Summary Comments

Canada Gazette Part I, Volume 153, No. 23 – Ballast Water Regulations (June 8, 2019)

Ballast Water Regulations – Cost-Benefit Analysis (April 2019)

The Lake Carriers' Association (LCA) provides the following comments to Transport Canada's Ballast Water Regulations (the Regulations) proposed in Canada Gazette Part I (Vol. 153, no. 23) on June 8, 2019 and the associated Cost-Benefit Analysis (April 2019). LCA respects the right of Canada to implement the International Maritime Organization's (IMO) Ballast Water Convention (the Convention) through the proposed Regulations, including establishing performance requirements for discharges of ballast water into Canadian waters. LCA disagrees with the Regulations' proposal to regulate ballast water loaded in Canadian waters and discharged into United States (U.S.) waters by U.S.-flag vessels operating exclusively on the Great Lakes (U.S.-flag lakers) and requests that it be removed from the proposed Regulations. This position is well-known to Transport Canada and also has been shared with a range of other Government of Canada officials (both departmental and elected) by LCA.

That requirement provides no environmental benefit to Canada. Neither the proposed Regulations nor the science referenced therein provides any evidence that discharges into Great Lakes U.S. waters by U.S.-flag lakers of untreated ballast water loaded in Great Lakes Canadian waters risks environmental harm to Canadian waters. The science documents referenced in the proposed Regulations only assess the risks to Canada's environment of discharges of untreated ballast water into Canadian waters and identify no specific benefits to Great Lakes Canadian waters of requiring U.S.-flag lakers to treat ballast water loaded in those waters and discharged in Great Lakes U.S. waters. As noted in Transport Canada's proposal regarding discharges into U.S. waters by U.S.-flag lakers of ballast water loaded in U.S. waters, "it would be better left to the United States to regulate these discharges." The same logic applies to ballast water loaded in Canadian waters and discharged in U.S. waters by those same vessels.

That requirement imposes disproportionate costs on U.S.-flag lakers. Transport Canada has repeatedly stated that only 5–10 percent of U.S.-flag lakers would be impacted by the proposed Regulations. This is based upon the false assumption that equates the percentage of U.S./Canada Great Lakes trade cargo volume transported by U.S.-flag lakers to the percentage of the U.S.-flag laker fleet affected by the proposed Regulations. In fact, on average 43 different vessels of the 55 U.S.-flag laker fleet annually trade with Canada and almost all U.S.-flag lakers have engaged in this trade over the past decade. This represents 78 percent of the U.S.-flag laker fleet on an annual basis and 95 percent of the fleet on a long-term basis, not 5–10 percent, although all U.S.-flag lakers are capable of serving Canada.

The costs to the impacted U.S.-flag lakers associated with the proposed Regulations are significant [$1.132 billion (CDN)] and far exceed all Canadian-flag fleet costs, as estimated in Transport Canada's proposal [$632 million (CDN)]. LCA provided Transport Canada two documents related to the costs associated with retrofitting the U.S.-flag laker fleet to operate on board BWMSs, as well as off-vessel options as described by the Convention and U.S. regulations:

- Technical Engineering Analysis and Economic Feasibility Study for Ballast Water Management System Installation and Operation on board U.S.-flag Great Lakes Fleet (April 2017), Choice

Ballast Solutions

- Preliminary Cost Estimate for the Shoreside Ballast Treatment and Supply for the U.S. Great Lakes (February 2017), Hull and Associates

These were hand delivered to Transport Canada on May 9, 2018. Further discussion on these economic impacts is provided in the section-by-section comments following this summary.

That requirement is not required by the Convention. Transport Canada proposal claims that the Convention requires Canada to regulate ballast water loaded in Canadian waters and discharged in the waters of other countries but does not cite any specific section of the Convention or the Convention's regulations that imposes such a requirement. After consulting with several industry experts, LCA is not aware of any other party to the Convention proposing to regulate the loading of ballast water in its waters if that ballast water is subsequently discharged into another country's waters.

Transport Canada's proposal makes the argument that "the Convention requires Canada to apply the requirements of the Convention to vessels of non-parties to ensure that no more favourable treatment is given to such vessels," but does not explain why requiring the treatment of ballast water loaded in Canadian waters and discharged into U.S. waters by U.S.-flag lakers is required for Canada to comply with this aspect of the Convention.

LCA's proposed change described above would not provide more favorable treatment overall for U.S.-flag lakers compared to Canadian or other parties' vessels. While LCA's proposal to remove the requirement to treat ballast water loaded in Canadian waters from the proposed Regulations might appear to favor pre-2009 U.S.-flag lakers delivering U.S. cargo to Canada (which requires loading ballast water in Canadian waters) despite it applying to vessels of all flags (because U.S. regulations don't require pre-2009 lakers to install a BWMS), any such advantage in that direction of trade would be offset with regard to the Canada to U.S. direction of trade by retaining the requirement in the proposed Regulations that ballast water loaded in Great Lakes U.S. waters and discharged into Great Lakes Canadian waters (needed for lakers to load cargo in Canada) be treated before discharge, which would favor Canadian-flag vessels (because they can install a BWMS at far lower cost than pre-2009 U.S.-flag lakers and would not have to meet the Convention discharge standard).

The differences between the approaches to laker ballast water of U.S. requirements and the proposed Regulations (including LCA's requested changes) appear to favor each country's own vessels regarding ballast water discharges in the Great Lakes waters of each country because of the different ages and trading patterns of those vessels. Therefore, in combination, these relative advantages would balance each other out, and the proposed Regulations (including LCA's requested changes) would not provide more favorable treatment overall to either country's vessels with regard to U.S./Canada Great Lakes trade and would comply with the Convention.

Finally, although the Regulations' proposal to eliminate saltwater flushing/exchange for all ocean-going vessels (salties) entering the Laurentian Great Lakes system by September 2024 would not impact the U.S.-flag laker fleet, LCA believes it is ill advised. Our section-by-section comments below, based upon scientific research and regulatory documentation, delve deeper into this. Ballast water exchange plus treatment was initially proposed by officials from Canada's Department of Fisheries and Oceans (DFO)

and Transport Canada before being adopted by U.S. state and federal governments. Transport Canada seems willing to go well beyond the Convention to regulate U.S.-flag lakers without scientific justification. Despite clear scientific evidence of the additional environmental benefits of flushing/exchange plus treatment of ballast water loaded from outside the Great Lakes, the agency, however, appears to be reluctant to go beyond the Convention with regard to salties.

In summary, LCA does not object to Transport Canada's proposed Regulations' requiring treatment of ballast water discharged into Canadian waters. LCA's greatest concern is that the proposed Regulations provide no adequate justification for regulating ballast water loaded in Canadian waters and discharged in U.S. waters, so LCA requests that this requirement be removed from the proposed Regulations. It would create a non-tariff barrier to trade that would prevent U.S.-flag lakers from exporting American products and raw materials to Canada. It would give the Canadian-flag fleet a monopoly on U.S./Canada Great Lakes trade. The regulation of ballast water loading provides no demonstrable environmental benefit to Canada and it goes beyond the Convention. Also, the use of an "equipment standard" instead of a discharge standard is inconsistent with the Convention.

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Regulatory Impact Analysis Statement

Page 2542, Rationale –

In Gazette Part I, the statement "The implementation of the Convention's performance standard by foreign and domestic vessels would reduce the environmental and economic impacts of invasive species introduced to Canada by foreign vessels, introduced to foreign waters by Canadian vessels, and spread within Canada by domestic vessels" provides no rationale for regulating the loading of ballast water in Canada by U.S.-flag lakers that will be discharged in U.S. waters, as these discharges would not introduce aquatic non-native species (ANS) into Canada. Furthermore, any ANS in ballast water loaded in Canadian waters and discharged untreated into U.S. waters that are present in ballast water subsequently loaded in the same U.S. waters and discharged into Canadian waters would have to be treated prior to that discharge, as proposed by the Regulations. This ANS risk issue is discussed in more detail in other comments below.

Further, Gazette Part I states, "The proposed Regulations would impose a total present value cost of $632.39 million. Private vessel owners would incur the majority of the costs associated with the proposed Regulations (approximately 96%)." This cost was calculated based only on the impacts on Canadian vessels. Transport Canada representatives have publicly stated that, because the U.S.-flag laker fleet only carries 5–10 percent of the U.S./Canada Great Lakes trade, then only 5–10 percent of the U.S.-flag laker fleet engages in this operation and would be subject to the proposed Regulations. Those representatives also have stated that the proposed Regulations would have a minimal impact on the U.S.-flag laker fleet. LCA refutes these statements, as described below.

In a survey of the operators of the 55 vessel U.S.-flag laker fleet in July and August of 2019, operators reported that on average 43 different U.S.-flag lakers each year, 78 percent of the fleet, will trade between U.S. and Canadian ports, and almost all U.S.-flag lakers have engaged in this trade over the past decade. Because these vessels' customer requirements preclude any one of them being dedicated to only the U.S./Canada laker trade, all of them would need to comply with the proposed Regulations in order to maintain their historical share of this market while also meeting their U.S. domestic trade customers' needs.

Transport Canada should include the cost impacts of its proposed Regulations on the U.S.-flag laker fleet because Canada intends to impose equipment requirements on these vessels of a non-party to the IMO Convention that would not otherwise be required to install such equipment. In a study commissioned by LCA[1], Choice Ballast Solutions, an internationally recognized engineering firm in BWMS installation and retrofits, calculated the costs to the U.S.-flag laker fleet to comply with the Convention by installing and operating a BWMS on each vessel (the Choice Ballast Solutions study recognized that no BWMS currently exists that would allow U.S.-flag lakers to meet the Convention's ballast water discharge

[1] Choice Ballast Solutions. "Technical Engineering Analysis and Economic Feasibility Study for Ballast Water Management System Installation and Operation on board U.S.-flag Great Lakes Fleet." Cleveland, Ohio. April 13, 2017. Hand delivered to Colin Henein and Marc-Yves Bertin on May 9, 2018.

standard). That calculated costs totaled $639 million (USD) [$839 million (CDN)] for acquisition, retrofitting, and installation and $11 million (USD) [$14 million (CDN)], annually for operation and maintenance for the U.S.-flag laker fleet.[2] For the purposes of the proposed Regulations, the full cost includes the cost to acquire, retrofit, and install BWMS s on the U.S.-flag laker fleet [$839 million (CDN)] plus the cost to operate and maintain those BWMS over the analytical period [$293 million (CDN)].

This brings the total cost of compliance to $1.132 billion (CDN) for the acquisition, retrofitting, installation, operation, and maintenance of BWMSs on every U.S.-flag laker captured under the proposed Regulations[3]. Adding this amount to the proposed Regulations' estimated cost to the Canadian fleet of $632 million (CDN) brings the total cost of complying with the proposed Regulations to $1.764 billion (CDN), which exceeds Transport Canada's assumed $1.296 billion (CDN) in benefits by $468 million (CDN). LCA estimates that the proposed Regulations would transfer approximately $30–$45 million (USD) [$38–$57 million (CDN) in 2017 dollars] in revenue annually from the U.S.-flag laker fleet to the Canadian-flag laker fleet if U.S.-flag lakers had to exit the U.S./Canada Great Lakes trade instead of complying with the proposed Regulations.

Clearly, the proposed Regulations have a much stronger impact on the U.S.-flag laker fleet than stated by Transport Canada.

Page 2543, Background –

Gazette Part I states, "In 2014, a peer-reviewed national risk assessment, prepared by Fisheries and Oceans Canada for Transport Canada, found that …. international vessels travelling to the Great Lakes from overseas represented the lowest risk category of vessels, due to full compliance with requirements that they replace ballast water contents with water taken up from the open ocean," and further states, "…. domestic Great Lakes vessels posed a high risk of spreading invasive species to new areas, exacerbating associated negative effects." We strongly disagree with applying this statement to U.S.-flag lakers because it is without merit, regardless of the "peer-reviewed national risk assessment." The 2014 national risk assessment upon which this statement is based, and the science on which that risk assessment is based, only looked at port-to-port movements of ANS by ballast water through discharges in Canadian ports, not the spread of ANS from U.S. ports to neighboring Canadian waters by other

[2] Costs are attributed to Transport Canada's proposed Regulations specifically because the United States exempts all lakers built before 2009, U.S. and Canadian, from having to install equipment to treat ballast water if they operate exclusively within the Great Lakes and St. Lawrence River. The cost to the U.S.-flag laker fleet of complying with Transport Canada's proposed Regulations is wholly attributable to those Regulations.

[3] Figure includes the one-time cost to retrofit the U.S.-flag laker fleet to accept BWMS and acquire and install BWMSs on that fleet, $839 million (CDN), and the $14 million (CDN) annual cost to operate and maintain BWMSs on the U.S.-flag laker fleet accounting for inflation (averaged over the previous 10 years at 2 percent), discounted rate tagged to the 10-year U.S. Treasury note (2.5 percent), and adjusted to an average 22-year expected use period of each BWMS during the 25-year analytical period of the proposed Regulations, $293 million (CDN). Costs are adjusted to 2017 dollars. LCA estimates a 22-year operating period for U.S.-lakers instead of the 20-year operating period assumed in the proposed Regulations for Canadian vessels because the BWMS retrofit and installation work is so extensive for pre-2009 U.S.-flag lakers that it needs to be done during the regularly scheduled drydock period of each vessel, which are staggered over a five-year period, and cannot all be accomplished during the year prior to the proposed Regulations' 2024 implementation deadline.

vectors[4]. Therefore, that risk assessment provides no scientific basis to characterize U.S.-flag laker ballast water loaded in Great Lakes Canadian waters and discharged without treatment into Great Lakes U.S. waters as creating an environmental risk to Great Lakes Canadian waters, especially since the proposed Regulations would require ballast water taken up in Great Lakes U.S. waters to be treated before being discharged in Great Lakes Canadian waters.

A real-world example of the risk of ANS spread and transport by U.S.-flag lakers is the record of ANS spread within the Great Lakes through ballast water since the mandate that salties flush/exchange their ballast water before entering the Great Lakes became fully effective in 2006, shutting the door on ballast water-mediated ANS introductions. Since then, more than 90 billion gallons of ballast water has been moved by U.S.-flag lakers from the four lower Great Lakes into the U.S. waters of Lake Superior ports. In that time, there have been no new ballast water-mediated establishments of ANS in those Lake Superior waters. This statement is supported by the Great Lakes Aquatic Nonindigenous Species Information System (GLANSIS)[5]. This is an extremely large and comprehensive sample size that covers the loading of ballast water from the four lower Great Lakes and freshwater ports of the St. Lawrence River.

Although salties travelling from international ports must comply with a requirement to treat ballast water to the Convention's D-2 discharge standard (not yet fully implemented in Canada or consistently throughout the world) and are required by existing Canadian and United States requirements to flush their ballast tanks and exchange ballast water beyond the 200 nautical mile Exclusive Economic Zones (EEZs) of Canada and the United States in waters deeper than 2,000 meters, these ships still represent a risk of ANS introduction to Great Lakes Canadian waters. The management practice of flushing/exchange buys down that risk. Briski, et al. (2015) stated "BWE (ballast water exchange) used in combination with BWT (ballast water treatment) provides a significant additional reduction of plankton abundance, and this effect increases with greater abundance (after treatment) in 'BWT alone' tanks. As per expectations, 'BWT alone' tanks filled in freshwater ports contained mainly freshwater or euryhaline taxa at discharge, while 'BWE plus BWT' tanks contained mainly marine taxa that primarily originated from the BWE area, and would likely not survive if discharged into freshwater ecosystems."[6] The proposed Regulations, however, would eliminate Canada's flushing/exchange requirement for salties after September 8, 2024, a practice that is effective at >99 percent per Reid (2012)[7] and found by Canadian scientists to be more effective when combined with BWT than BWT alone[8].

[4] Casas-Monroy, O., et al., National Risk Assessment for Introduction of Aquatic Nonindigenous Species to Canada by Ballast Water. Fisheries and Oceans Canada, Canadian Science Advisory Secretariat. 2014.
[5] Available online at: https://www.glerl.noaa.gov/glansis/
[6] Briski, Elizabeta, et al., Combining Ballast Water Exchange and Treatment to Maximize Prevention of Species Introductions to Freshwater Ecosystems. Environmental Science and Technology. July 14, 2015.
[7] Reid, David, The Role of Osmotic Stress (Salinity Shock) in Protecting the Great Lakes from Ballast-Associated Aquatic Invaders. Prepared for the U.S. Saint Lawrence Seaway Development Corporation (SLSDC). November 30, 2012.
[8] Canadian Science Advisory Secretariat. Science Advice on the Effectiveness of Ballast Water Exchange Plus Treatment as a Mechanism to Reduce the Introduction and Establishment of Aquatic Invasive Species in Canadian Ports." May 2019.

Page 2544, Objective –

Effectively eliminating the ability of U.S.-flag lakers to deliver U.S. cargoes to Canada is not "maximizing compatibility with differing and evolving United States ballast water regime." Because the United States does not regulate the loading of ballast water in U.S. waters that will be discharged in another country's waters, Transport Canada's statement cannot be considered accurate as long as the proposed Regulations would regulate ballast water loaded in Great Lakes Canadian waters and discharged on the U.S. side. Transport Canada's proposed Regulations are designed to supersede U.S. requirements by regulating discharges in U.S. waters of ballast water loaded in Canadian waters. Also, the proposed Regulations' requirement to install BWMSs on all lakers would promote "technical uncertainty associated with (Canada's implementation of) the Convention" since Canada will not require these BWMSs to meet either the Convention's or U.S. ballast water discharge standards, thus potentially putting any such vessel out of compliance with U.S. requirements. Transport Canada's use of "deemed compliance" substitutes an equipment standard for the Convention's discharge standard.

Page 2545, Domestic and Great Lakes vessels –

This section includes the statement, "To address the spread of species within Canada, domestic and Great Lakes vessels would be required to comply with the same applicable requirements as vessels in Group 1 above, except those vessels will have until September 8, 2024, to come into compliance with the performance standard. Non-party vessels (e.g., U.S. vessels) that transit through Canadian waters of the Great Lakes Basin without loading or unloading ballast water would be exempt from the proposed Regulations (see "Regulatory Development" below)." LCA requests the last sentence of that paragraph be revised to read "Non-party vessels (e.g., U.S. vessels) that transit through Canadian waters of the Great Lakes Basin without unloading ballast water in Canadian waters would be exempt from the proposed Regulations (see "Regulatory Development" below)."

Transport Canada's proposed regulation of U.S.-flag lakers' loading of ballast water in Canadian waters that will be discharged in U.S. waters would not "address the spread of species within Canada" because any ANS in that ballast water would be discharged in U.S. waters, not Canadian waters. As noted earlier, there is no scientific evidence of ANS discharged in U.S.-flag laker ballast water migrating from U.S. waters to Canadian waters. Because such U.S.-flag laker discharges would occur in U.S. waters, it would be better left to the United States to regulate them. There is no scientific evidence that any ANS already present in Great Lakes Canadian waters would be more likely to spread to other Great Lakes Canadian waters compared to other possible vectors if it is first loaded by a U.S.-flag laker and discharged untreated in Great Lakes U.S. waters. Any ballast water loaded in U.S. ports in which such discharges of untreated, Canadian-sourced ballast water had taken place would still be required to be treated before it could be discharged in Canadian waters. Within the Great Lakes, treatment of ballast water loaded in Canadian waters and discharged in U.S. waters is not required to provide the same level of protection for Canadian waters as the proposed Regulations would require for ballast water discharged in Canadian waters. Also, the Convention sets discharge standards, not loading standards, as protective measures.

Page 2546, Regulatory development, Consultation –

This section describes the efforts undertaken by Transport Canada to engage and consult with the

regulated community, including the October 2012 Transport Canada discussion paper for which LCA provided comments[9]. However, the U.S.-flag laker fleet, as the second largest impacted community of vessels on the Great Lakes, was not invited to participate in the crucial Government-Industry Working Group on Ballast Water (Working Group) that was formed by Transport Canada in 2017. U.S.-flag vessel operators were the only Great Lakes vessel representatives excluded. A Canadian parent company of a U.S.-flag laker operator also was excluded from the Working Group, however, Canadian owners of non-Canadian-flag vessels, foreign owners of salties, and Canadian ports were invited to be part of the Working Group. Although LCA met with Transport Canada officials throughout the timeline between the 2012 discussion paper and the publication of this Gazette Part I, we see no evidence that any data, research, or statements of fact provided by LCA to Transport Canada regarding regulating U.S.-flag laker discharges in U.S. waters of ballast water loaded in Canadian waters were given any consideration in the drafting of the proposed Regulations. This represents a significant oversight on Transport Canada's part and as a result, the full effect of the impact on the "regulated community" is not adequately represented by Transport Canada in the proposed Regulations.

Page 2457, Efficacy of ballast water management systems in Great Lakes conditions –

The proposed Canadian compliance regime for the Great Lakes is out of step with U.S. requirements regarding the discharge of ballast water. The U.S. Coast Guard (USCG) and the U.S. Environmental Protection Agency (U.S. EPA) generally require that vessels discharging ballast water in U.S. waters meet a discharge standard that limits the number of live organisms in a specified volumetric sample of ballast water.[10] Transport Canada proposes to ignore the Convention's discharge standard and institute an equipment standard for the Great Lakes. This will likely place vessels required to meet the Canadian equipment standard out of step and compliance with U.S. requirements. Forcing U.S.-flag lakers delivering U.S. cargoes to Canadian ports to treat ballast water loaded in Canadian waters, which does not involve the discharge of ballast water into Canadian waters, will do nothing to reduce the impacts of ANS in Canadian waters that is not already being accomplished through the use of U.S.-required best management practices (BMPs)[11]. These BMPs have proven effective at both limiting the number of fish present in the water loaded as ballast and killing any such fish that are loaded with the ballast water before it is discharged, thus preventing the spread by U.S.-flag laker ballast water of ANS fish capable of natural migration.

Page 2547, Feasibility of installing approved BWMS on Great Lakes vessels –

LCA is concerned by the equipment requirement proposed by Transport Canada for ballast water management. Anticipated impacts to the U.S.-flag laker fleet from complying with these proposed Regulations include the loss of operational efficiencies and an increase in the overall environmental footprint, including:

- Increasing voyage times by slow steaming to meet minimum hold times for certain BWMS in

[9] James H. I. Weakly, President, Lake Carriers' Association to Dr. Colin Henein, Policy Advisor, Marine Policy, Transport Canada. Letter dated March 28, 2013.
[10] 33 Code of Federal Regulations (CFR) Part 151.1511, Ballast water discharge standard.
[11] 33 CFR Part 151.2050, Additional requirements – nonindigenous species reduction practices.

compliance with USCG type approval certificates;
- Installing additional power generators on board to operate these systems;
- Reducing the cargo carrying capacity of the lakers; and
- Spending more time at the dock loading and unloading cargoes.

These operational impacts would require additional fuel consumption, decrease fuel efficiency, increase air emissions, and require additional trips in an already constrained Great Lakes shipping season to carry the same amount of cargo.

Other impacts that can be expected with many of the existing USCG type approved BWMSs include severe corrosion to U.S.-flag lakers' uncoated ballast tanks and associated equipment[12,13] and ballast water discharges exceeding state drinking water standards for all BWMSs employing chemical disinfection. Table 1, *U.S. Coast Guard Type-Approved Ballast Water Management System Side-by-Side Comparison*, at the end of this document, explains in detail how each currently USCG type approved BWMS is incompatible with U.S.-flag lakers. Table 1 shows that of these 20 USCG type approved BWMSs:

- Five are not approved for use on U.S.-flag vessels;
- Twelve use chemical disinfection and have been shown to exceed state drinking water standards for the discharges;
- Those same 12 would have deleterious corrosion impacts in U.S.-flag lakers;
- Sixteen have minimum hold times that exceed voyage times of typical U.S.-flag laker voyages; and
- Eleven cannot meet the flow rates required for operation of the U.S.-flag lakers with the lowest capacity ballast water pumps in the fleet, and none of the 20 can meet the flow rate requirements of the U.S.-flag lakers with the highest capacity pumps in the fleet.

Another challenge is the physical and chemical properties of Great Lakes waters compared to other waters of the world. The testing parameters for meeting the minimum standards for USCG type approval do not reflect the real-world conditions in the Great Lakes. For example, the USCG requires testing water to include a minimum total suspended solids (TSS) of 24 mg/l. Typical TSS found in U.S. Great Lakes port waters range from 400 mg/l in the Rouge River in Detroit, MI, to 1,000 mg/l in the Cuyahoga River in Cleveland, OH.

Additionally, at IMO's Marine Environment Protection Committee (MEPC)-72 meeting, a representative from Friends of the Earth stated that no BWMS has been tested or shown to be effective in water temperatures below 5°C. Transport Canada participated in MEPC-72 and was present when this statement was made and did not object. This statement was also presented at both the 20th and 23rd Ballast Water Management Conference by LCA and acknowledged by Transport Canada participants in

[12] Song, Yongxin, et al., Corrosion of Marine Carbon Steel by Electrochemically Treated Ballast Water. Dalain Maritime University, School of Marine Engineering. Peoples Republic of China. December 1, 2014.
[13] Lysogorski, Diane K., et al., Investigation of Ballast Water Treatment's Effect on Corrosion. U.S. Department of Homeland Security, U.S. Coast Guard's Research and Development Center. New London, CT. March 2013.

each conference. Water temperatures in the Great Lakes during the shipping season can be as low as 0°C. Lake Erie is below 5°C for five months a year, lakes Michigan and Huron for almost half the year, and on Lake Superior 5°C might not be reached until June and be back below by November. Six of the BWMSs listed in Table 1 are not approved for operation at a water temperature of 0–1° C.

Also, USCG type approval testing for freshwater allows a salinity as high as 0.9 practical salinity units (psu), but Great Lakes water, especially Lake Superior, has a much lower salinity than that. To be effective, twelve of the BWMS listed in Table 1 require a higher salinity than is found in the Great Lakes.

The Convention's section D-2, USCG 33 CFR 151.2030, and U.S. EPA at 2.2.3.5 in the 2013 Vessel General Permit (VGP) set discharge standards for ballast water, but the Great Lakes states also have drinking water standards that they set under the Clean Water Act. The Great Lakes states' limits of total residual chlorine (TRC) in ballast water discharges range from 0.019 mg/l to 0.05 mg/l, with most states at 0.038 mg/l for measured acute levels. BWMSs only monitor TRC to 1.0 mg/l accuracy and manufacturers of BWMSs report that discharges may be as high as 2.0 mg/l, a level 100 times greater than the maximum allowed in New York and Pennsylvania. Mandating U.S.-flag lakers to acquire, install, and operate a BWMS that discharges TRC in excess of the states' discharge limits would mandate noncompliance. This is unacceptable to LCA and U.S. regulatory requirements.

While not every USCG type approved BWMS fails in all of the above factors, no USCG type approved BWMS passes all of them with respect to U.S. lakers. No BWMSs have been tested and passed using Great Lakes water. In fact, vessel operators and BWMS manufacturers have either withdrawn their laboratory testing from the Great Lakes or avoided it completely for shipboard testing.

Finally, even if it was feasible to install a USCG type approved BWMS on a U.S.-flag laker and meet the Convention's D-2 discharge standard, Transport Canada has failed to provide an accurate science-based rationale for requiring U.S.-flag lakers to do so in order to load ballast water in Canadian waters and discharge it in U.S. waters. Feasibility alone is not a sufficient rationale for regulation.

Page 2548, Consultations with the United States –

This section includes the statement "Based on these discussions, the following issues have been explored or approaches adopted to maximize regulatory compatibility." Because neither the United States nor the Convention require regulating the loading of ballast water that will be discharged in another country's waters, this statement cannot be considered accurate as long as the Regulations propose to regulate ballast water loaded in Great Lakes Canadian waters and discharged in Great Lakes U.S. waters.

Page 2548, Transiting Great Lakes vessels –

This section includes the statement "While the unmanaged ballast water of these vessels poses environmental risks to the shared natural resources of Canada and the United States, it would be better left to the United States to regulate these vessels." Transport Canada has not provided a scientific rationale for claiming that U.S.-flag lakers loading ballast water in either U.S. or Canadian waters of the Great Lakes and discharging it in U.S. waters poses environmental risks to Canada's natural resources. None of the scientific studies referenced in the proposed Regulations address the risk to Canada of such

discharges. Simply noting that the United States and Canada both claim portions of the Great Lakes does not mean that everything that happens in the waters of one country automatically impacts the waters of the other. Also, the Regulations provide no rationale for regulating discharges of ballast water into U.S. waters differently based on whether that water was loaded in Canada or the United States. LCA asserts that in both instances the appropriate regulator of those discharges is the United States, not Canada. Transport Canada admits that the United States is the appropriate regulator for ballast water loaded in U.S. waters and water loaded in all other countries that is discharged into U.S. waters, but provides no scientific rationale for asserting that Transport Canada, not the United States, is the appropriate regulator for ballast water loaded in Canada and discharged into U.S. waters.

In this section, Gazette Part I also states, "The Convention requires Canada to apply the requirements of the Convention to vessels of non-parties, to ensure that no more favourable treatment is given to such vessels." Canada's proposed Regulations would actually establish a *de facto* economic advantage for Canadian vessels. Establishing ballast water loading in Canadian waters as triggering the requirement for the installation of a BWMS without it needing to meet the Convention's discharge standard favors Canadian vessels and imposes a severe economic disadvantage on U.S.-flag lakers. The financial burden on the U.S.-flag fleet would be enormous (see LCA's comments under "Page 2554, Rationale" above) and far greater than imposed on Canadian vessels. Vessel designs and routes give Canadian vessels a significant cost advantage under Transport Canada's proposed Regulations. Many Canadian-flag lakers were designed and built with the intention of installing a BWMS, but no pre-2009 U.S.-flag lakers were designed or built with the intention of installing a BWMS. U.S.-flag lakers would be required to install a BWMS that will not work on their vessels or has not been proven to meet the Convention's discharge standards in the challenging waters of the Great Lakes.

This section further states, "The Convention's requirements include the development of approved ballast water management plans for meeting the Convention's performance standard wherever ballast water is discharged, even if the ballast is ultimately discharged into waters of non-parties. The proposed Regulations would therefore require that vessels that load or discharge ballast water in Canada hold and keep on board a document of compliance issued by, or on behalf of, their flag state that certifies that the vessel meets the requirements of the Convention." LCA requests Transport Canada remove the phrase "load or" from the second sentence above. Neither the text of the Convention nor its implementing regulations include a requirement that parties to the Convention regulate the loading of ballast water that will be discharged in another country's waters.

While LCA's proposal to remove the requirement to treat ballast water loaded in Canadian waters from the proposed Regulations might appear to favor pre-2009 U.S.-flag lakers delivering U.S. cargo to Canada (which requires loading ballast water in Canadian waters) despite it applying to vessels of all flags (because U.S. regulations don't require pre-2009 U.S.-flag lakers to install a BWMS), any such advantage in that direction of trade would be offset with regard to the Canada-to-U.S. direction of trade by retaining the requirement in the proposed Regulations that ballast water loaded in Great Lakes U.S. waters and discharged into Great Lakes Canadian waters (needed for lakers to load cargo in Canada) be treated before discharge, which would favor Canadian-flag vessels (because they can install a BWMS at far lower cost than pre-2009 U.S.-flag lakers and would not have to meet the Convention discharge

standard).

The differences between the approaches to laker ballast water of U.S. requirements and the proposed Regulations (as they would be changed by LCA's proposal) appear to favor each country's own vessels regarding ballast water discharges in the Great Lakes waters of each country because of the different ages and trading patterns of those vessels. Therefore, in combination, these relative advantages would balance each other out, and the proposed Regulations (as they would be changed by LCA's proposal) would not provide more favorable treatment overall to either country's vessels with regard to U.S./Canada Great Lakes trade and comply with the Convention.

Because U.S.-flag lakers and Canadian vessels are different ages, are designed differently, and operate differently with regard to waters outside the Great Lakes and St. Lawrence River, it is not possible for Transport Canada to develop ballast water regulations that impact each country's fleet exactly the same way and also are consistent with both U.S. regulations and the Convention. Therefore, ensuring "not more favourable treatment" of either country's fleet requires balancing the advantages and disadvantages of the U.S. and Canadian regulatory systems with regard to each fleet to achieve an equitable outcome with respect to Great Lakes trade between the United States and Canada. That is what LCA's requested changes to the proposed Regulations would do, but Transport Canada's proposed regulations do not.

Page 2550, Regulatory analysis, Benefits and costs –

This section states the present values of both costs and benefits of the proposed Regulations as calculated by Transport Canada. LCA notes that neither the cost calculation, nor the benefit calculation, include U.S.-flag laker ballast water discharges in U.S. waters. If regulation of U.S.-flag laker ballast water loading or discharge in Canadian waters remains in the proposed Regulations, then the cost to the U.S.-flag laker fleet must be included, even though there would be no corresponding additional environmental benefits to Canada. Please reference LCA's comments under "Page 2542, Rationale," above, and LCA's comments below specific to the Cost-Benefit Analysis (CBA) that accompanies the Regulatory Impact Analysis Statement.

Page 2551, Canadian vessels operating in Canada and the United States –

This section states that under Transport Canada's existing ballast water regulations both Canadian and U.S.-flag vessels that operate exclusively in the Great Lakes are not required to manage their ballast water. The USCG, U.S. EPA, and seven of the eight Great Lakes states, however, have requirements in place obligating Canadian and U.S.-flag lakers operating in U.S. Great Lakes waters to manage their ballast water through complying with BMPs, installing and operating a BWMS for lakers built on or after January 1, 2009, reporting ballast water discharges, keeping records of discharges and sediment removal, certifying records, and conducting regular inspections. U.S.-flag lakers built on or after that date already are required to eventually install a BWMS under U.S. regulations.[14]

[14] The U.S. EPA in their 2013 Vessel General Permit (VGP) at Section 2.2.3.5.3.3, Vessels that Operate Exclusively on the Laurentian Great Lakes (Commonly Known as Lakers) Built Before January 1, 2009, exempts lakers built before this date from having to install a BWMS, but those built on or after that date are required to do so. VGP at Section

Page 2552, Table 1, Affected vessels based on the length and where the vessels operate –

If Canada proposes to regulate U.S.-flag lakers' ballast water operations, whether the final Regulations include only discharges of ballast water in Canadian waters or its loading in those waters as well, pre-2009 U.S.-flag lakers should be included in this table because they are not currently required to install BWMS under current U.S. or Canadian regulations. As noted in LCA's comments above regarding page 2542, all pre-2009 U.S.-flag lakers would be captured by the proposed Regulations but are not accounted for in Transport Canada's CBA. For U.S.-flag lakers, the columns "Existing Regulations," "New Regulations," and "Incremental Requirements" would align with "Canadian vessels operating in Canada and the United States (exclusively in the Great Lakes Basin)."

Page 2553, Baseline scenario and regulatory scenario –

This section includes the statement "As per the Convention, all vessels built after 2017 that carry ballast water are required to have a BWMS on board; the cost of acquisition and installation of the BWMS for those vessels is not considered as an incremental cost. The operation cost of those vessels is already included in the analysis." LCA notes that the analysis did not include pre-2009 U.S.-flag lakers, which are not required by the U.S. to install a BWMS, but would be by the proposed Regulations if they load or discharge ballast water in Canadian waters. Therefore, these vessels should be included in this analysis.

Page 2553, Costs –

Gazette Part I states, "The costs associated with the proposed regulations would be carried by two groups: private vessel owners and government. The estimated total present value cost of the proposed regulations over the 25-year analytical time frame is $632.39 million." In the study commissioned by LCA[15], Choice Ballast Solutions calculated the costs associated with the U.S.-flag laker fleet complying with the Convention by acquiring, retrofitting, installing, operating, and maintaining a BWMS on each vessel. These costs totaled $839 million (CDN) for acquisition, retrofitting, and installation and $14 million (CDN) annually for operation and maintenance.[16] Costs to the U.S.-flag Great Lakes fleet should be included since Canada is intending to impose new equipment requirements on pre-2009 U.S.-flag lakers. As described in LCA's comments above regarding page 2542, Transport Canada's estimated total present value calculation should then be recalculated to include the $839 million (CDN) cost of acquiring, retrofitting, and installing a BWMS on each U.S.-flag laker captured under the proposed Regulations. The operation and maintenance of these BWMSs aboard the U.S.-flag laker fleet over an average of 22 years of the 25-year analytical time frame would be $293 million (CDN) and should be

1.9.1, Modification of the VGP, states that when the USCG has granted or denied an extension request pursuant to 33 CFR 151.2036 regarding an implementation date in VGP Part 2.2.3.5, that information will be considered by U.S. EPA, but is not binding on U.S. EPA. No BWMS has yet been identified as capable of working on any U.S.-flag laker that meet these requirements or regulatory mandates for the eight Great Lakes states, such as compliance with drinking water discharge limits of total residual chlorine.

[15] Choice Ballast Solutions (2017). Hand delivered to Colin Henein and Marc-Yves Bertin on May 9, 2018.

[16] Costs are associated with Canada's implementation of the Convention specifically because the USCG exempts all pre-2009 lakers, U.S. and Canadian, from having to install equipment to treat ballast water and current Transport Canada regulations do the same. The cost of U.S.-flag laker compliance with Transport Canada's proposed Regulations is wholly attributable those Regulations.

included as well[17]. LCA estimates that the actual total cost of the proposed Regulations [including the $1.132 billion (CDN) in U.S.-flag laker costs] is $1.764 billion (CDN), not $632 million (CDN), which exceeds the total present value benefits of $1.296 billion (CDN) and results in a net cost of implementation of $468 million (CDN).

Page 2554 Table 2, Average acquisition, installation, and operation costs for vessels longer than 50 m (in millions of 2017 dollars) –

LCA notes that the average acquisition and installation costs for Canadian self-unloading vessels in Table 2 is far too low to accurately reflect those costs with respect to U.S. self-unloading lakers that were not specifically built to include a BWMS. Table 2 does not include an equivalent vessel type for the U.S.-flag fleet's 1,000-foot self-unloading lakers. Choice Ballast Solutions' study[18] calculated that it would cost $41.9 million (CDN) to acquire, retrofit, and install a BWMS and $440,000 (CDN) annually for the operation and maintenance of a BWMS on a single 1,000-foot U.S.-flag laker with a manifold ballast water system. To acquire, retrofit, install, operate, and maintain a BWMS on a single 1,000-foot U.S.-flag laker with an independent ballast water system would cost $48 million (CDN) and $380,000 (CDN), respectively.

Page 2555, Average cost per barge –

Gazette Part I states, "Due to the lack of information on the ballast water piping and electrical systems of barges, the costs associated with compliance are not available. It is likely that barges will adopt a case-by-case approach to compliance that cannot be estimated by Transport Canada. However, the cost would not likely exceed that of installing the Hyde Guardian on the M/V Ranger. This cost has therefore been used for barges in (the Cost-Benefit Analysis) CBA as a conservative estimate of the maximum cost that barge owners could face. It is likely that other less expensive means of compliance would be used for barges." LCA finds it concerning that Transport Canada appears to not be familiar with the ballast water system design for commercial barges and yet it intends to regulate them. This lack of understanding greatly underestimates the costs of compliance with the proposed Regulations by the Canadian and U.S.-flag laker barge fleets.

The M/V Ranger is not a representative equivalent to the performance or cost of acquiring, installing, operating, and maintaining a BWMS on a typical laker barge. Laker barges can be 24,199 gross registered tonnage (GRT), 1,000 feet long, have a cargo capacity of 64,000 net tons, a ballast water capacity of 15 million gallons, and pumping rate of 51,000 gallons per minute (gpm). The M/V Ranger is

[17]Figure includes the one-time cost to acquire and install BWMSs on a retrofitted U.S.-flag laker fleet, $839 million (CDN), and the $14 million (CDN) annual cost to operate and maintain systems on the U.S.-flag laker fleet [accounting for inflation (averaged over the previous 10 years at 2 percent), discounted rate tagged to the 10-year U.S. Treasury note (2.5 percent), and adjusted to an average 22-year expected use period of each BWMS], $293 million (CDN). Costs are adjusted to 2017 dollars. LCA estimates a 22-year operating period for U.S.-lakers instead of the 20-year operating period assumed in the proposed Regulations for Canadian vessels because the BWMS retrofit and installation work is so extensive for pre-2009 U.S.-flag lakers that it needs to be done during the regularly scheduled drydock period of each vessel, which are staggered over a five-year period, and cannot all be accomplished during the year prior to the proposed Regulations' implementation deadline.

[18] Choice Ballast Solutions (2017). Hand delivered to Colin Henein and Marc-Yves Bertin on May 9, 2018.

a passenger vessel of 650 GRT, 165 feet long, and has minimal ballast water capacity at very low pumping rates. In fact, the smallest barge in the U.S.-flag laker fleet for carrying bulk materials is 310 feet long and 2,346 GRT. The Hyde Guardian system tested on the M/V Ranger is for emergency purposes, not for use on most voyages, has a very low pumping rate, and uses chemical disinfection that is operationally incompatible with all U.S.-flag lakers and exceeds U.S. state drinking water standards when it discharges its treated ballast water. Saying that the costs associated with using the Hyde Guardian system on a smaller passenger vessel is a "conservative estimate" is completely wrong for the typical bulk cargo carrying laker barge. The more appropriate classification of laker barges based on their ballasting systems is with a self-propelled, self-unloading bulk carrier.

Page 2556, Table 3, Present value of acquisition, installation and operation costs to privately owned Canadian vessels (in millions of 2017 dollars) –

Transport Canada continues to not count the U.S.-flag fleet in its analysis of the impacts of the proposed Regulations. As described above, the total calculated costs to acquire, retrofit, install, operate, and maintain a BWMS on all pre-2009 U.S.-flag lakers is $1.132 billion (CDN) over the analytical period of the proposed Regulations[19]. Please note, the cost to acquire, retrofit, and install a BWMS on just the 13 1,000-foot U.S.-flag lakers would be $599 million (CDN). All 13 1,000-foot lakers have the potential to trade in Canada. None of them are required by U.S. EPA or USCG to install a BWMS, but they all manage their ballast water in accordance with U.S. laws and regulations. The cost to the U.S.-flag laker fleet needs to be included in the costs associated with implementing the proposed Regulations.

Page 2558, Average cost per barge –

The assumption that vessel operators, in particular operators of lakers, will "always choose the lowest cost option" for a BWMS is incorrect. Other factors will be included with a vessel operator's choice of a BWMS are treatment type, compatibility with a vessel's design and operation, proven effectiveness in Great Lakes waters, meeting state and federal regulatory requirements, and other factors that can certainly drive costs toward the highest end rather than to the lowest.

Page 2560, Expected avoided invasive species –

Using the Congressional Office of Technology Assessment "Report on Harmful Nonindigenous Species"[20] (the OTA Report) is inappropriate for calculating aquatic non-native or invasive[21] establishment by

[19] Costs are associated with Canada's implementation of the Convention specifically because the United States exempts all lakers built before 2009, U.S. and Canadian, from having to install equipment to treat ballast water if they operate exclusively within the Great Lakes and St. Lawrence River. The cost of U.S.-flag laker compliance with Transport Canada's proposed Regulations is wholly attributable those Regulations.

[20] Windle, Phyllis. "Congressional Office of Technology Assessment Report on Harmful Nonindigenous Species." Windle Research Services. College Park, MD. October 1993.

[21] Please note that not all non-native species become invasive or establish viable populations anywhere that they are introduced. The National Park Service defines a invasive species as a non-native organism whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health (in accordance with Executive Order 13751, which aligns with research and regulatory definitions through the world). Gazette Part I defaults to the use of the term "invasive" for all non-native species.

ballast water. The OTA Report considers all non-native species, aquatic and terrestrial, and not just via ballast water but by all defined 64 vectors for the introduction of a non-native species. Gazette Part I cites both the DFO 2019 assessment and the OTA's factor of 15 percent of all non-natives introduced into a new environment will result in 9.11 species "expected to cause severe economic or environmental damage." Pimentel (2004) estimates 8 percent[22]. Using Pimentel's more recent and better-reasoned figure, the avoidance of the introduction of a species becoming invasive would drop to 4.88 rather than the 9.11 cited in Gazette Part 1.

The Great Lakes, however, have seen impressive results from the more than a decade experience with the BMP requiring all salties to flush their ballast tanks and exchange their ballast water beyond the 200 nautical mile EEZs of Canada and the U.S. in waters of at least 2,000 meters before entering the St. Lawrence River. This process must result in all ballast water being carried on board to have a minimum salinity of 30 parts per thousand (ppt)[23]. Reid (2012) states that "salinity shock (also known as osmotic shock) can cause high mortality (>99%) of freshwater and brackish water organisms."[24] To bolster Reid's figures, since 2006 when mandatory flushing/exchange were required before entry into the Laurentian Great Lakes, there have been no new ANS introduced via ballast water. This is according to U.S. federal research, regulatory, and management agencies, including: U.S. EPA, USCG, U.S. Geological Survey (USGS), U.S. Fish and Wildlife Service (USFWS), and the National Oceanic and Atmospheric Administration (NOAA), as documented in the GLANSIS[25].

On average, 420 to 500 salties enter the Laurentian Great Lakes each year. Using these numbers, the sample size for the reduction of all ANS, invasive or otherwise, over the 12+ years that the mandatory flushing/exchange requirement for salties has been in place equates to an estimated 5,520 vessels and 96,000 ballast tanks with the potential to carry 27.6 billion gallons of ballast water over that period without a single occurrence of a new ANS arriving and establishing in the Great Lakes via ballast water.

The DFO 2019 assessment did not include voyages solely within the Great Lakes and St. Lawrence River[26]. Also, that document compared the effectiveness of ballast water exchange plus treatment with ballast water treatment alone. It did not compare the effectiveness of the current regulatory system regarding pre-2009 U.S.-flag lakers (no exchange or treatment) with the requirement in the proposed Regulations for those vessels (treatment only). Therefore, none of the benefits from reductions in invasive species calculated for the proposed Regulations are based on any new requirements that they would impose on pre-2009 U.S.-flag lakers. LCA notes that the overall reductions in invasive species due to the proposed Regulations should be only minutely influenced by the requirements the Regulations would impose on vessel discharges in the Great Lakes because the rate of invasions in Great Lakes waters has already been greatly reduced. Page 3 of the DFO 2019 assessment states, "The current management strategy of ballast water exchange has greatly reduced invasion rates in the Great Lakes

[22] Pimentel, David, et al. "Environmental and economic costs associated with alien invasive species in the United States." Ecological Economics, Volume 52, Issue 3, pages 273–288. Published February 15, 2005.
[23] 33 CFR 151.1510(a)(1), Ballast water management requirements.
[24] Reid (2012).
[25] GLANSIS (https://www.glerl.noaa.gov/glansis/), accessed on Wednesday, July 31, 2019.
[26] See Table 3 on page 6 of that document.

(Bailey et al. [2011], Bailey et al. [2012])".[27]

Page 2563, Qualitative benefits –

The statement, "Many fish species, such as the blue pike and the Lake Ontario Atlantic salmon, have declined significantly in population, or even disappeared from the Great Lakes due to non-indigenous species," and the assumption of extirpation or extinction of these two species because of ANS introduction is false. The Blue pike decline and extinction was due to "extensive commercial fishing, combined with pollution and hybridization with walleye (which) decimated the Great Lake's blue pike populations," so much so that by the early 1960's they were not found in Canadian or U.S. waters of the Great Lakes[28].

As for the Lake Ontario variant of the Atlantic salmon, Nature Conservancy Canada reports that the fish "officially vanished" from Canadian and U.S. waters of the Great Lakes by 1898 due to the "loss of spawning habitat, overfishing, and pollution[29]."

Gazette Part I also states, "Another aquatic invasive species believed to have been introduced and spread via ballast water discharge is the Ruffe, a freshwater fish commonly found in Europe and Asia. Its introduction has disrupted Lake Superior's ecosystem as they are able to reproduce quickly and compete with other species (like the Yellow perch) for food supply." In addressing the impacts of Ruffe on the St. Louis River and Duluth-Superior Harbor, Minnesota Sea Grant states, "It would be easy to blame all of these changes on the Ruffe, but some could be the result of natural fluctuations, fishing pressure, or fisheries management practices[30]." These statements on the Blue pike, Lake Ontario Atlantic salmon, and Ruffe are simplistic and misleading in some cases and false in others. Including these examples as evidence of harm in the Regulatory Impact Analysis Statement is wrong and negatively skews honest dialogue on the topic of the impacts of ANS introduced by ballast water. These statements should be removed and applicable sections of Gazette Part I and the CBA should be amended to eliminate these misleading claims, and these claims should not be repeated in future discussions on this topic without supporting scientific evidence.

Page 2564, Qualitative benefits –

Gazette Part I states, "Ballast water can also carry invasive species that were not introduced through ballast water, like the Sea lamprey and the Alewife, facilitating their spread to different water bodies."

[27] Canadian Science Advisory Secretariat. (May 2019).
[28] Ruminski, Jarret. Nature Conservancy Canada. "The legend of the blue pike: An endangered species tale." Accessed online on July 10, 2019, at: http://www.natureconservancy.ca/en/blog/archive/the-legend-of-the-blue-pike.html.
[29] Ruminski, Jarret. Nature Conservancy Canada. "Atlantic Salmon: Lake Ontario's ghost fish." Accessed online on July 10, 2019, at: http://www.natureconservancy.ca/en/blog/archive/atlantic-salmon-lake.html.
[30] Minnesota Sea Grant. "Ruffe, a new threat to our fisheries." Accessed online on July 18, 2019, at: http://www.seagrant.umn.edu/ais/ruffe_threat.

This statement is in no way supported by any scientific research. GLANSIS reports that Sea lamprey[31] were first collected in the Great Lakes in 1835 in Lake Ontario, their introduction into the other Great Lakes is attributable to the access they were afforded through the construction and opening of canals such as the Welland Canal that saw them in all the Great Lakes by 1946. The Alewife[32] had a similar introduction as first documented in 1868 and were found in all the Great Lakes by 1954. Both species spread without the assistance of ballast water. The BMP of U.S.-flag lakers pumping on intake and discharge of ballast water and resulting mastication precludes survival of larger ANS species such as Sea lamprey, Alewife, and Ruffe as seen since that BMP was mandated by U.S. EPA's VGP in 2008. It is also safe to say that this BMP, which was voluntarily introduced by U.S.-flag lakers years before it was required, has shut down any further potential spread of live ANS fish by U.S.-flag laker ballast water.

By saying that these invasive species could be spread via U.S.-flag laker ballast water, Gazette Part I is mistakenly or purposely misleading the narrative on the impacts of U.S.-flag laker fleet ballast water loading and discharge. This paragraph should be removed from the proposed Regulations and this claim should not be repeated in future discussions on this topic without supporting scientific evidence.

Page 2570, Regulatory cooperation and alignment –

The proposed Regulations in no way "align to the extent feasible with the differing U.S. regimes for ballast water." LCA notes that it clearly would be feasible for the proposed Regulations to exclude the loading of ballast water in Canadian waters by U.S.-flag lakers and its subsequent discharge in U.S. waters in order to better align with U.S. requirements. The proposed Regulations include no explanation why this would not be feasible or how regulating this activity benefits Canada's waters.

The U.S. EPA and USCG exempt pre-2009 lakers from installing a BWMS based upon the operational constraints a BWMS would impose on these vessels, the assumed lack of a resulting net benefit in reducing the spread and subsequent impacts of ANS in the Great Lakes, and the absence of any suitable BWMS for these vessels. The United States does not have an equipment standard as Canada is proposing. The United States does not regulate ballast water based upon its loading, rather only its discharge.

Also, Canada is proposing to eliminate the requirement for flushing/exchange of ballast water from salties arriving into the Laurentian Great Lakes system from international ports despite the DFO 2019 assessment's calculation that exchange plus treatment of this ballast water would be significantly more effective than treatment alone.[33] The United States has legislatively mandated retaining this practice in the 2018 Vessel Incidental Discharge Act (VIDA) because it has thus far proven to be completely successful since it was mandated by regulation in 2006. The combination of flushing/exchange plus

[31] Species profile for Sea lamprey (*Petromyzon marinus*). Accessed online on August 1, 2019, at: https://nas.er.usgs.gov/queries/greatlakes/FactSheet.aspx?SpeciesID=836&Potential=N&Type=1&HUCNumber=All%20Great%20Lakes.
[32] Species profile for Alewife (*Alosa pseudoharengus*). Accessed online on August 1, 2019, at: https://nas.er.usgs.gov/queries/greatlakes/FactSheet.aspx?SpeciesID=490&Potential=N&Type=1&HUCNumber=DHuron.
[33] Canadian Science Advisory Secretariat. (May 2019).

treatment was first proposed by officials from Transport Canada and DFO. These officials strongly advocated for flushing/exchange plus treatment at Great Lakes Panel on Aquatic Nuisance Species discussions and at Great Lakes Ballast Water Collaborative meetings. During the drafting of the current U.S. ballast water regulations, the proposal that salties conduct flushing/exchange plus treatment was not objected to by the Canadian government, Canadian-flag fleet, or saltie operators.

Page 2570, Strategic environmental assessment –

In reviewing the applicability of the "Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals," (the Directive) Transport Canada determined a "preliminary scan" was sufficient and that no further action, including developing a Strategic Environmental Assessment, was needed to comply with the Directive. LCA believes that Transport Canada erred in coming to this conclusion. Per the Directive, the applicability and requirement for a Strategic Environmental Assessment is warranted if the two following conditions are met:

1. The proposal is submitted to an individual minister or the Cabinet for approval; and
2. Implementation of the proposal may result in important environmental effects, either positive or negative.

LCA believes both of these conditions are met. First, comments from Gazette Part I are submitted to the minister responsible for the administration of the relevant statute; while the minister is duty bound to consider all comments, she/he is not required to explain or justify her/his ultimate decision regarding changes, if any, made to the proposed regulations. Once the minister is satisfied with the proposed Regulations, they are made official through an "executive order." In the case of these ballast water regulations, the approval authority for the executive order is the Governor in Council. Accordingly, the minister must seek the approval of the responsible Cabinet committee, the "Special Committee of Council."

Second, the term environmental effect[34] means:

1. Any change that the policy, plan or program may cause in the environment, including any effect of any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by Aboriginal persons, or on any structure, site or thing that is of historical, archaeological, paleontological or architectural significance; and
2. Any change to the policy, plan or program that may be caused by the environment, whether any such change occurs within or outside Canada.

Gazette Part I describes in both the Regulatory Impact Analysis Statement and the CBA how the reduction in impacts to the environment are directly related to the reduction in introduction of ANS and how that applies to residential water intakes, power generation facilities, commercial fishing, aquaculture facilities, and recreational activities such as boating, fishing, and golf. This certainly applies to changes in health and socio-economic conditions, Aboriginal lands and resources, and sites of

[34] https://www.ceaa-acee.gc.ca/default.asp?lang=En&n=D213D286-1&offset=2&toc=hide

historical, archaeological, paleontological, or architectural significance. These regulatory changes have definitive binational impacts. A Strategic Environmental Assessment should have been, and should now be, completed. A preliminary scan alone is insufficient.

Ballast Water Regulations

Page 2575, Non-application –

LCA requests that proposed Regulation (3)(a) be amended by striking "load or" so that it would read as follows:

> "(a) vessels operating under the authority of a state that is not a party to the Convention if they operate exclusively in the Great Lakes Basin and if they do not release ballast water into waters under Canadian jurisdiction;"

Page 2579, Alternative Methods of Ballast Water Management, Approved methods –

The proposed Regulation 13 references the Convention Regulation B 3.7 relating to other methods of ballast water management. This Convention regulation states, "Other methods of ballast water management may also be accepted as alternatives to be requirement …. Provided that such methods ensure at least the same level of protection to the environment, human health, property or resources …." Not discharging untreated ballast water in Canadian waters would have to be considered the most effective BMP in controlling the introduction of ANS into Great Lakes Canadian waters. Therefore, vessels only loading ballast water in Great Lakes Canadian waters and not discharging it in Canadian waters meet the requirements of that Convention regulation. Therefore, if the regulation of ballast water loaded in Great Lakes Canadian waters and discharged in Great Lakes U.S. waters is eliminated from the proposed Regulations, the Regulations would be consistent with the Convention.

Ballast water discharged into Canadian waters would have to be treated. LCA does not oppose this requirement.

Page 2582, Vessels of Non-Parties to the Convention, Equivalent document –

LCA requests that proposed Regulation 23 be amended by striking "load or" so that it would read as follows:

> "A vessel that is entitled to fly the flag of a state that is not a party to the Convention must not release ballast water in waters under Canadian jurisdiction unless that vessel holds and keeps on board a document issued by or on behalf of the government of that state that certifies that the vessel meets the requirements of the Convention."

Ballast Water Regulations – Cost-Benefit Analysis (April 2019)

Page 1, Section 1, Executive Summary –

The CBA states, "The proposed Regulations would impose a total present value cost of $632.39 million. Private vessel owners would incur the majority of the costs associated with the proposed Regulations (approximately 96%)." As described in LCA's comments above regarding page 2542, Transport Canada's estimated total present value calculation should be recalculated to include the costs of acquiring, retrofitting, installing, operating, and maintaining BWMSs on the U.S.-flag laker fleet that would be captured by the proposed Regulations [$1.132 billion (CDN)]. LCA estimates that the total present value cost, including U.S.-flag laker compliance costs, exceeds the benefits of implementing the proposed Regulations by $468 million (CDN).

Page 3, Section 4.2.2, Canadian Vessels Operating in Canada and the United States –

The CBA states, "Canadian vessels that operate in both Canada and the United States exclusively in the Great Lakes and St. Lawrence are exempted from managing their ballast water." This statement describes only current Canadian regulations and fails to include the impact of U.S. regulations. While not all Canadian and U.S. lakers are required to install a BWMS, under 33 CFR Part 151, the 2013 VGP at Section 2.2.3.5.3.3, and seven of the eight Great Lakes states require Canadian and U.S.-flag lakers operating in Great Lakes U.S. waters to manage their ballast water through complying with BMPs, installing and operating a BWMS for lakers built after 2008, reporting ballast water discharges, keeping records of discharges and sediment removal, certifying records, and conducting regular inspections.[35]

Page 6, Section 6.1.1.1, Average cost per vessel longer than 50 meters (excluding barges) –

Transport Canada has designated six separate categories of vessel design to assess the costs of BWMS acquisition, installation, operation, and maintenance. Of these six, three may apply to the U.S.-flag fleet: self-unloader with accommodations aft; self-unloader with accommodations forward and aft; and straight-decker. It is not clear to LCA why or how these categories were chosen as they have little to no relevance to ballast water operation on vessels, particularly the "accommodation" designation which has no implications on ballast system configuration and operation. What is important and what separates the needs of vessel typing are:

- Duration and location of voyage
- Pump configuration
- Number of ballast tanks

[35] The U.S. EPA in their 2013 Vessel General Permit (VGP) at Section 2.2.3.5.3.3, Vessels that Operate Exclusively on the Laurentian Great Lakes (Commonly Known as Lakers) Built Before January 1, 2009, exempts lakers built before this date from having to install a BWMS, but those built on or after that date are required to do so. VGP at Section 1.9.1, Modification of the VGP, states that when the USCG has granted or denied an extension request pursuant to 33 CFR 151.2036 regarding an implementation date in VGP Part 2.2.3.5, that information will be considered by U.S. EPA, but is not binding on U.S. EPA. No BWMS has yet been identified as capable of working on any U.S.-flag laker that meet these requirements or regulatory mandates for the eight Great Lakes states, such as compliance with drinking water discharge limits of total residual chlorine.

- Total ballast water volume
- Ballast water pumping rate
- Available on board power
- Available space on board to install a BWMS
- Loss of cargo carrying capacity
- Location installation limitations in-line with USCG type approval requirements

With these considerations, the U.S. and Canadian Great Lakes fleets are more appropriately broken down into the following categories[36]:

- 1,000-foot large-capacity with a manifold ballast system
- 1,000-foot large capacity independent ballast system
- 690-foot to 806-foot converted bulkers to self-unloaders with a manifold ballast system
- 500-foot to 800-foot newer build self-unloading ships and barges
- Purpose-built barges and tank barges with a manifold ballast system
- Tugs and miscellaneous vessels not otherwise classified[37]

Therefore, assigning costs to vessel types described in the CBA is immaterial to the requirements for acquiring, retrofitting, installing, operating, and maintaining a BWMS on board a laker, U.S. or Canadian, and Table 2, *Acquisition and Installation of Ballast Water Management System (2017$)* in the CBA should be re-categorized and recalculated.

Page 12, Table 6, Present Value of Acquisition, Installation, and Operation Costs to Privately Owned Canadian Vessels (2017$ in millions) –

As with Table 2, this table should be re-categorized and recalculated based upon the vessel types described above. The costs to the pre-2009 U.S.-flag laker fleet should be included.

Page 14, Section 7, Benefits –

Aggregating all of Canada into a single monetized benefit of $1.296 billion (CDN) over 25 years is an oversimplification of very distinct regions and potential impacts of alternative management practices throughout Canada. As the CBA supports in referencing Drake (2015) on page 17, "The results showed that arrival, survival, and establishment would vary across regions and across species.[38]" In particular, the Laurentian Great Lakes system has seen impressive results from the BMP requiring all salties to flush their ballast tanks and exchange their ballast water beyond the 200 nautical mile EEZs of Canada and the United States in waters of at least 2,000 meters before entering the St. Lawrence River. The regulations governing this process require all ballast water being carried on board to have a minimum salinity of 30 ppt[39]. Reid (2012) states that "salinity shock (also known as osmotic shock) can cause high mortality

[36] Choice Ballast Solutions (April 2017). Hand delivered to Colin Henein and Marc-Yves Bertin on May 9, 2018.
[37] "Tugs and miscellaneous vessels" would fall into the separate Canadian designation of vessels under 50 meters in length.
[38] Drake, A. "Final Report: Benefits Analysis for Ballast Water Discharge Standards." Prepared for Transport Canada, Environmental Policy Directorate. 2015.
[39] 33 CFR 151.1510(a)(1), Ballast water management requirements.

(>99%) of freshwater and brackish water organisms."[40] To implement the flushing/exchange regime compliance, the regulatory partners[41] on the St. Lawrence Seaway have performed inspections of all vessels entering the Laurentian Great Lakes system. In their "2018 Summary of Great Lakes Seaway Ballast Water Working Group (BWWG), January 2019," the BWWG reports, "In 2018, 100% of vessels bound for the Great Lakes Seaway from outside the (EEZ) received ballast management exams on each Seaway transit. In total, all 9,343 ballast tanks were assessed during the 498 vessel transits." This inspection requirement has been in place since 2006. Since then there have been no new discoveries or establishment of ANS entering the Great Lakes through ballast water. This is according to the U.S. federal research, regulatory, and management agencies U.S. EPA, USCG, SLSDC, USGS, USFWS, and NOAA as documented in GLANSIS[42]. On average 420 to 500 salties enter the Laurentian Great Lakes system each year. Using these numbers over the 12+ years that inspections have been taking place equates to 5,520 vessels and about 96,000 ballast tanks without a single occurrence of a new ANS arriving via ballast water. This 12+-year sample size would suggest that any further monetized benefits of additional ballast water treatment for laker operation in the Great Lakes would drop to zero. This data shows osmotic shock is a highly effective and cost efficient treatment to eliminate the threat of a new ANS introduction[43].

Page 23, Section 7.2, Qualitative Benefits –

The statement, "Many fish species, such as the Blue pike and the Lake Ontario Atlantic salmon, have declined significantly in population, or even disappeared from the Great Lakes due to non-indigenous species," and the assumption of extirpation or extinction of these two species because of introduced ANS is false. The Blue pike decline and extinction was due to "extensive commercial fishing, combined with pollution and hybridization with Walleye decimated the Great Lakes' Blue pike populations," so much so that by the early 1960's they were not found in Canadian or U.S. waters of the Great Lakes[44].

As for the Lake Ontario variant of the Atlantic salmon, Nature Conservancy Canada reports that the fish "officially vanished" from Canadian and U.S. waters of the Great Lakes by 1898 due to the "loss of spawning habitat, overfishing, and pollution, not due to non-indigenous species[45]."

The CBA in the same section also states, "Another aquatic invasive species believed to have been introduced and spread via ballast water discharge is the Ruffe, a freshwater fish commonly found in Europe and Asia. Its introduction has disrupted Lake Superior's ecosystem as they are able to reproduce

[40] Reid (2012).
[41] Partners include USCG, SLSDC, St. Lawrence Seaway Management Corporation, and Transport Canada-Marine Safety and Security. These agencies comprise the membership of the BWWG.
[42] GLANSIS (https://www.glerl.noaa.gov/glansis/), accessed on Wednesday, July 31, 2019.
[43] Please note that Transport Canada proposes eliminating the flushing and exchange requirement once their Regulations come into full effect in September 0f 2024. The United States will retain this requirement for the Great Lakes as mandated in the Vessel Incidental Discharge Act.
[44] Ruminski, Jarret. Nature Conservancy Canada. "The legend of the blue pike: An endangered species tale." Accessed July 10, 2019, on line at: http://www.natureconservancy.ca/en/blog/archive/the-legend-of-the-blue-pike.html.
[45] Ruminski, Jarret. Nature Conservancy Canada. "Atlantic Salmon: Lake Ontario's ghost fish." Accessed online on July 10, 2019, at: http://www.natureconservancy.ca/en/blog/archive/atlantic-salmon-lake.html.

quickly and compete with other species (like the Yellow perch) for food supply." In addressing the impacts of Ruffe on the St. Louis River and Duluth-Superior Harbor, Minnesota Sea Grant states, "It would be easy to blame all of these changes on the Ruffe, but some could be the result of natural fluctuations, fishing pressure, or fisheries management practices[46]." The CBA's statements on the Blue pike, Lake Ontario Atlantic salmon, and Ruffe are simplistic and misleading and in some instances false. Including these examples as evidence of harm in the CBA is wrong and skews honest dialogue on the topic of the impacts of ANS introduced by ballast water. The applicable sections of the CBA and Gazette Part I should be amended to eliminate those misleading claims and they should not be repeated without scientific evidence in future discussions on this topic.

Page 24, Section 9, Distributional Analysis, Table 13, Distributional Analysis-Costs of Privately Owned Vessels by Different Regions –

Table 13 breaks Canada into six regions to delineate costs associated with compliance of the proposed Regulations. Of the six, Ontario is of primary importance to the U.S.-flag laker fleet and Quebec is secondary. The U.S.-flag laker fleet augments the Canadian-flag laker fleet throughout the shipping season delivering cargoes between U.S. and Canadian ports. As noted in LCA's comments above regarding page 2542 of the proposed Regulations, all pre-2009 U.S.-flag lakers would be captured by the proposed Regulations. The $1.132 billion (CDN) present value cost associated with acquiring, retrofitting, installing, operating, and maintaining BWMSs on the U.S.-flag laker fleet described earlier in this document is not accounted for in this table. Considering that U.S.-flag lakers have not been scientifically determined to be responsible for the introduction or spread of ANS, this burden is considerable and highly disproportionate with perceived benefits.

Pages 25-26, Section 10, Sensitivity Analysis Results –

The sensitivity analysis should be revised to reflect the higher costs of including the U.S.-flag laker fleet captured by the proposed Regulations and lower benefits due to the already realized Great Lakes environmental gains resulting from saltie ballast water exchange requirements.

Page 26, Section 11, Conclusions –

The CBA states, "…. it is essential that regulatory measures target the prevention of future introduction and spread of non-indigenous species." To us it is unfathomable, therefore, that Transport Canada proposes to eliminate the proven effective practice of requiring salties to flush/exchange their ballast water before entering the Laurentian Great Lakes system. By Transport Canada's own analysis, only relying on a BWMS to meet the Convention's D-2 discharge standards, the reduction in the incidence of introduction of new ANS would only be reduced by about 60 percent. Retaining the current requirement that salties use both exchange plus treatment of ballast water would be significantly more effective than treatment alone.[47] Osmotic shock has been shown it can be greater than 99 percent

[46] Minnesota Sea Grant. "Ruffe, a new threat to our fisheries." Accessed online on July 10, 2019, at: http://www.seagrant.umn.edu/ais/ruffe_threat.
[47] Canadian Science Advisory Secretariat. (May 2019).

effective for eliminating freshwater organisms[48]. Since the United States is legislatively mandated to maintain this practice in VIDA, this lessening of the ballast water regulations on the Canadian side of the Great Lakes clearly does not align to the extent feasible with the differing U.S. regime for ballast water.

Page 30, Section 13.1.4, Commercial Shipping –

The discussion on Zebra mussels attaching to the hulls of lakers and increasing the drag and therefore fuel need and resulting cost is not considered a significant issue with the U.S.-flag laker fleet. Nor is their buildup in water intake systems, ballast water or otherwise, generally concerning. Any build up that may occur is dealt with at the scheduled dry docking every five to six years. The additional costs are negligible as a general average of the fleet. Assigning a 0.04 percent of the U.S.-flag laker fleet's value is not appropriate.

[48] Reid (2012).

Table 1, U.S. Coast Guard Type-Approved Ballast Water Management System Side-by-Side Comparison

BWMS	USCG Approval No.	Filtration?	Disinfection Process	Ambient Feed or In-tank Restrictions?		Total Residual Oxidant	Corrosive?[1]	Hold Time?	Maximum Flow Rate (m^3/hour)	Approved for Installation in Hazardous Locations? (46 CFR 111.105)	Approved for Installation on U.S.-flag Vessels? (46 CFR Sub. F & J)	Compatible with U.S.-flag Lakers?[2]
				Temperature	Salinity							
Optamarin	162.060/1/1	Yes	Ultraviolet (UV)	No	N/A	N/A	No	Yes (72 hours)	3,000	No	Yes	No HT,MFR
PureBallast 3.0 & 3.1	162.060/2/3	Yes	UV	No	N/A	N/A	No	Yes (72 hours)	3,000	Yes (conditional)[3]	Yes	No HT,MFR
OceanSaver[4]	162.060/3/3	Yes	Electrodialysis	Yes (>17°C)	Yes (>20 psu)	1.7 mg/L	Yes	No	7,200	No	Yes	No C,WQ,ST
Sunrui	162.060/4/1	Yes	Electrolysis	Yes (>5°C)	Yes (15 psu)	7.5 mg/L	Yes	No	8,500	No	No	No C,WQ,NA,ST
EcoChlor[5,6]	162.060/5/0	Yes	Chemical Injection	No	4.24 mg/L	4.25 mg/L	Yes	Yes (24 hours)	12,000[7]	Yes	Yes	No C,WQ,HT,ST
ERMA FIRST[8]	162.060/6/1	Yes	Electrolysis	Yes (>-2°C)	Yes (0.9 psu)	6 mg/L	Yes	No	3,000[9]	Yes (conditional)	Yes	No C,WQ,MFR,ST
Electro-Cleen	162.060/7/0	No	Electrolysis	No	Yes (1.5 psu)	9 mg/L	Yes	Yes (120 hours)	1,000[10]	Yes (conditional)	Yes	No C,WQ,HT,MFR,ST
Purimar	162.060/8/0	Yes	Electrolysis	Yes (4-40 °C)	Yes (10 psu)	2.5-3 mg/L	Yes	Yes (24 hours)	6,500[11]	No	No	No C,WQ,HT,NA,ST
BIO-SEA B	162.060/9/0	Yes	UV	No	N/A	N/A	No	No (freshwater)	1,400	No	Yes	No MFR
Aquarius EC	162.060/10/0	Yes	Electrolysis	Yes (>15°C)	Yes (>15 psu)	10 mg/L	Yes	Yes (24 hours)	4,000	No	No	No C,WQ,HT,MFR,NA,ST
HiBallast	162.060/11/0	Yes	Electrolysis	Yes (>4 °C)	Yes (>15 psu)	8 mg/L	Yes	Yes (48 hours)	8,000[12]	Yes (conditional)	Yes	No C,WQ,HT,ST
OceanGuard	162.060/12/0	Yes	Electrolysis	No	Yes (>0.85 psu)	2 mg/L	Yes	Yes (120 hours)	5,200	No	No	No C,WQ,HT,NA,ST
BallastAce	162.060/13/0	Yes	Chemical Injection	No	Yes (20 mg/L)	No	Yes	Yes (24 hours)	3,500	No	No	No C,WQ,HT,MFR,NA,ST
GloEn-Patrol	162.060/14/0	Yes	UV	Yes (-2-40°C)	N/A	N/A	No	Yes (48 hours)	6,000	Yes (conditional)	Yes	No HT
BALPURE	162.060/15/0	Yes	Electrolysis	Yes (15-50°C)	Yes (18-36 psu)	7-15 mg/L	Yes	Yes (24 hours)	8,570	Yes (conditional)	Yes	No C,WQ,HT,ST
inTank BWTS	162.060/16/0	No	Chemical Injection Electrochlorination[13]	Yes (0-35°C)	>22 mS/cm conductivity	2-5 mg/L	Yes	Yes (24 hours)	N/A[14]	Yes (conditional)	Yes	No C,WQ,HT
CompactClean	162.060/17/1	Yes	UV	No	N/A	N/A	No	Yes (2 hours)	3,000	No	Yes	No HT,MFR,ST
Aquarius UV	162.060/18/0	Yes	UV	Yes (-2-45 °C)	N/A	N/A	No	Yes (72 hours)	1,000	No	Yes	No HT,MFR
PureBallast 3.2	162.060/19/0	Yes	UV	No	N/A	N/A	No	Yes (2.5 hours)	3,000	Yes (conditional)	Yes	No HT,MFR
Evolution	162.060/20/0	Yes	UV	> -2°C	N/A	N/A	No	Yes (48 hours)	1,500	No	Yes	No HT,MFR

[1] International Maritime Organization G8 testing requirements include corrosion but only as it relates to tank coatings in accordance with the International Paint and Printing Ink Council.
[2] Aspects that impact compatibility of a system to a U.S.-flag laker include chemical compatibility with vessel construction ("**C**"), discharges exceeding state drinking waters limits ("**WQ**"), hold times in ballast tanks versus voyage times ("**HT**"), low rates incapable of maintaining normal load/unload rates for cargo operations ("**MFR**"), U.S. Coast Guard approval for installation and operation on a U.S.-flag vessel ("**NA**"), and/or feed stock limitations due to salinity or temperature ("**ST**").
[3] "Yes (conditional)" means certain components (e.g., power distribution unit, control unit, electrolysis unit, neutralization tank, etc.) may not be installed in areas designated as "hazardous".
[4] Requires feed water storage equivalent to 2 to 5 percent of total ballast water volume.
[5] Tested at Golden Bear facility in waters over 12°C, only.
[6] Chemical dosing (ClO_2) without neutralization process. Does not monitor for total residual chlorine at discharge.
[7] Flow rate varies from maximum listed in USCG TA certificate, 3,740 m^3/hour. Table reflects EcoChlor's reported maximum available flow rate per the manufacturer, EcoChlor.
[8] Requires feed water storage equivalent to 2 percent of total ballast water volume.
[9] Flow rate varies from maximum listed in USCG TA certificate, 10,000 m^3/hour. Table reflects ERMA FIRST's reported maximum available flow rate per the manufacturer, Erma First.
[10] Flow rate varies from maximum listed in USCG TA certificate, 12,000 m^3/hour. Table reflects Electro-Cleen's reported maximum available flow rate per the manufacturer, Techcross.
[11] Flow rate varies from maximum listed in USCG TA certificate, 10,000 m^3/hour. Table reflects Purimar's reported maximum available flow rate per the manufacturer, Samsung Heavy Industries.
[12] Flow rate varies from maximum listed in USCG TA certificate, 10,000 m^3/hour. Table reflects HiBallast's reported maximum available flow rate per the manufacturer, Hyundai Heavy Industries.
[13] System offers two options for chemical disinfection: direct injection of NaOCl or generation on board through electrochlorination.
[14] Treatment is performed in ballast water tank after uptake and before discharge. Total amount of ballast water capable of being treated with chemical capacity on board is 200,000 m^3 (52 million gallons).