arthropoda (Crustacea)	Branchiopoda	Podonidae	*Pleopis polyphaemoides*
Arthropoda (Crustacea)	Ostracoda	Halocyprididae	*Obtusoecia obtusata*
Arthropoda (Crustacea)	Ostracoda	Halocyprididae	*Discoconchoecia elegans*
Arthropoda (Crustacea)	Ostracoda	Philomedidae	*Philomedes brenda*
Arthropoda (Crustacea)	Ostracoda	Bythocytheridae	*Sclerochilus contortus*
Arthropoda (Crustacea)	Ostracoda	Cytheruridae	*Semicytherura nigrescens*
Arthropoda (Crustacea)	Ostracoda	Cytheruridae	*Semicytherura similis*
Arthropoda (Crustacea)	Ostracoda	Eucytheridae	*Eucytheridea papillosa*
Arthropoda (Crustacea)	Ostracoda	Hemicytheridae	*Baffinicythere emarginata*
Arthropoda (Crustacea)	Ostracoda	Hemicytheridae	*Hemicythere*
Arthropoda (Crustacea)	Ostracoda	Paradoxostomatidae	*Cytherois*
Arthropoda (Crustacea)	Ostracoda	Paradoxostomatidae	*Paracytherois arcuata*
Arthropoda (Crustacea)	Ostracoda	Trachyleberididae	*Actinocythereis dunelmensis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Acartiidae	*Acartia tonsa*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Acartiidae	*Acartia hudsonica*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Acartiidae	*Acartia longiremis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Acartiidae	*Acartia bifilosa*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Acartiidae	*Acartia clausi*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Acartiidae	*Acartia forcipata*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Aetideidae	*Aetideus armatus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Aetideidae	*Bradyidius armatus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Aetideidae	*Bradyidius similis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Aetideidae	*Chiridius gracilis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Aetideidae	*Gaetanus brevispinus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Aetideidae	*Gaetanus tenuispinus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Aetideidae	*Jaschnovia brevis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Calanidae	*Calanus finmarchicus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Calanidae	*Calanus glacialis*

Phylum	Class	Family	Genus Species
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Calanidae	*Calanus hyperboreus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Centropagidae	*Centropages hamatus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Centropagidae	*Centrophages typicus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Centropagidae	*Limnocalanus macrurus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Clausocalanidae	*Microcalanus pygmaeus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Clausocalanidae	*Microcalanus pusillus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Clausocalanidae	*Pseudocalanus minutus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Euchaetidae	*Euchaeta marina*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Euchaetidae	*Paraeuchaeta norvegica*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Heterorhabdidae	*Heterorhabdus norvegicus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Metridinidae	*Metridia longa*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Metridinidae	*Metridia lucens*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Scolecitrichidae	*Scolecithricella minor*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Spinocalanidae	*Spinocalanus longicornis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Temoridae	*Eurytemora affinis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Temoridae	*Eurytemora americana*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Temoridae	*Eurytemora herdmani*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Temoridae	*Temora longicornis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Tortanidae	*Tortanus discaudatus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Cyclopinidae	*Cyclopina laurentica*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Cyclopinidae	*Cyclopina vachoni*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Oithonidae	*Oithona atlantica*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Oithonidae	*Oithona setigera*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Oithonidae	*Oithona similis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ameiridae	*Ameira divagans*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ameiridae	*Filexilia trisetosa*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ameiridae	*Ameira parvula*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ameiridae	*Ameira spinipes*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ameiridae	*Leptomesochra attenuata*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ameiridae	*Nitokra typica*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ameiridae	*Psammameira grandis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ameiridae	*Sarsameira parva*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ancorabolidae	*Arthropsyllus serratus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Canthocamptidae	*Leimia vaga*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Canthocamptidae	*Mesochra arenicola*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Canthocamptidae	*Mesochra pygmaea*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Cletodidae	*Enhydrosoma curticauda*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Cletodidae	*Enhydrosoma longifurcatum*

Phylum	Class	Family	Genus Species
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Cylindropsyllidae	*Evansula arenicola*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Dactylopusiidae	*Dactylopusia glacialis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Dactylopusiidae	*Dactylopusia vulgaris*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Dactylopusiidae	*Paradactylopodia latipes*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ectinosomatidae	*Bradya typica*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ectinosomatidae	*Ectinosoma melaniceps*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ectinosomatidae	*Halectinosoma brevirostre*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ectinosomatidae	*Halectinosoma chrystalii*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ectinosomatidae	*Halectinosoma curticorne*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ectinosomatidae	*Halectinosoma elongatum*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ectinosomatidae	*Halectinosoma intermedium*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ectinosomatidae	*Halectinosoma littorale*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ectinosomatidae	*Halectinosoma neglectum*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ectinosomatidae	*Halectinosoma proximum*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ectinosomatidae	*Halectinosoma pseudosarsi*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Ectinosomatidae	*Pseudobradya acuta*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Harpacticidae	*Harpacticus uniremis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Harpacticidae	*Tigriopus brevicornis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Harpacticidae	*Zaus abbreviatus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Harpacticidae	*Zaus spinatus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Laophontidae	*Asellopsis littoralis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Laophontidae	*Echinolaophonte horrida*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Laophontidae	*Heterolaophonte discophora*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Laophontidae	*Heterolaophonte laurentica*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Laophontidae	*Laophonte arenicola*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Laophontidae	*Paralaophonte hyperborea*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Laophontidae	*Paralaophonte perplexa*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Laophontidae	*Platychelipus littoralis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Laophontidae	*Pseudonychocamptus proximus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Leptastacidae	*Paraleptastacus holsaticus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Leptastacidae	*Paraleptastacus laurenticus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Leptastacidae	*Paraleptastacus longicaudatus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Leptastacidae	*Schizothrix rostrata*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Miraciidae	*Amonardia arctica*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Miraciidae	*Amphiascoides debilis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Miraciidae	*Delavalia palustris*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Miraciidae	*Sarsamphiascus demersus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Miraciidae	*Stenhelia divergens*

Phylum	Class	Family	Genus Species
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Miraciidae	*Stenhelia gibba*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Miraciidae	*Typhlamphiascus typhlops*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Nannopodidae	*Nannopus palustris*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Orthopsyllidae	*Orthopsyllus linearis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Paramesochridae	*Emertonia laurentica*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Paramesochridae	*Emertonia major*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Paramesochridae	*Wellsopsyllus (Scottopsyllus) herdmani*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Paramesochridae	*Wellsopsyllus (Scottopsyllus) minor*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Peltidiidae	*Alteutha depressa*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Pseudotachidiidae	*Danielssenia typica*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Rhizotrichidae	*Rhizothrix minuta*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Tachidiidae	*Microarthridion laurenticum*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Tachidiidae	*Microarthridion littorale*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Tegastidae	*Tegastes falcatus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Tegastidae	*Tegastes nanus*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Tetragonicipitidae	*Tetragoniceps longicaudata*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Tetragonicipitidae	*Tetragoniceps truncata*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Thalestridae	*Parathalestris cronii*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Thalestridae	*Parathalestris jacksoni*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Thalestridae	*Rhynchothalestris helgolandica*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Tisbidae	*Scutellidium arthuri*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Tisbidae	*Scutellidium longicauda*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Tisbidae	*Tisbe furcata*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Oncaeidae	*Oncaea venusta*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Oncaeidae	*Triconia borealis*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Oncaeidae	*Triconia conifera*
Arthropoda (Crustacea)	Hexanauplia (Copepoda)	Oncaeidae	*Triconia similis*
Arthropoda (Crustacea)	Hexanauplia (Thecostraca)	Archaeobalanidae	*Chirona hameri*
Arthropoda (Crustacea)	Hexanauplia (Thecostraca)	Archaeobalanidae	*Semibalanus balanoides*
Arthropoda (Crustacea)	Hexanauplia (Thecostraca)	Balanidae	*Amphibalanus improvisus*
Arthropoda (Crustacea)	Hexanauplia (Thecostraca)	Balanidae	*Balanus balanus*
Arthropoda (Crustacea)	Hexanauplia (Thecostraca)	Balanidae	*Balanus crenatus*
Arthropoda (Crustacea)	Malacostraca (Phyllocarida)	Nebaliidae	*Nebalia bipes*
Arthropoda (Crustacea)	Malacostraca	Mysidae	*Boreomysis (Boreomysis) arctica*
Arthropoda (Crustacea)	Malacostraca	Mysidae	*Boreomysis (Boreomysis) tridens*
Arthropoda (Crustacea)	Malacostraca	Mysidae	*Amblyops abbreviatus*
Arthropoda (Crustacea)	Malacostraca	Mysidae	*Amblyops kempi*

Phylum	Class	Family	Genus Species
Arthropoda (Crustacea)	Malacostraca	Mysidae	*Erythrops abyssorum*
Arthropoda (Crustacea)	Malacostraca	Mysidae	*Erythrops erythrophthalmus*
Arthropoda (Crustacea)	Malacostraca	Mysidae	*Meterythrops robustus*
Arthropoda (Crustacea)	Malacostraca	Mysidae	*Parerythrops obesus*
Arthropoda (Crustacea)	Malacostraca	Mysidae	*Pseudomma affine*
Arthropoda (Crustacea)	Malacostraca	Mysidae	*Pseudomma truncatum*
Arthropoda (Crustacea)	Malacostraca	Mysidae	*Mysidetes farrani*
Arthropoda (Crustacea)	Malacostraca	Mysidae	*Mysis gaspensis*
Arthropoda (Crustacea)	Malacostraca	Mysidae	*Mysis litoralis*
Arthropoda (Crustacea)	Malacostraca	Mysidae	*Mysis mixta*
Arthropoda (Crustacea)	Malacostraca	Mysidae	*Mysis oculata*
Arthropoda (Crustacea)	Malacostraca	Mysidae	*Mysis stenolepis*
Arthropoda (Crustacea)	Malacostraca	Mysidae	*Neomysis americana*
Arthropoda (Crustacea)	Malacostraca	Bodotriidae	*Leptocuma*
Arthropoda (Crustacea)	Malacostraca	Bodotriidae	*Mancocuma stellifera*
Arthropoda (Crustacea)	Malacostraca	Diastylidae	*Brachydiastylis resima*
Arthropoda (Crustacea)	Malacostraca	Diastylidae	*Diastylis abbreviata*
Arthropoda (Crustacea)	Malacostraca	Diastylidae	*Diastylis edwardsii*
Arthropoda (Crustacea)	Malacostraca	Diastylidae	*Diastylis glabra*
Arthropoda (Crustacea)	Malacostraca	Diastylidae	*Diastylis goodsiri*
Arthropoda (Crustacea)	Malacostraca	Diastylidae	*Diastylis lucifera*
Arthropoda (Crustacea)	Malacostraca	Diastylidae	*Diastylis rathkei*
Arthropoda (Crustacea)	Malacostraca	Diastylidae	*Diastylis sculpta*
Arthropoda (Crustacea)	Malacostraca	Diastylidae	*Diastyloides serratus*
Arthropoda (Crustacea)	Malacostraca	Diastylidae	*Leptostylis ampullacea*
Arthropoda (Crustacea)	Malacostraca	Diastylidae	*Leptostylis longimana*
Arthropoda (Crustacea)	Malacostraca	Diastylidae	*Leptostylis villosa*
Arthropoda (Crustacea)	Malacostraca	Lampropidae	*Lamprops fuscatus*
Arthropoda (Crustacea)	Malacostraca	Lampropidae	*Lamprops quadriplicata*
Arthropoda (Crustacea)	Malacostraca	Leuconidae	*Eudorella emarginata*
Arthropoda (Crustacea)	Malacostraca	Leuconidae	*Eudorella gracilis*
Arthropoda (Crustacea)	Malacostraca	Leuconidae	*Eudorella hispida*
Arthropoda (Crustacea)	Malacostraca	Leuconidae	*Eudorellopsis biplicata*
Arthropoda (Crustacea)	Malacostraca	Leuconidae	*Eudorellopsis deformis*
Arthropoda (Crustacea)	Malacostraca	Leuconidae	*Eudorellopsis integra*
Arthropoda (Crustacea)	Malacostraca	Leuconidae	*Leucon acutirostris*
Arthropoda (Crustacea)	Malacostraca	Leuconidae	*Leucon fulvus*
Arthropoda (Crustacea)	Malacostraca	Leuconidae	*Leucon nasica*

Phylum	Class	Family	Genus Species
Arthropoda (Crustacea)	Malacostraca	Leuconidae	*Leucon nasicoides*
Arthropoda (Crustacea)	Malacostraca	Leuconidae	*Leucon pallidus*
Arthropoda (Crustacea)	Malacostraca	Nannastacidae	*Campylaspis horrida*
Arthropoda (Crustacea)	Malacostraca	Nannastacidae	*Campylaspis rubicunda*
Arthropoda (Crustacea)	Malacostraca	Nannastacidae	*Cumella (cumella) carinata*
Arthropoda (Crustacea)	Malacostraca	Pseudocumatidae	*Petalosarsia declivis*
Arthropoda (Crustacea)	Malacostraca	Akanthophoreidae	*Akanthophoreus gracilis*
Arthropoda (Crustacea)	Malacostraca	Akanthophoreidae	*Parakanthophoreus longiremis*
Arthropoda (Crustacea)	Malacostraca	Leptocheliidae	*Leptochelia*
Arthropoda (Crustacea)	Malacostraca	Leptocheliidae	*Pseudonototanais filum*
Arthropoda (Crustacea)	Malacostraca	Leptognathiidae	*Leptognathia breviremis*
Arthropoda (Crustacea)	Malacostraca	Pseudotanaidae	*Pseudotanais*
Arthropoda (Crustacea)	Malacostraca	Sphyrapodidae	*Pseudosphyrapus anomalus*
Arthropoda (Crustacea)	Malacostraca	Desmosomatidae	*Eugerda tenuimana*
Arthropoda (Crustacea)	Malacostraca	Janiridae	*Ianiropsis*
Arthropoda (Crustacea)	Malacostraca	Janiridae	*Jaera albifrons*
Arthropoda (Crustacea)	Malacostraca	Janiridae	*Jaera ischiosetosa*
Arthropoda (Crustacea)	Malacostraca	Janiridae	*Jaera posthirsuta*
Arthropoda (Crustacea)	Malacostraca	Janiridae	*Jaera praehirsuta*
Arthropoda (Crustacea)	Malacostraca	Janiridae	*Janira alta*
Arthropoda (Crustacea)	Malacostraca	Munnidae	*Munna acanthifera*
Arthropoda (Crustacea)	Malacostraca	Munnidae	*Munna boeckii*
Arthropoda (Crustacea)	Malacostraca	Munnidae	*Munna fabricii*
Arthropoda (Crustacea)	Malacostraca	Munnidae	*Munna hanseni*
Arthropoda (Crustacea)	Malacostraca	Munnidae	*Munna limicola*
Arthropoda (Crustacea)	Malacostraca	Munnidae	*Uromunna petiti*
Arthropoda (Crustacea)	Malacostraca	Munnopsidae	*Baeonectes muticus*
Arthropoda (Crustacea)	Malacostraca	Munnopsidae	*Eurycope cornuta*
Arthropoda (Crustacea)	Malacostraca	Munnopsidae	*Eurycope inermis*
Arthropoda (Crustacea)	Malacostraca	Munnopsidae	*Eurycope producta*
Arthropoda (Crustacea)	Malacostraca	Munnopsidae	*Ilyarachna longicornis*
Arthropoda (Crustacea)	Malacostraca	Munnopsidae	*Munnopsis typica*
Arthropoda (Crustacea)	Malacostraca	Paramunnidae	*Pleurogonium inerme*
Arthropoda (Crustacea)	Malacostraca	Paramunnidae	*Pleurogonium intermedium*
Arthropoda (Crustacea)	Malacostraca	Paramunnidae	*Pleurogonium spinosissimum*
Arthropoda (Crustacea)	Malacostraca	Leptanthuridae	*Calathura brachiata*
Arthropoda (Crustacea)	Malacostraca	Aegidae	*Syscenus infelix*
Arthropoda (Crustacea)	Malacostraca	Cirolanidae	*Politolana polita*

Phylum	Class	Family	Genus Species
Arthropoda (Crustacea)	Malacostraca	Gnathiidae	*Caecognathia elongata*
Arthropoda (Crustacea)	Malacostraca	Bopyridae	*Hemiarthrus abdominalis*
Arthropoda (Crustacea)	Malacostraca	Aegidae	*Syscenus infelix*
Arthropoda (Crustacea)	Malacostraca	Limnoriidae	*Limnoria borealis*
Arthropoda (Crustacea)	Malacostraca	Limnoriidae	*Limnoria lignorum*
Arthropoda (Crustacea)	Malacostraca	Idoteidae	*Edotia triloba*
Arthropoda (Crustacea)	Malacostraca	Idoteidae	*Idotea balthica*
Arthropoda (Crustacea)	Malacostraca	Idoteidae	*Idotea phosphorea*
Arthropoda (Crustacea)	Malacostraca	Idoteidae	*Synidotea bicuspida*
Arthropoda (Crustacea)	Malacostraca	Idoteidae	*Synidotea nodulosa*
Arthropoda (Crustacea)	Malacostraca	Hyperiidae	*Themisto abyssorum*
Arthropoda (Crustacea)	Malacostraca	Hyperiidae	*Themisto compressa*
Arthropoda (Crustacea)	Malacostraca	Hyperiidae	*Themisto libellula*
Arthropoda (Crustacea)	Malacostraca	Scinidae	*Scina borealis*
Arthropoda (Crustacea)	Malacostraca	Aristiidae	*Aristias topsenti*
Arthropoda (Crustacea)	Malacostraca	Lysianassidae	*Hippomedon propinqvus*
Arthropoda (Crustacea)	Malacostraca	Lysianassidae	*Orchomene macroserratus*
Arthropoda (Crustacea)	Malacostraca	Lysianassidae	*Orchomenella minuta*
Arthropoda (Crustacea)	Malacostraca	Lysianassidae	*Orchomenella obtusa*
Arthropoda (Crustacea)	Malacostraca	Lysianassidae	*Orchomenella pinguis*
Arthropoda (Crustacea)	Malacostraca	Lysianassidae	*Psammonyx nobilis*
Arthropoda (Crustacea)	Malacostraca	Lysianassidae	*Psammonyx terranovae*
Arthropoda (Crustacea)	Malacostraca	Lysianassidae	*Schisturella pulchra*
Arthropoda (Crustacea)	Malacostraca	Opisidae	*Opisa eschrichtii*
Arthropoda (Crustacea)	Malacostraca	Uristidae	*Anonyx compactus*
Arthropoda (Crustacea)	Malacostraca	Uristidae	*Anonyx lilljeborgi*
Arthropoda (Crustacea)	Malacostraca	Uristidae	*Anonyx makarovi*
Arthropoda (Crustacea)	Malacostraca	Uristidae	*Anonyx nugax*
Arthropoda (Crustacea)	Malacostraca	Uristidae	*Anonyx ochoticus*
Arthropoda (Crustacea)	Malacostraca	Uristidae	*Anonyx sarsi*
Arthropoda (Crustacea)	Malacostraca	Uristidae	*Centromedon pumilus*
Arthropoda (Crustacea)	Malacostraca	Uristidae	*Menigrates obtusifrons*
Arthropoda (Crustacea)	Malacostraca	Uristidae	*Menigrates spinirami*
Arthropoda (Crustacea)	Malacostraca	Uristidae	*Menigratopsis svennilssoni*
Arthropoda (Crustacea)	Malacostraca	Uristidae	*Onisimus barentsi*
Arthropoda (Crustacea)	Malacostraca	Uristidae	*Onisimus edwardsii*
Arthropoda (Crustacea)	Malacostraca	Uristidae	*Onisimus litoralis*
Arthropoda (Crustacea)	Malacostraca	Uristidae	*Onisimus normani*

Phylum	Class	Family	Genus Species
Arthropoda (Crustacea)	Malacostraca	Uristidae	*Paralibrotus setosus*
Arthropoda (Crustacea)	Malacostraca	Uristidae	*Tmetonyx cicada*
Arthropoda (Crustacea)	Malacostraca	Pontoporeiidae	*Pontoporeia femorata*
Arthropoda (Crustacea)	Malacostraca	Acanthonotozomatidae	*Acanthonotozoma serratum*
Arthropoda (Crustacea)	Malacostraca	Ampeliscidae	*Ampelisca declivitatis*
Arthropoda (Crustacea)	Malacostraca	Ampeliscidae	*Ampelisca eschrichtii*
Arthropoda (Crustacea)	Malacostraca	Ampeliscidae	*Ampelisca macrocephala*
Arthropoda (Crustacea)	Malacostraca	Ampeliscidae	*Ampelisca vadorum*
Arthropoda (Crustacea)	Malacostraca	Ampeliscidae	*Byblis gaimardii*
Arthropoda (Crustacea)	Malacostraca	Ampeliscidae	*Haploops laevis*
Arthropoda (Crustacea)	Malacostraca	Ampeliscidae	*Haploops setosa*
Arthropoda (Crustacea)	Malacostraca	Ampeliscidae	*Haploops tubicola*
Arthropoda (Crustacea)	Malacostraca	Amphilochidae	*Amphilochopsis hamatus*
Arthropoda (Crustacea)	Malacostraca	Amphilochidae	*Amphilochus tenuimanus*
Arthropoda (Crustacea)	Malacostraca	Amphilochidae	*Gitanopsis arctica*
Arthropoda (Crustacea)	Malacostraca	Amphilochidae	*Gitanopsis bispinosa*
Arthropoda (Crustacea)	Malacostraca	Amphilochidae	*Gitanopsis inermis*
Arthropoda (Crustacea)	Malacostraca	Atylidae	*Atylus carinatus*
Arthropoda (Crustacea)	Malacostraca	Dexaminidae	*Guernea (Prinassus) nordenskioldi*
Arthropoda (Crustacea)	Malacostraca	Epimeriidae	*Epimeria loricata*
Arthropoda (Crustacea)	Malacostraca	Eusiridae	*Eusirella elegans*
Arthropoda (Crustacea)	Malacostraca	Eusiridae	*Eusirogenes deflexifrons*
Arthropoda (Crustacea)	Malacostraca	Eusiridae	*Eusirus cuspidatus*
Arthropoda (Crustacea)	Malacostraca	Eusiridae	*Eusirus longipes*
Arthropoda (Crustacea)	Malacostraca	Eusiridae	*Eusirus propinquus*
Arthropoda (Crustacea)	Malacostraca	Eusiridae	*Rhachotropis aculeata*
Arthropoda (Crustacea)	Malacostraca	Eusiridae	*Rhachotropis distincta*
Arthropoda (Crustacea)	Malacostraca	Eusiridae	*Rhachotropis inflata*
Arthropoda (Crustacea)	Malacostraca	Eusiridae	*Rhachotropis oculata*
Arthropoda (Crustacea)	Malacostraca	Liljeborgiidae	*Idunella aequicornis*
Arthropoda (Crustacea)	Malacostraca	Melphidippidae	*Melphidippa borealis*
Arthropoda (Crustacea)	Malacostraca	Melphidippidae	*Melphidippa goesi*
Arthropoda (Crustacea)	Malacostraca	Melphidippidae	*Melphidippa macrura*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Acanthostepheia malmgreni*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Aceroides (Aceroides) latipes*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Ameroculodes edwardsi*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Arrhinopsis longicornis*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Arrhis phyllonyx*

Phylum	Class	Family	Genus Species
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Bathymedon longimanus*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Bathymedon obtusifrons*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Deflexilodes intermedius*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Deflexilodes tesselatus*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Deflexilodes tuberculatus*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Monoculodes latimanus*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Monoculodes packardi*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Monoculopsis longicornis*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Oediceros borealis*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Oediceros saginatus*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Paroediceros lynceus*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Paroediceros propinquus*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Rostroculodes borealis*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Rostroculodes schneideri*
Arthropoda (Crustacea)	Malacostraca	Oedicerotidae	*Westwoodilla caecula*
Arthropoda (Crustacea)	Malacostraca	Pardaliscidae	*Halice abyssi*
Arthropoda (Crustacea)	Malacostraca	Pardaliscidae	*Pardalisca cuspidata*
Arthropoda (Crustacea)	Malacostraca	Pardaliscidae	*Pardaliscella lavrovi*
Arthropoda (Crustacea)	Malacostraca	Phoxocephalidae	*Harpinia cabotensis*
Arthropoda (Crustacea)	Malacostraca	Phoxocephalidae	*Harpinia propinqua*
Arthropoda (Crustacea)	Malacostraca	Phoxocephalidae	*Harpinia serrata*
Arthropoda (Crustacea)	Malacostraca	Phoxocephalidae	*Paraphoxus oculatus*
Arthropoda (Crustacea)	Malacostraca	Phoxocephalidae	*Phoxocephalus holbolli*
Arthropoda (Crustacea)	Malacostraca	Pleustidae	*Neopleustes pulchellus*
Arthropoda (Crustacea)	Malacostraca	Pleustidae	*Parapleustes gracilis*
Arthropoda (Crustacea)	Malacostraca	Pleustidae	*Pleustes panopla*
Arthropoda (Crustacea)	Malacostraca	Pleustidae	*Pleustomesus medius*
Arthropoda (Crustacea)	Malacostraca	Pleustidae	*Pleusymtes glaber*
Arthropoda (Crustacea)	Malacostraca	Pleustidae	*Pleusymtes pulchella*
Arthropoda (Crustacea)	Malacostraca	Pleustidae	*Stenopleustes latipes*
Arthropoda (Crustacea)	Malacostraca	Stegocephalidae	*Andaniella pectinata*
Arthropoda (Crustacea)	Malacostraca	Stegocephalidae	*Andaniexis abyssi*
Arthropoda (Crustacea)	Malacostraca	Stegocephalidae	*Andaniopsis nordlandica*
Arthropoda (Crustacea)	Malacostraca	Stegocephalidae	*Stegocephaloides auratus*
Arthropoda (Crustacea)	Malacostraca	Stegocephalidae	*Stegocephalus inflatus*
Arthropoda (Crustacea)	Malacostraca	Stenothoidae	*Hardametopa carinata*
Arthropoda (Crustacea)	Malacostraca	Stenothoidae	*Metopa abyssalis*
Arthropoda (Crustacea)	Malacostraca	Stenothoidae	*Metopa alderi*

Phylum	Class	Family	Genus Species
Arthropoda (Crustacea)	Malacostraca	Stenothoidae	*Metopa boeckii*
Arthropoda (Crustacea)	Malacostraca	Stenothoidae	*Metopa borealis*
Arthropoda (Crustacea)	Malacostraca	Stenothoidae	*Metopa bruzelii*
Arthropoda (Crustacea)	Malacostraca	Stenothoidae	*Metopa clypeata*
Arthropoda (Crustacea)	Malacostraca	Stenothoidae	*Metopa propinqua*
Arthropoda (Crustacea)	Malacostraca	Stenothoidae	*Metopa pusilla*
Arthropoda (Crustacea)	Malacostraca	Stenothoidae	*Metopa robusta*
Arthropoda (Crustacea)	Malacostraca	Stenothoidae	*Metopa spitzbergensis*
Arthropoda (Crustacea)	Malacostraca	Stenothoidae	*Metopa tenuimana*
Arthropoda (Crustacea)	Malacostraca	Stenothoidae	*Metopella angusta*
Arthropoda (Crustacea)	Malacostraca	Stenothoidae	*Metopelloides micropalpa*
Arthropoda (Crustacea)	Malacostraca	Stenothoidae	*Stenothoe brevicornis*
Arthropoda (Crustacea)	Malacostraca	Stilipedidae	*Astyra abyssi*
Arthropoda (Crustacea)	Malacostraca	Synopiidae	*Syrrhoe crenulata*
Arthropoda (Crustacea)	Malacostraca	Synopiidae	*Tiron spiniferus*
Arthropoda (Crustacea)	Malacostraca	Unciolidae	*Unciola irrorata*
Arthropoda (Crustacea)	Malacostraca	Caprellidae	*Aeginina longicornis*
Arthropoda (Crustacea)	Malacostraca	Caprellidae	*Caprella linearis*
Arthropoda (Crustacea)	Malacostraca	Caprellidae	*Caprella rinki*
Arthropoda (Crustacea)	Malacostraca	Caprellidae	*Caprella septentrionalis*
Arthropoda (Crustacea)	Malacostraca	Dulichiidae	*Dulichia falcata*
Arthropoda (Crustacea)	Malacostraca	Dulichiidae	*Dulichia tuberculata*
Arthropoda (Crustacea)	Malacostraca	Dulichiidae	*Dyopedos arcticus*
Arthropoda (Crustacea)	Malacostraca	Dulichiidae	*Dyopedos monacantha*
Arthropoda (Crustacea)	Malacostraca	Dulichiidae	*Dyopedos porrectus*
Arthropoda (Crustacea)	Malacostraca	Dulichiidae	*Paradulichia typica*
Arthropoda (Crustacea)	Malacostraca	Corophiidae	*Monocorophium acherusicum*
Arthropoda (Crustacea)	Malacostraca	Corophiidae	*Monocorophium tuberculatum*
Arthropoda (Crustacea)	Malacostraca	Corophiidae	*Crassicorophium bonellii*
Arthropoda (Crustacea)	Malacostraca	Corophiidae	*Crassicorophium crassicorne*
Arthropoda (Crustacea)	Malacostraca	Corophiidae	*Goesia depressa*
Arthropoda (Crustacea)	Malacostraca	Corophiidae	*Leptocheirus pinguis*
Arthropoda (Crustacea)	Malacostraca	Corophiidae	*Neohela monstrosa*
Arthropoda (Crustacea)	Malacostraca	Corophiidae	*Protomedeia fasciata*
Arthropoda (Crustacea)	Malacostraca	Corophiidae	*Protomedeia grandimana*
Arthropoda (Crustacea)	Malacostraca	Corophiidae	*Protomedeia stephenseni*
Arthropoda (Crustacea)	Malacostraca	Isaeidae	
Arthropoda (Crustacea)	Malacostraca	Ischyroceridae	*Ericthonius rubricornis*

Phylum	Class	Family	Genus Species
Arthropoda (Crustacea)	Malacostraca	Ischyroceridae	*Ericthonius tolli*
Arthropoda (Crustacea)	Malacostraca	Ischyroceridae	*Ischyrocerus anguipes*
Arthropoda (Crustacea)	Malacostraca	Ischyroceridae	*Ischyrocerus commensalis*
Arthropoda (Crustacea)	Malacostraca	Ischyroceridae	*Ischyrocerus latipes*
Arthropoda (Crustacea)	Malacostraca	Ischyroceridae	*Ischyrocerus megacheir*
Arthropoda (Crustacea)	Malacostraca	Ischyroceridae	*Ischyrocerus megalops*
Arthropoda (Crustacea)	Malacostraca	Ischyroceridae	*Ischyrocerus nanoides*
Arthropoda (Crustacea)	Malacostraca	Ischyroceridae	*Protomedeia fasciata*
Arthropoda (Crustacea)	Malacostraca	Ischyroceridae	*Protomedeia stephenseni*
Arthropoda (Crustacea)	Malacostraca	Photidae	*Gammaropsis melanops*
Arthropoda (Crustacea)	Malacostraca	Photidae	*Gammaropsis nitida*
Arthropoda (Crustacea)	Malacostraca	Photidae	*Photis reinhardi*
Arthropoda (Crustacea)	Malacostraca	Photidae	*Photis tenuicornis*
Arthropoda (Crustacea)	Malacostraca	Bathyporeiidae	*Amphiporeia lawrenciana*
Arthropoda (Crustacea)	Malacostraca	Gammarellidae	*Gammarellus angulosus*
Arthropoda (Crustacea)	Malacostraca	Gammarellidae	*Gammarellus homari*
Arthropoda (Crustacea)	Malacostraca	Gammaridae	*Gammarus annulatus*
Arthropoda (Crustacea)	Malacostraca	Gammaridae	*Gammarus daiberi*
Arthropoda (Crustacea)	Malacostraca	Gammaridae	*Gammarus duebeni*
Arthropoda (Crustacea)	Malacostraca	Gammaridae	*Gammarus lawrencianus*
Arthropoda (Crustacea)	Malacostraca	Gammaridae	*Gammarus oceanicus*
Arthropoda (Crustacea)	Malacostraca	Gammaridae	*Gammarus setosus*
Arthropoda (Crustacea)	Malacostraca	Gammaridae	*Gammarus tigrinus*
Arthropoda (Crustacea)	Malacostraca	Calliopiidae	*Amphithopsis longicaudata*
Arthropoda (Crustacea)	Malacostraca	Calliopiidae	*Apherusa megalops*
Arthropoda (Crustacea)	Malacostraca	Calliopiidae	*Calliopius laeviusculus*
Arthropoda (Crustacea)	Malacostraca	Calliopiidae	*Halirages fulvocinctus*
Arthropoda (Crustacea)	Malacostraca	Calliopiidae	*Haliragoides inermis*
Arthropoda (Crustacea)	Malacostraca	Calliopiidae	*Laothoes polylovi*
Arthropoda (Crustacea)	Malacostraca	Calliopiidae	*Oradarea longimana*
Arthropoda (Crustacea)	Malacostraca	Calliopiidae	*Weyprechtia heuglini*
Arthropoda (Crustacea)	Malacostraca	Calliopiidae	*Weyprechtia pinguis*
Arthropoda (Crustacea)	Malacostraca	Pontogeneiidae	*Pontogeneia inermis*
Arthropoda (Crustacea)	Malacostraca	Maeridae	*Maera danae*
Arthropoda (Crustacea)	Malacostraca	Maeridae	*Maera loveni*
Arthropoda (Crustacea)	Malacostraca	Maeridae	*Wimvadocus torelli*
Arthropoda (Crustacea)	Malacostraca	Melitidae	*Megamoera dentata*
Arthropoda (Crustacea)	Malacostraca	Melitidae	*Quasimelita formosa*

Phylum	Class	Family	Genus Species
Arthropoda (Crustacea)	Malacostraca	Hyalidae	*Apohyale prevostii*
Arthropoda (Crustacea)	Malacostraca	Talitridae	*Americorchestia megalophthalma*
Arthropoda (Crustacea)	Malacostraca	Euphausiidae	*Meganyctiphanes norvegica*
Arthropoda (Crustacea)	Malacostraca	Euphausiidae	*Thysanoessa inermis*
Arthropoda (Crustacea)	Malacostraca	Euphausiidae	*Thysanoessa longicaudata*
Arthropoda (Crustacea)	Malacostraca	Euphausiidae	*Thysanoessa raschii*
Arthropoda (Crustacea)	Malacostraca	Crangonidae	*Argis dentata*
Arthropoda (Crustacea)	Malacostraca	Crangonidae	*Crangon septemspinosa*
Arthropoda (Crustacea)	Malacostraca	Crangonidae	*Pontophilus norvegicus*
Arthropoda (Crustacea)	Malacostraca	Crangonidae	*Sabinea sarsii*
Arthropoda (Crustacea)	Malacostraca	Crangonidae	*Sabinea septemcarinata*
Arthropoda (Crustacea)	Malacostraca	Crangonidae	*Sclerocrangon boreas*
Arthropoda (Crustacea)	Malacostraca	Hippolytidae	*Eualus fabricii*
Arthropoda (Crustacea)	Malacostraca	Hippolytidae	*Eualus gaimardii*
Arthropoda (Crustacea)	Malacostraca	Hippolytidae	*Eualus macilentus*
Arthropoda (Crustacea)	Malacostraca	Hippolytidae	*Lebbeus groenlandicus*
Arthropoda (Crustacea)	Malacostraca	Hippolytidae	*Lebbeus microceros*
Arthropoda (Crustacea)	Malacostraca	Hippolytidae	*Lebbeus polaris*
Arthropoda (Crustacea)	Malacostraca	Hippolytidae	*Spirontocaris liljeborgii*
Arthropoda (Crustacea)	Malacostraca	Hippolytidae	*Spirontocaris phippsii*
Arthropoda (Crustacea)	Malacostraca	Hippolytidae	*Spirontocaris spinus*
Arthropoda (Crustacea)	Malacostraca	Palaemonidae	*Palaemonetes pugio*
Arthropoda (Crustacea)	Malacostraca	Pandalidae	*Atlantopandalus propinqvus*
Arthropoda (Crustacea)	Malacostraca	Pandalidae	*Pandalus borealis*
Arthropoda (Crustacea)	Malacostraca	Pandalidae	*Pandalus montagui*
Arthropoda (Crustacea)	Malacostraca	Pasiphaeidae	*Pasiphaea multidentata*
Arthropoda (Crustacea)	Malacostraca	Pasiphaeidae	*Pasiphaea tarda*
Arthropoda (Crustacea)	Malacostraca	Nephropidae	*Homarus americanus*
Arthropoda (Crustacea)	Malacostraca	Axiidae	*Calocaris templemani*
Arthropoda (Crustacea)	Malacostraca	Lithodidae	*Lithodes maja*
Arthropoda (Crustacea)	Malacostraca	Munidopsidae	*Munidopsis curvirostra*
Arthropoda (Crustacea)	Malacostraca	Paguridae	*Pagurus acadianus*
Arthropoda (Crustacea)	Malacostraca	Paguridae	*Pagurus arcuatus*
Arthropoda (Crustacea)	Malacostraca	Paguridae	*Pagurus pubescens*
Arthropoda (Crustacea)	Malacostraca	Cancridae	*Cancer irroratus*
Arthropoda (Crustacea)	Malacostraca	Oregoniidae	*Chionoecetes opilio*
Arthropoda (Crustacea)	Malacostraca	Oregoniidae	*Hyas araneus*
Arthropoda (Crustacea)	Malacostraca	Oregoniidae	*Hyas coarctatus*

Phylum	Class	Family	Genus Species
Arthropoda (Chelicerata)	Arachnida	Halacaridae	*Copidognathus biodomus*
Arthropoda (Chelicerata)	Arachnida	Halacaridae	*Halacarus*
Arthropoda (Chelicerata)	Arachnida	Halacaridae	*Isobactrus setosus*
Arthropoda (Chelicerata)	Pycnogonida	Callipallenidae	*Pseudopallene circularis*
Arthropoda (Chelicerata)	Pycnogonida	Nymphonidae	*Nymphon brevirostre*
Arthropoda (Chelicerata)	Pycnogonida	Nymphonidae	*Nymphon grossipes*
Arthropoda (Chelicerata)	Pycnogonida	Nymphonidae	*Nymphon longitarse*
Arthropoda (Chelicerata)	Pycnogonida	Nymphonidae	*Nymphon macrum*
Arthropoda (Chelicerata)	Pycnogonida	Nymphonidae	*Nymphon sluiteri*
Arthropoda (Chelicerata)	Pycnogonida	Nymphonidae	*Nymphon stroemi*
Arthropoda (Chelicerata)	Pycnogonida	Phoxichilidiidae	*Phoxichilidium femoratum*
Arthropoda (Hexapoda)	Insecta	Corixidae	*Trichocorixa verticalis*

ECHINODERMATA

Phylum	Class	Family	Genus Species
Echinodermata	Asteroidea	Asteriidae	*Asterias rubens*
Echinodermata	Asteroidea	Asteriidae	*Leptasterias groenlandica*
Echinodermata	Asteroidea	Asteriidae	*Leptasterias littoralis*
Echinodermata	Asteroidea	Asteriidae	*Leptasterias polaris*
Echinodermata	Asteroidea	Asteriidae	*Leptasterias tenera*
Echinodermata	Asteroidea	Asteriidae	*Stephanasterias albula*
Echinodermata	Asteroidea	Ctenodiscidae	*Ctenodiscus crispatus*
Echinodermata	Asteroidea	Echinasteridae	*Henricia perforata*
Echinodermata	Asteroidea	Echinasteridae	*Henricia spongiosa*
Echinodermata	Asteroidea	Goniasteridae	*Hippasteria phrygiana*
Echinodermata	Asteroidea	Poraniidae	*Poraniomorpha hispida*
Echinodermata	Asteroidea	Solasteridae	*Crossaster papposus*
Echinodermata	Asteroidea	Solasteridae	*Solaster endeca*
Echinodermata	Asteroidea	Pterasteridae	*Pteraster militaris*
Echinodermata	Ophiuroidea	Gorgonocephalidae	*Gorgonocephalus arcticus*
Echinodermata	Ophiuroidea	Amphiuridae	*Amphipholis squamata*
Echinodermata	Ophiuroidea	Amphiuridae	*Amphiura fragilis*
Echinodermata	Ophiuroidea	Amphiuridae	*Amphiura otteri*
Echinodermata	Ophiuroidea	Amphiuridae	*Amphiura sundevalli*
Echinodermata	Ophiuroidea	Ophiacanthidae	*Ophiacantha bidentata*
Echinodermata	Ophiuroidea	Ophiactidae	*Ophiopholis aculeata*
Echinodermata	Ophiuroidea	Ophiactidae	*Ophiopus arcticus*

Phylum	Class	Family	Genus Species
Echinodermata	Ophiuroidea	Ophiomyxidae	*Ophioscolex glacialis*
Echinodermata	Ophiuroidea	Ophiuridae	*Ophiura robusta*
Echinodermata	Ophiuroidea	Ophiuridae	*Ophiura sarsii*
Echinodermata	Ophiuroidea	Ophiuridae	*Stegophiura nodosa*
Echinodermata	Ophiuroidea	Ophiuridae	*Stegophiura stuwitzii*
Echinodermata	Echinoidea	Strongylocentrotidae	*Strongylocentrotus droebachiensis*
Echinodermata	Echinoidea	Strongylocentrotidae	*Strongylocentrotus pallidus*
Echinodermata	Echinoidea	Echinarachniidae	*Echinarachnius parma*
Echinodermata	Echinoidea	Schizasteridae	*Brisaster fragilis*
Echinodermata	Holothuroidea	Chiridotidae	*Chiridota laevis*
Echinodermata	Holothuroidea	Cucumariidae	*Cucumaria frondosa*
Echinodermata	Holothuroidea	Cucumariidae	*Ekmania barthii*
Echinodermata	Holothuroidea	Phyllophoridae	*Pentamera calcigera*
Echinodermata	Holothuroidea	Psolidae	*Psolus fabricii*
Echinodermata	Holothuroidea	Psolidae	*Psolus phantapus*
Echinodermata	Holothuroidea	Eupyrgidae	*Eupyrgus scaber*
Echinodermata	Holothuroidea	Molpadiidae	*Molpadia borealis*

OTHER PHYLA

Phylum	Class	Family	Genus Species
Entoprocta	-	Barentsiidae	*Barentsia*
Entoprocta	-	Pedicellinidae	*Pedicellina*
Bryozoa	Gymnolaemata	Bugulidae	*Bugulina flabellata*
Bryozoa	Gymnolaemata	Bugulidae	*Crisularia turrita*
Bryozoa	Gymnolaemata	Bugulidae	*Dendrobeania murrayana*
Bryozoa	Gymnolaemata	Calloporidae	*Amphiblestrum auritum*
Bryozoa	Gymnolaemata	Calloporidae	*Callopora craticula*
Bryozoa	Gymnolaemata	Calloporidae	*Callopora lineata*
Bryozoa	Gymnolaemata	Calloporidae	*Cauloramphus cymbaeformis*
Bryozoa	Gymnolaemata	Calloporidae	*Tegella arctica*
Bryozoa	Gymnolaemata	Calloporidae	*Tegella armifera*
Bryozoa	Gymnolaemata	Calloporidae	*Tegella unicornis*
Bryozoa	Gymnolaemata	Candidae	*Aquiloniella scabra*
Bryozoa	Gymnolaemata	Celleporidae	*Celleporina ventricosa*
Bryozoa	Gymnolaemata	Doryporellidae	*Doryporella spathulifera*
Bryozoa	Gymnolaemata	Eucrateidae	*Eucratea loricata*
Bryozoa	Gymnolaemata	Flustridae	*Serratiflustra serrul*ata

Phylum	Class	Family	Genus Species
Bryozoa	Gymnolaemata	Hippoporidridae	*Hippoporella hippopus*
Bryozoa	Gymnolaemata	Hippothoidae	*Celleporella hyalina*
Bryozoa	Gymnolaemata	Myriaporidae	*Myriapora*
Bryozoa	Gymnolaemata	Escharellidae	*Escharella immersa*
Bryozoa	Gymnolaemata	Schizoporellidae	*Schizoporella unicornis*
Bryozoa	Gymnolaemata	Smittinidae	*Parasmittina trispinosa*
Bryozoa	Gymnolaemata	Smittinidae	*Smittina bella*
Bryozoa	Gymnolaemata	Stomachetosellidae	*Stomacrustula hincksi*
Bryozoa	Gymnolaemata	Umbonulidae	*Arctonula arctica*
Bryozoa	Gymnolaemata	Umbonulidae	*Rhamphostomella costata*
Bryozoa	Gymnolaemata	Umbonulidae	*Rhamphostomella ovata*
Bryozoa	Gymnolaemata	Umbonulidae	*Rhamphostomella plicata*
Bryozoa	Gymnolaemata	Umbonulidae	*Rhamphostomella radiatula*
Bryozoa	Gymnolaemata	Alcyonidiidae	*Alcyonidium gelatinosum*
Bryozoa	Gymnolaemata	Flustrellidridae	*Flustrellidra corniculata*
Bryozoa	Gymnolaemata	Flustrellidridae	Flustrellidra hispida
Bryozoa	Gymnolaemata	Escharellidae	*Escharella*
Bryozoa	Stenolaemata	Crisiidae	*Crisia eburnea*
Bryozoa	Stenolaemata	Idmoneidae	*Idmonea*
Bryozoa	Stenolaemata	Lichenoporidae	*Disporella hispida*
Bryozoa	Stenolaemata	Lichenoporidae	*Lichenopora*
Bryozoa	Stenolaemata	Lichenoporidae	*Patinella verrucaria*
Bryozoa	Stenolaemata	Oncousoeciidae	*Oncousoecia canaden*sis
Bryozoa	Stenolaemata	Plagioeciidae	*Plagioecia patina*
Bryozoa	Stenolaemata	Tubuliporidae	*Bathysoecia polygonalis*
Bryozoa	Stenolaemata	Tubuliporidae	*Tubulipora*
Brachiopoda	Rhynchonellata	Hemithirididae	*Hemithiris psittacea*
Chaetognatha	Sagittoidea	Sagittidae	*Parasagitta elegans*
Chaetognatha	Sagittoidea	Sagittidae	*Pseudosagitta maxima*
Chaetognatha	Sagittoidea	Eukrohniidae	*Eukrohnia hamata*
Chordata	Appendicularia	Fritillariidae	*Fritillaria borealis*
Chordata	Appendicularia	Oikopleuridae	*Oikopleura labradoriensis*
Chordata	Ascidiacea	Didemnidae	*Didemnum albidum*
Chordata	Ascidiacea	Didemnidae	*Didemnum candidum*
Chordata	Ascidiacea	Holozoidae	*Distaplia clavata*
Chordata	Ascidiacea	Polyclinidae	*Aplidium glabrum*
Chordata	Ascidiacea	Ascidiidae	*Ascidia obliqua*
Chordata	Ascidiacea	Corellidae	*Chelyosoma macleayanum*

Phylum	Class	Family	Genus Species
Chordata	Ascidiacea	Molgulidae	*Bostrichobranchus pilularis*
Chordata	Ascidiacea	Molgulidae	*Molgula complanata*
Chordata	Ascidiacea	Molgulidae	*Molgula griffithsii*
Chordata	Ascidiacea	Molgulidae	*Molgula manhattensis*
Chordata	Ascidiacea	Molgulidae	*Molgula retortiformis*
Chordata	Ascidiacea	Molgulidae	*Molgula siphonalis*
Chordata	Ascidiacea	Pyuridae	*Boltenia echinata*
Chordata	Ascidiacea	Pyuridae	*Boltenia ovifera*
Chordata	Ascidiacea	Pyuridae	*Halocynthia pyriformis*
Chordata	Ascidiacea	Styelidae	*Cnemidocarpa mollis*
Chordata	Ascidiacea	Styelidae	*Cnemidocarpa rhizopus*
Chordata	Ascidiacea	Styelidae	*Dendrodoa aggregata*
Chordata	Ascidiacea	Styelidae	*Dendrodoa carnea*
Chordata	Ascidiacea	Styelidae	*Dendrodoa grossularia*
Chordata	Ascidiacea	Styelidae	*Dendrodoa pulchella*
Chordata	Ascidiacea	Styelidae	*Pelonaia corrugata*
Chordata	Ascidiacea	Styelidae	*Polycarpa fibrosa*
Chordata	Ascidiacea	Styelidae	*Styela coriacea*
Chordata	Ascidiacea	Styelidae	*Styela rustica*