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ORGANISMOS ACUÁTICOS PERJUDICIALES EN EL AGUA DE LASTRE

Informe sobre la fase de adquisición de experiencia con respecto al Convenio sobre la gestión del agua de lastre

Nota de la Secretaría

RESUMEN

Sinopsis:	Este documento contiene el informe del análisis de datos sobre la fase de adquisición de experiencia con respecto al Convenio sobre la gestión del agua de lastre (BWM).
Principio estratégico, si es aplicable:	1
Resultados:	1.21
Medidas que han de adoptarse:	Véase el párrafo 29.
Documentos conexos:	Resolución MEPC.290(71), circular BWM.2/Circ.67/Rev.1, circular nº 3913, MEPC 76/4/3 y MEPC 77/4/5.

Introducción

1 En su 71º periodo de sesiones (3 a 7 de julio de 2017), el Comité de protección del medio marino (MEPC) adoptó la resolución MEPC.290(71), por la que se establecía la fase de adquisición de experiencia (EBP) con respecto al Convenio internacional para el control y la gestión del agua de lastre y los sedimentos de los buques, 2004 (Convenio BWM), a fin de que el Comité pudiera vigilar la implantación del Convenio.

2 Para agilizar los procesos de recopilación y análisis de datos de la EBP, el Comité aprobó el plan de recopilación y análisis de datos (DGAP) conexo (BWM.2/Circ.67/Rev.1) y pidió a la Secretaría que prestase su apoyo para la recopilación de datos y el análisis de la EBP.

3 En lo que respecta al apoyo financiero de la EBP, la Secretaría ha recibido con gratitud fondos de los Gobiernos de Australia, Canadá, Francia, Noruega y Países Bajos que se están utilizando para respaldar el análisis de los datos y la elaboración de un informe al respecto para su presentación al Comité.

Acuerdo con la UMM

4 Para apoyar y complementar la EBP, la Secretaría invitó a la Universidad Marítima Mundial (UMM) a que participara en la recopilación y análisis de datos, así como en la elaboración del informe de análisis de datos.

5 Las tareas de la UMM se establecieron en el documento MEPC 76/4/3 (Secretaría). Además, en el documento MEPC 77/4/5 (Secretaría) se facilitó al Comité información actualizada sobre el estado de la recopilación de datos a partir de septiembre de 2021 y una descripción de los procesos de recopilación de datos.

6 Se ha animado a las Administraciones y a las partes interesadas que deseen presentar datos sobre la EBP a que se pongan en contacto con la UMM.

Recopilación de datos

7 Además de la invitación formal, la UMM se puso en contacto directamente con las Administraciones para solicitar sus aportaciones. El contacto con las Administraciones que presentaron datos complementarios también incluyó deliberaciones para aclarar el proceso de recopilación de datos, e incluir, cuando era posible, los datos que no seguían el formato del DGAP.

8 Un total de 38 Administraciones respondieron a las distintas solicitudes de información, tal y como se señala en el capítulo 1 del anexo.

9 Para complementar los datos del DGAP facilitados por las Administraciones, la UMM recopiló datos e información adicionales directamente de las partes interesadas pertinentes, teniendo en cuenta la posible duplicación de datos y las dificultades planteadas por la refundición de conjuntos de datos grandes y variados (MEPC 77/4/5). Dos memorandos de entendimiento de supervisión por el Estado rector del puerto y otras nueve partes interesadas presentaron datos, como se indica en el capítulo 1 del anexo.

10 Las Administraciones presentaron conjuntos de datos considerables (capítulo 2 del anexo) y, en general, las tendencias y los patrones identificados en estos datos eran coherentes con la información proporcionada por las partes interesadas y la corroboraban (capítulo 3 del anexo).

11 En las siguientes secciones se señalan los principales puntos identificados durante el análisis de los datos. El informe completo figura en el anexo.

Conclusiones de los Estados de abanderamiento y de las organizaciones reconocidas

12 Veintiún Estados de abanderamiento presentaron datos sobre 16 199 buques a los que se aplicaba el Convenio, de los cuales, 13 971 buques estaban sujetos a la regla D-2 en el momento de la notificación. Los Estados de abanderamiento informaron de que 7 329 buques estaban equipados con un sistema de gestión del agua de lastre (BWMS) homologado. De los tipos conocidos de BWMS instalados, el 93,6 % de los sistemas utilizaban la irradiación ultravioleta (UV) o la electrocloración.

13 Los Estados de abanderamiento proporcionaron datos de 45 710 reconocimientos realizados, con un total de 512 defectos, lo que representa un índice de cumplimiento mínimo estimado del 98,9 % (basado en una estimación conservadora de un defecto por reconocimiento). Los fallos mecánicos, eléctricos, del proceso de tratamiento y relacionados con el mantenimiento y la limpieza fueron los defectos conocidos más frecuentes.

14 Se notificaron 758 siniestros y defectos relacionados con las operaciones de gestión del agua de lastre (regla E-1.7 del Convenio BWM), junto con otros siete sucesos de seguridad relacionados con la gestión del agua de lastre.

15 Los datos comunicados por las organizaciones reconocidas (OR) coincidían en líneas generales con los datos del Estado de abanderamiento en lo que respecta al desglose de los BWMS por tipo y a los defectos observados durante los reconocimientos.

Resultados de los Estados rectores de puertos y de los memorandos de entendimiento de supervisión por el Estado rector del puerto

16 Diecinueve administraciones facilitaron datos de conformidad con el DGAP. Estos datos incluían 83 376 inspecciones, de las cuales se estimaba que aproximadamente el 90 % eran satisfactorias.

17 Los defectos más frecuentes fueron los relacionados con el libro de registro del agua de lastre (más del 70 %), seguidos de la falta de tripulación designada con responsabilidades en materia de BWMS o familiarizada con estos y la falta de un certificado válido a bordo.

18 Menos del 1 % de las inspecciones incluían la extracción y el análisis de muestras de agua de lastre para comprobar el cumplimiento.

19 Aunque los datos relativos a las medidas en respuesta a las inspecciones insatisfactorias eran limitados, los datos presentados indicaban que, en casi el 97 % de los casos, se proporcionó información o asesoramiento. Aproximadamente el 3 % de las medidas fueron sanciones, advertencias, detenciones y prohibición de descarga.

20 En general, estos resultados eran coherentes con los datos adicionales proporcionados por un país que no es Parte del Convenio y que realiza las inspecciones de acuerdo con su propio marco nacional, así como con los datos refundidos presentados por dos memorandos de entendimiento de supervisión por el Estado rector del puerto. En concreto, el país no Parte señaló un alto índice de inspecciones satisfactorias (98 %), y los memorandos de entendimiento informaron de que las entradas en el libro registro del agua de lastre eran los defectos más comunes

Conclusiones derivadas de los datos complementarios y del periodo de prueba

21 De los 123 eventos de muestreo y análisis detallados comunicados por las Administraciones, el 68 % cumplían la norma D-2. Los datos presentados por las Administraciones eran coherentes, en general, con los recibidos de las organizaciones de pruebas de agua de lastre: de las pruebas comunicadas por esas organizaciones, el 80 % de las pruebas de puesta en marcha y el 78 % de las pruebas de conformidad cumplían la norma D-2.

22 Los incumplimientos de la norma D-2 fueron más frecuentes en la clase de tamaño de organismo ≥ 50 µm. Esta clase de tamaño figuraba en el 97 % de las pruebas de cumplimiento no superadas que habían notificado las Administraciones, en el 93 % de las pruebas de cumplimiento no superadas presentadas por las organizaciones de pruebas de agua de lastre y en el 81 % de las pruebas de puesta en servicio no superadas comunicadas por las organizaciones de pruebas.

23 En las descargas que cumplían la norma D-2 notificadas por las Administraciones, las concentraciones de organismos resultaron ser significativamente inferiores a la norma de descarga, con medias inferiores a 1 organismo/m^3 para la clase de tamaño ≥ 50 µm y 2 organismos/mL para la clase de tamaño 10 – 50 µm. Por el contrario, el 61 % de los

incumplimientos en la clase de tamaño ≥ 50 µm se incumplía más de diez veces el límite de descarga.

24 En algunos casos, se analizaron muestras de descargas que habían sido objeto de un cambio de agua de lastre con respecto a la norma D-2. A pesar de las limitaciones que conllevan los volúmenes pequeños de muestras, los informes indican que solo el 33 % de los buques que realizaban el cambio de agua de lastre para cumplir la norma D-1 presentaban niveles de organismos en el agua de lastre descargada de los que podían considerarse que cumplían la norma D-2 (en comparación con el 68 % y el 78 % de las descargas de los buques que utilizaban un BWMS, según los informes de las Administraciones y las organizaciones de pruebas, respectivamente).

25 Aproximadamente dos tercios de los BWMS que utilizaban sustancias activas cumplían la prescripción de concentración máxima admisible de descarga (MADC) para los oxidantes residuales durante las pruebas de conformidad. Las Administraciones informaron de que el 27 % de las descargas superaban la MADC, mientras que las organizaciones de pruebas informaron de que el 34 % de las descargas superaban la MADC. (En el caso de las organizaciones que informan de las pruebas de puesta en marcha, solo el 8 % de las descargas superaban la MADC).

26 El MEPC 77 solicitó que este informe incluyera una evaluación de la relación entre la eficacia biológica de los BWMS y si la homologación se había llevado a cabo de acuerdo con el Código BWMS o las versiones anteriores de las Directrices (D8) (MEPC 77/16, párrafo 4.18). Si bien esto pudo determinarse para 75 BWMS, las cifras se distribuyeron de forma desigual entre el Código BWMS y las versiones anteriores de las Directrices (D8), lo que impidió realizar comparaciones significativas.

27 De las respuestas recibidas de las Administraciones a la interfaz complementaria en relación con las observaciones de las tripulaciones de los buques, el 12,5 % de las tripulaciones de los buques señalaron "dificultades con el funcionamiento/mantenimiento de los BWMS en general" (19 de 151 respuestas de buques instalados con un BWMS, en uso o no). Esta información de las Administraciones indica que la frecuencia de las dificultades es significativamente menor que la notificada en un reconocimiento del sector, en el que se informó de que el 77 % de los BWMS tenían problemas o no estaban en buen estado.

Conclusiones de las partes interesadas

28 Las partes interesadas (incluidas asociaciones del sector y compañías) aportaron observaciones sobre los retos que plantea el funcionamiento de los BWMS, como los sistemas de control y alarma, el software, el rendimiento de los filtros y sensores, las piezas de respeto y el mantenimiento, y los reconocimientos del sector. En particular, las tres preocupaciones más comunes de estas encuestas fueron el porcentaje de BWMS que presentaban problemas de funcionamiento, la falta de formación suficiente de la tripulación sobre los BWMS y el apoyo insuficiente de los proveedores para el mantenimiento y la calibración de los BWMS.

Medidas cuya adopción se pide al Comité

29 Se invita al Comité a que examine la información proporcionada en este documento y a que adopte las medidas que estime oportunas.

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ANNEX

DATA ANALYSIS REPORT ON THE EXPERIENCE-BUILDING PHASE (EBP) ASSOCIATED WITH THE BALLAST WATER MANAGEMENT (BWM) CONVENTION

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1 LIST OF CONTRIBUTORS TO THE EBP

The following entities contributed data to the experience-building phase.

Countries and territories:

Argentina
Australia
Barbados
Brazil
Bulgaria
Canada
China
Comoros
Cook Islands
Croatia
Cyprus
Estonia
Finland
Georgia
Germany
Japan
Jordan
Kenya
Liberia
Lithuania
Malaysia
Malta
Mexico
Netherlands
New Zealand
Norway
Palau
Panama
Republic of Korea
Russian Federation
Saudi Arabia
Singapore
Togo
Tuvalu
United Kingdom
United States
Vanuatu
Cayman Islands

Inter-governmental organizations:

Memorandum of Understanding on Port State Control in the Asia-Pacific Region (Tokyo MoU)
Paris Memorandum of Understanding on Port State Control (Paris MoU)

Non-governmental organizations with consultative status at IMO:

BIMCO
International Association of Classification Societies (IACS)
International Association of Independent Tanker Owners (INTERTANKO)
International Association of Dry Cargo Shipowners (INTERCARGO)
Ballastwater Equipment Manufacturers' Association (BEMA)
Global TestNet

Other:

Three private stakeholders

2 DATA PROVIDED BY ADMINISTRATIONS

2.1 INTRODUCTION

Overview of DGAP interfaces and collected data

2.1.1 Administrations were encouraged to participate in the experience-building phase (EBP) to maximize the information and materials available to the Committee for consideration. The data gathering and analysis plan (DGAP) for the EBP structured the data collection process with four interfaces for submitting data (BWM.2/Circ.67/Rev.1, paragraph 3.1):

.1 Basic interface: straightforward reports from port and flag States that summarize basic data that might normally be collected by these States (basic flag State report and basic port State report);

.2 Supplementary interface: reports on specific topics from port States and flag States that would require greater analysis and/or additional research work (ballast water analysis report);

.3 Trial period interface: reports from port States on methods for sampling and analysis during PSC; and

.4 Stakeholder interface: reports from all stakeholders on their perspectives and experience (e.g. shipowners, BWMS manufacturers, recognized organizations).

2.1.2 A total of 38 Administrations submitted data to at least one of the four DGAP interfaces. A total of 34 Administrations responded to the basic interface and seven Administrations responded to the other interfaces.

2.1.3 The data reported by 21 flag States for the basic flag State interface covered 16,199 ships and 45,710 surveys. The data summarized in the basic port State interface was reported by 19 Administrations and represents a combined 83,376 inspections.

2.1.4 The supplementary, trial period and stakeholder interfaces permitted less structured data and information to allow for broader input. Information regarding sampling and analysis of ballast water discharges from ships was submitted by seven Administrations. One Administration submitted data to the trial period interface and one Administration submitted data to the stakeholder interface.

Challenges with data collection and management

2.1.5 Although a substantial amount of data was assembled as part of the EBP, it should also be noted that there were some challenges in data collection and management. The WMU received comments that the original format of data requested, interpretation of categories and requirements, amounts of data to collect and consolidate, multiple internal sources of data and its circulation, and limited resources and time, all presented challenges to efficient data collection and submission.

2.1.6 Some data provided to the EBP was incomplete for a specific category or topic. For example, not all items referred to in the DGAP interface templates were completed because Administrations may or may not have verified data in each category listed.

2.1.7 In a few cases, inconsistencies were identified in data submissions. When this occurred, Administrations were contacted directly for clarification.

2.2 BASIC INTERFACE: FLAG STATES

Introduction and data summary

2.2.1 Data from flag States was collected in accordance with the basic flag State interface, as set out in appendix A of the DGAP. In addition to the information collected through GISIS, a web-based questionnaire based on the template provided in appendix A was created to facilitate data collection from Administrations.

2.2.2 Twenty-one Administrations submitted data. Among them was one flag State that is not Party to the Convention but is actively supporting its fleet through a BWM Convention compliance programme.

2.2.3 Table 1 summarizes the data collected from the 21 flag States in the format set out in appendix A of the DGAP. To accommodate flag States using their own reporting systems, four additional data categories were added, as shown in italics in Table 1 and explained in footnotes.

Table 1: Summary of data submitted by 21 flag States

Part 1: Fleet and its ballast water management plans			
Administrations			21
Time period of report			08/09/2017 to 19/10/2021
Date report prepared			31/08/2020 to 12/11/2021
Ships to which Convention applies:	Total number of ships	Container ships	2,234
		Bulk carriers	4,937
		Tankers	3,990
		Ferries	89
		Cruise ships	139
		Other (attach details)	4,810
	Number currently subject to regulation D-2		13,971
	Number fitted with BWMS	*Total number fitted with BWMS compliant with D-2 standards*[1]	7,329
		Electro-chlorination	2,261
		Ozonation	99
		Other chemical injection	153
		Ultraviolet	2,564
		Other	78
		Unspecified[2]	2,148
Approved ballast water management plans	Total number of approved plans		15,700
	Number of approved plans that include:	D-1 procedures	11,247
		Contingency measures	7,723
		Exemptions (regulation A-4)	186
		Other methods (regulation B-3.7)	0
		Use of reception facilities (regulation B-3.6)	70
		Prototype BWMS (regulation D-4)	3

1 This item was added to the basic flag State web-based questionnaire to accommodate data from flag States providing a total number of ships fitted but unable to provide a breakdown by BWMS type.

2 This item was added to the basic flag State web-based questionnaire after consultation with flag States unable to identify the type of systems installed on some (but not all) of their ships.

Part 2: Outcome of ballast water surveys		
Number of surveys undertaken	Initial	9,950
	Annual	25,211
	Renewal	2,919
	Intermediate	7,630
Deficiencies noted during these surveys (even if later resolved)	Mechanical	80
	Physical	13
	Treatment process	49
	Electrical	64
	Piping	13
	Location	3
	Maintenance and cleaning	16
	Sampling facilities	1
	Other (attach details)	273

Part 3: Reported accidents and defects			
Number of reports of accidents to the ship and/or defects (regulation E-1.7)	Originating outside the ship's ballast water system		2
	Originating in the ship's ballast water system	*Number of reports originating in the ship's ballast water system (total)*[3]	758
		BWMS treatment equipment	328
		BWMS control and monitoring equipment	183
		Other aspect of the ballasting system	50
Number of other safety incidents reported to the flag State that relate to the Convention	*Associated with the ship's ballast water system (total)*[4]		7
	Associated with the ship's ballast water system	BWMS treatment equipment	0
		BWMS control and monitoring equipment	0
		Other aspect of the ballasting system	6
	Associated with the storage or handling of Active Substances (including neutralizers)		5
	Associated with the use of ballast water to control trim, list, draught, stability or stresses of the ship		2
	Other (attach details)		0

Part 1: Fleet and its ballast water management plans

Ships to which the Convention applies

2.2.4 The data provided by flag States for the EBP includes 16,199 ships to which the Convention applies, broken down by ship type as shown in Figure 1. This is generally consistent with the known composition of the world fleet, with bulk carriers, tankers and containerships making up over two-thirds of the ships included in this interface. Ship types that

[3] This item was added to the basic flag State web-based questionnaire to assess the total number of accidents even when origins were multiple or were not reported or identified.

[4] This item was added to the basic flag State web-based questionnaire to assess the total number of accidents associated with a ship's ballast water system even when origins were multiple or were not reported or identified.

were listed by flag States as "other" included various cargo and passenger carriers, fishing vessels, and other specialized ship types.

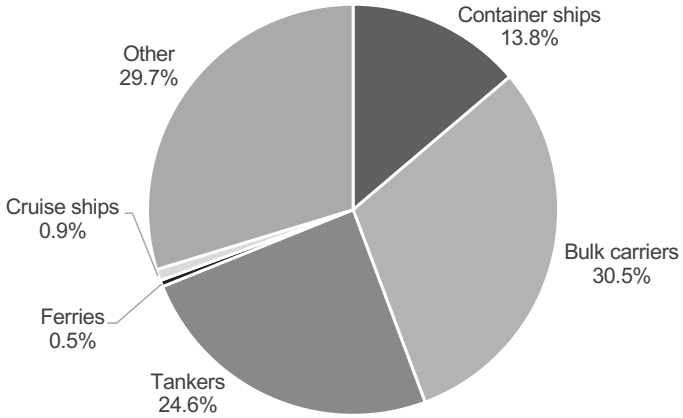

Figure 1: Distribution of ships by type as reported by flag States

2.2.5 Flag States reported a total of 13,971 ships subject to regulation D-2 at the time of reporting.

2.2.6 The flag States reported a total of 7,329 ships fitted with a BWMS type approved for compliance with the D-2 standard. Of these, 5,155 BWMS were identified according to the primary type of treatment technology (e.g. ultraviolet irradiation (UV), electro-chlorination, etc.), as shown in Figure 2.

2.2.7 Some Administrations were unable to identify the type for 2,148 BWMS. Given the large number of unidentified BWMS, an "unspecified" category was added.

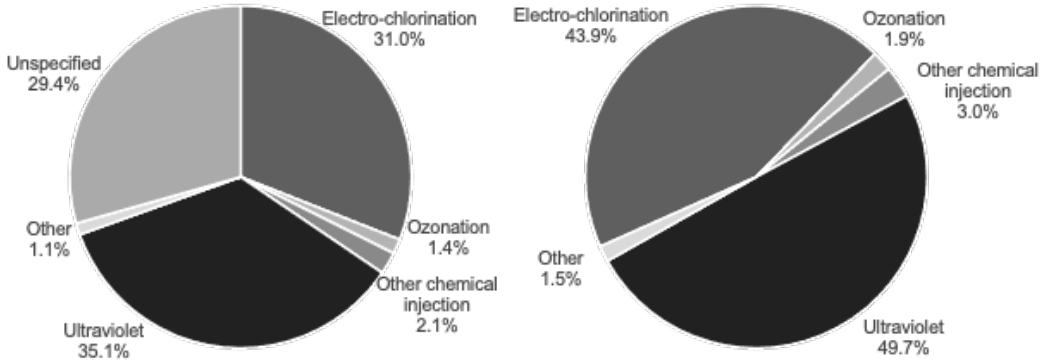

Figure 2: Reported types of ballast water management systems, including unspecified (left) and excluding unspecified (right)

2.2.8 These charts highlight the current widespread use of UV and electro-chlorination as primary treatments for BWMS, as these two treatment approaches represent 93.6% of known reported installations. This prevalence of electro-chlorination and ultraviolet BWMS is similar to both well-known industry trends and academic research publications.[5]

[5] Gerhard, W. A., Lundgreen, K., Drillet, G., Baumler, R., Holbech, H., & Gunsch, C. K. (2019). Installation and use of ballast water treatment systems–Implications for compliance and enforcement. *Ocean & Coastal Management*, *181*, 104907.

2.2.9 BWMS types reported under "other" included, inter alia, cavitation, membrane separation and ultrasonic treatments.

2.2.10 Filtration/separation is commonly integrated in the treatment processes for type-approved BWMS. However, the DGAP interfaces did not provide the ability to highlight the presence or absence of more than the primary treatment approach for a BWMS. Thus, flag States did not provide explicit information on the details of treatment processes, which may include filtration (or other separation mechanisms) in addition to the primary disinfection treatment methods. Therefore, this report was unable to evaluate any effects of filtration/separation on system operation and/or performance.

Approved ballast water management plans

2.2.11 The flag States reported 15,700 approved ballast water management plans (BWMPs).[6]

2.2.12 Of the BWMPs reported, the provided data indicated that 71.6% of the total number of approved BWMPs include ballast water exchange procedures to meet the D-1 standard and 49.2% involve contingency measures. A small percentage of ships (1.2%) have been granted exemptions in accordance with regulation A-4.

Part 2: Outcome of ballast water surveys

Surveys undertaken

2.2.13 Flag States reported a total of 45,710 surveys, which includes some ships that have gone through multiple surveys over time. Annual surveys represent the highest proportion of surveys performed (55.2%), as shown in Figure 3.

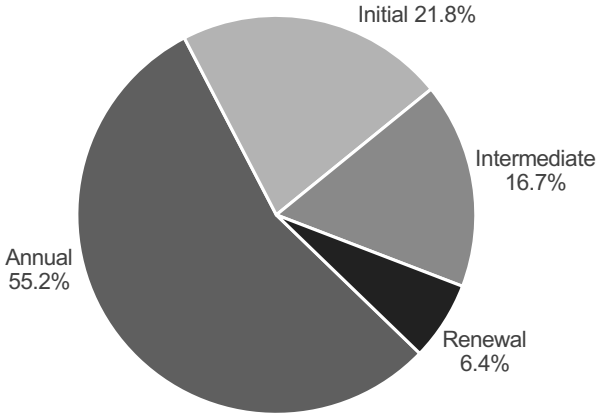

Figure 3: Distribution of surveys by type as reported by flag States

Deficiencies noted during surveys

2.2.14 Flag States reported a total of 512 deficiencies out of 45,710 surveys conducted, representing a maximum rate of non-compliant surveys of 1.1%. Though one deficiency per survey cannot necessarily be assumed, this would represent a conservatively high estimate of non-compliant surveys. Thus, a minimum estimate of 98.9% of surveys were estimated to be compliant.

[6] Due to missing or incomplete information, the number of approved plans is not equal to the total number of ships reported above.

2.2.15 Of the reported deficiencies, over half (53.3%) were in the "other" category, and thus could not be further assessed.[7] Additionally, it could not be determined if the various respondents had a similar understanding of this category and its meaning. The "other" category may represent unspecified/unidentified factors or combination of factors, or issues that cannot be entered in the remaining stated categories.

2.2.16 Of the known reported deficiencies, those related to mechanical, electrical and treatment processes were most commonly identified in surveys with 15.6%, 12.5% and 9.6%, respectively (Figure 4).

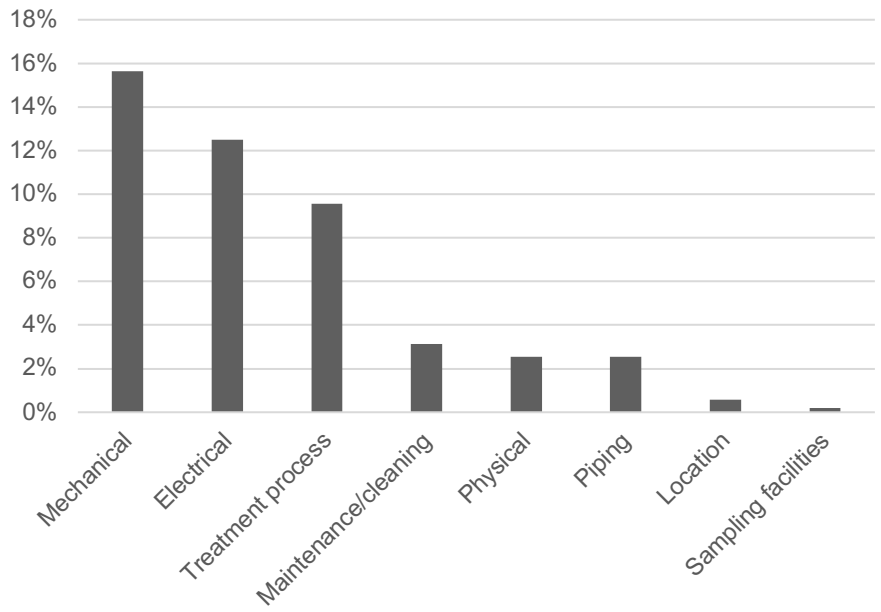

Figure 4: Types of reported deficiencies noted during surveys (excluding "other")

Part 3: Reported accidents and defects

Reported accidents and/or defects

2.2.17 Part 3 of Appendix A to the DGAP requested information on reported accidents to the ship and/or defects in line with regulation E-1.7 of the BWM Convention. Five flag States reported a total of 760 accidents and defects (two from outside of the BWMS and 758 originating in the ship's BWMS). Of these five flag States, three identified the area of the accidents and defects, representing 561 accidents and defects. It should be noted that two flag States provided 97.7% of the accidents and defects reported. Defects noted by flag States in the "other" category included those related to flow meters, system design limitations, and dosing chemical leakage.

Other safety incidents reported to the flag State that relate to the Convention

2.2.18 With regard to regulation E-1.7 of the BWM Convention, seven safety incidents were reported. One flag State reported six incidents associated with "other aspects of the ballasting

[7] Certain flag States provided deficiencies under "other" such as the ballast water management plan not being translated into the correct language and incorrect entries in the ballast water record book.

system" and another flag State registered one incident without indicating the part of the system affected.

2.2.19 Additionally, two flag States highlighted five safety incidents associated with the storage or handling of active substances (and associated neutralizing compounds) such as a chlorine leak from the dosing unit in the engine room and two safety incidents associated with the use of ballast water to control trim, list, draught, stability or stresses of the ship.

2.3 BASIC INTERFACE: PORT STATES

Introduction and data summary

2.3.1 Data from port States was collected in accordance with the basic port State interface, as set out in appendix B of the DGAP. In addition to the information collected through GISIS, a web-based questionnaire based on the template provided in appendix B was created to facilitate data collection from Administrations.

2.3.2 Nineteen Administrations submitted port State data to the EBP.[8] Where there were inconsistencies or obvious errors, Administrations were contacted directly for clarifications.

2.3.3 Table 2 summarizes the data collected from Administrations in the format set out in appendix B of the DGAP.

[8] In addition to data from nineteen port States that are Parties to the Convention presented here, one additional port State that is not a Party to the Convention submitted data. As it is a non-Party and performs inspections according to its own domestic framework rather than in accordance with the BWM Convention, the data was not included here. It is presented separately in section 3.3.

Table 2: Summary of data submitted by 19 port States

Part 1: PSC inspection outcomes			
Administrations			19
Time period of report:			08/09/2017 to 18/10/2021
Date report prepared:			30/08/2020 to 09/12/2021
Total number of inspections undertaken	With no ballast water sample		82,774
	With a ballast water sample	Analysed with respect to regulation D-1	427
		Analysed with respect to regulation D-2	175
Number of PSC inspections by outcome	Satisfactory		74,957
		Valid certificate not on board	292
		Approved ballast water management plan not on board	55
		Deficiency in record book entries	3,187
		Ship not in compliance with regulation D-1	77
		Ship not in compliance with regulation D-2 (BWMS was installed, maintained and operated correctly)	11
		Ship not in compliance with regulation D-2 (BWMS was not installed, maintained and operated correctly)	2
		Maintenance issues	9
		Crew not designated or unfamiliar with ballast water responsibilities	482
		Unsanctioned changes to structure, equipment, fittings, arrangements or material	0
		BWMS not used in accordance with operational instructions	3
		BWMS and equipment not in good working order or treatment not fully operational	19
		BWMS safety procedures not followed	0
		BWMS has been bypassed	1
		Other (attach details)	291

Part 2: Actions arising from unsatisfactory inspections (report number of actions)			
Action	Deficiency concerning regulation D-1	Deficiency concerning regulation D-2 or a BWMS	Deficiency concerning other aspect of the Convention
No action taken	0	0	0
Information/advice provided	40	3	769
Warning	0	0	6
Sanction	8	1	7
Detention	0	0	4
Exclusion	0	0	0
Other	0	276	611

Part 3: Implications of unsatisfactory inspections for ballast water discharge (report number of discharges)				
Action		Deficiency concerning regulation D-1	Deficiency concerning regulation D-2 or a BWMS	Deficiency concerning other aspect of the Convention
Discharge permitted without contingency measure		5,792	2,251	0
Discharge permitted following contingency measure	Ballast water exchange	0	28	0
	Emergency treatment	2	0	0
	Discharge ashore	1	0	0
	Other (attach details)	0	0	0
Discharge not permitted		4	0	60
Other		0	0	0

Part 1: PSC inspection outcomes

Total number of inspections undertaken

2.3.4 A total of 83,376 inspections were reported, including inspections both with and without ballast water sampling. Less than 1% of PSC inspections collected and analysed ballast water samples for compliance (0.7%). Of the ballast water samples analysed, 70.9% were analysed with respect to the D-1 standard and 29.1% were analysed with respect to the D-2 standard.

PSC inspections by outcome

2.3.5 Port States reported 74,957 inspections with satisfactory outcomes and a total of 4,429 deficiencies. However, these 4,429 deficiencies may not represent the same number of unsatisfactory inspections, as one inspection may record more than one deficiency. Furthermore, some PSC authorities reported deficiency types but did not report a total number of satisfactory or unsatisfactory inspections. Thus, it was not possible to reconstruct with certainty the total number of unsatisfactory inspections.

2.3.6 However, estimates were made of unsatisfactory outcomes. First, the total number of inspections was reported to be 83,376, which, combined with the reported 74,957 inspections with satisfactory outcomes, would suggest that up to 8,419 inspections may have been unsatisfactory. On the other hand, if each reported deficiency corresponded to one inspection (a conservative estimate), there may have been 4,429 unsatisfactory inspections. Thus, the percentage of satisfactory inspections out of the total number of inspections reported may range between approximately 89% and 94%.

2.3.7 With respect to identified deficiencies, the most frequently reported were ballast water record book entries (72%), followed by crew not designated or unfamiliar with the BWMS (nearly 11%), and no valid certificate on board (6.6%) (Figure 5).

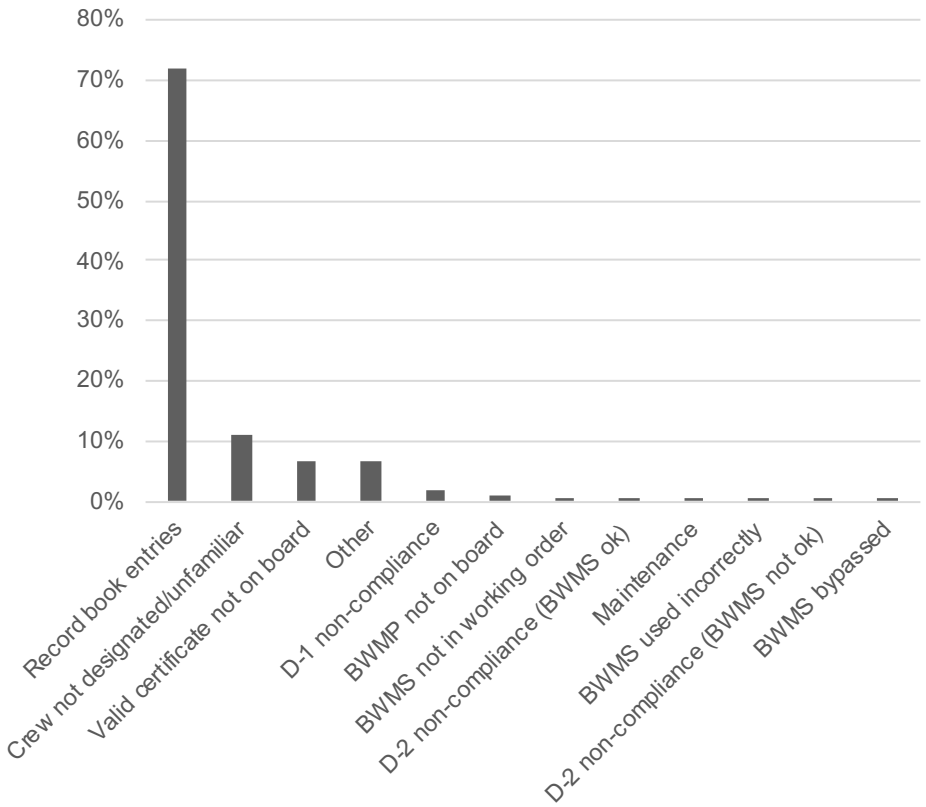

Figure 5: Unsatisfactory survey outcomes as reported by port States (including "other")

Part 2: Actions arising from unsatisfactory inspections

2.3.8 Limited data was submitted regarding actions arising from, or implications of, unsatisfactory inspections. Of the data reported, the category "other" constituted the highest proportion of actions arising from unsatisfactory inspections. Without additional information, it was not possible to detail the types of actions under this category. When the "other" category was excluded, the "information/advice provided" category represented nearly 97% of responses.

2.3.9 The number of sanctions, warnings and detentions accounted for 1.9%, 0.7% and 0.5% of actions taken in response to deficiencies, respectively. No exclusions were reported.

2.3.10 This suggests that, during the time period covered by the data, Administrations that submitted data were inclined to provide the information needed to avoid future deficiencies rather than penalizing ships by taking more severe enforcement actions.

Part 3: Implications of unsatisfactory inspections for ballast water discharge

2.3.11 Three Administrations provided detailed data for this question, and thus the data collected was limited. While the data submitted suggests that the overwhelming majority of discharges were permitted without contingency measures, a word of caution is needed due to the limited dataset. Certain Administrations took extra precautions including requiring specific actions such as ballast water exchange before allowing discharge, or otherwise prohibited discharge. Thus, definitive conclusions cannot be drawn regarding discharge without contingency measures.

2.4 SUPPLEMENTARY INTERFACE: BALLAST WATER ANALYSIS

Data collection and summary

2.4.1 Six Administrations provided detailed supplementary data and each of them was contacted individually to optimize information gathered.

2.4.2 Submitted supplementary data is summarized in Table 3 below.

Table 3: Summary of ballast water sample analyses reported

Overview of data gathered			
Standard verified	D-1 (71) and D-2 (130)		
Analysis against D-1 standard	Indicative analysis (30) / Detailed analysis (41)		
Analysis against D-2 standard	Indicative analysis (7) / Detailed analysis (123)		
Overview of compliance data (D-2 / detailed analysis)			
Size class	Compliant	Non-compliant	Non-compliant against any parameter[9]
x ≥ 50µm	66	38	39
10µm ≤ x < 50µm	103	3	
Vibrio cholerae	70	0	
Escherichia coli	85	0	
Intestinal Enterococci	85	0	

[9] Some detailed analyses with respect to the D-2 standard failed in multiple size classes, and thus the sum of failures per size class in the "Non-compliant" column is greater than the total number of failed tests, which is reported in this column.

Other information from supplementary interface data			
	Yes	No	Other responses
Isokinetic sample collection (probe size, flow rates and location correct) (Y/N)	72	58	
Total volume of water discharged from sampled tanks during sampling (m^3)	Variable (see analysis)		
Volume of sample(s) collected (indicate L or m^3)	Variable (see analysis)		
Was the sample(s) concentrated before analysis (Y/N)	Yes, for all analyses of organisms >50µm	No, for all analyses focused on organisms 10-50µm and microbial indicators	
Analysis method	Variable / according to BWM.2/Circ.42 (and revisions)		
Number of subsamples analysed	Variable		
Analysis completed within standard holding time (Y/N) - In line with testing carried out during the type approval of BWMS (within 6 hours from sampling)	152	0	
Analysis completed by (affiliation)	Variable (Administration, research institutes, accredited laboratories)		
Exchange conducted (Y/N)	66	123	
BWMS utilized (Y/N)	130	68	
BWMS manufacturer and model	Variable		
Date BWMS installed	Variable (from 2010 to 2019)		
Duration BWMS in regular use (no. of treatment cycles)	Variable		
Time since last calibration of BWMS sensor (months)	Variable (see analysis)		
Ship reports difficulty with BWMS operation/maintenance in general (Y/N)	19	132	
BWMS alarm occurred during sample treatment (Y/N)	17	159	
BWMS maintenance up to date (Y/N)	55	69	
Ballast water source location(s)	Variable		
Ballast water holding time (days)	Variable (from 1 day to up to 360 days) - see analysis		
Ballast water salinity at uptake/treatment (PSU)	Variable (freshwater, brackish water and marine water)		
Ballast water temperature at uptake/treatment (°C)	Variable (5°C to 36°C)		
Maximum Allowable Discharge Concentration exceeded (Y/N)	23	61	Variable - see analysis
Any other deficiencies during PSC inspection (Y/N)	4	130	

Ballast water sampling and analysis

2.4.3 Administrations submitted supplementary data representing 201 ballast water discharge sampling and analysis events. The data included 71 ballast water discharge events

investigating the D-1 standard[10] and 130 discharge sampling events assessing the D-2 standard from ships using a type approved BWMS.

2.4.4 Samples were collected and analysed using methods and approaches consistent with BWM.2/Circ.42/Rev.2. The analyses were carried out shortly after sampling in line with the testing requirements set out in the BWMS Code (e.g. analysis within six hours from sampling). The sampling and the analyses were carried out by different governmental bodies, research institutions, or accredited testing organizations, on the behalf of various Administrations.

2.4.5 Sampling was carried out using integrated samplers (sampling skids) as described in documents MEPC 75/INF.11 (Singapore) and MEPC 76/INF.56 (Australia) or using standard plankton nets and tank systems for reception of the sampled water.

2.4.6 Of the tests assessing compliance with the D-2 standard, 72 were sampled in an isokinetic manner (in accordance with Guidelines (G2)) and 58 were considered to be non-isokinetic either because the samples were taken as grab samples or because the sampling port installation did not allow for isokinetic sampling. One Administration reported that only 14% of installations were found to be suitable for isokinetic sampling in accordance with the ISO 11711-1:2019 standard (MEPC 76/INF.56), in line with a recent peer reviewed publication[11] on the same topic.

2.4.7 Ballast water sample volumes reported by Administrations ranged from 20 L to more than 3 m^3 (Figure 6). Additionally, more than a quarter of the tests were carried out with volumes smaller than the minimum recommended for commissioning tests (BWM.2/Circ.70/Rev.1) or required by the BWMS Code and suggested by scientific literature for the ≥ 50 µm size class.[12]

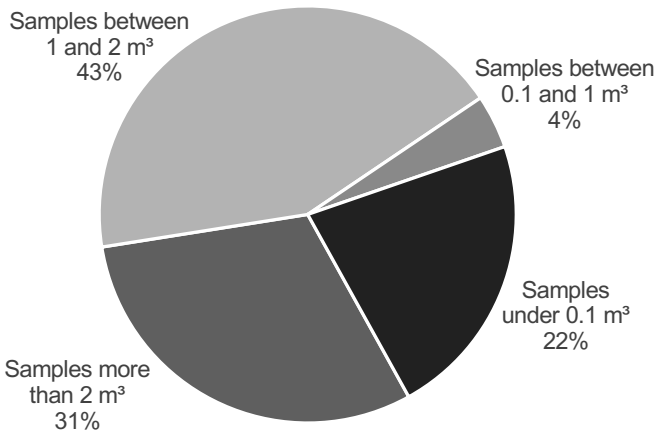

Figure 6: Number of samples by volume used for compliance testing of organisms ≥ 50 µm in size

10 The data included 22 ships with an installed BWMS but not using the system. Therefore, these discharges were considered under analyses for the D-1 standard.

11 Drake LA, Bailey SA, Brydges T, Carney KJ, Ruiz GM, Bayly-Stark J, Drillet G, Everett, RA (2021) Design and installation of ballast water sample ports: Current status and implications for assessing compliance with discharge standards, Marine Pollution Bulletin, Volume 167

12 For commissioning testing, BWM.2/Circ.70/Rev.1 recommends 1 m^3. For type approval of systems, the BWMS Code required volume is at least 3 m^3. Scientific peer reviewed paper reported optimal volume even larger, up to 6-8 m^3 – see Miller, A. W., Frazier, M., Smith, G. E., Perry, E. S., Ruiz, G. M., & Tamburri, M. N. (2011). Enumerating sparse organisms in ships' ballast water: why counting to 10 is not so easy. Environmental science & technology, 45(8), 3539-3546.

2.4.8 The analytical approaches used by Administrations varied, with some using only detailed analyses as described in BWM.2/Circ.42/Rev.2, including: (a) measure of indicator microbes, (b) the use of staining methods for the analysis of organisms in the 10 - 50µm size class (FDA/CMFDA), and (c) microscopic assessments of organism mobility in the ≥ 50µm size class (some details are available in documents MEPC 75/INF.11 (Singapore) and MEPC 76/INF.56 (Australia)). Data submitted mentioned analysis using the protist regrowth MPN method for assessment of the 10 - 50µm size class.

2.4.9 Other submitted data had been analysed using indicative analyses, using various kits or compliance monitoring devices (CMDs) either alone or in parallel to the detailed analysis (MEPC 75/INF.11; MEPC 76/INF.56). While this information is related and useful to the EBP, it is not possible to draw conclusions on the performances of each of these CMD technologies used by testing organizations or port States, as there is limited information provided concerning the method used for indicative analysis or CMD assessment and validation.

Tests carried out with respect to the D-2 standard

2.4.10 Administrations reported 123 tests carried out using detailed analyses, of which 84 samples or discharges (68%) were compliant with the D-2 standard. Conversely, 39 samples or discharges (32%) showed non-compliance with the D-2 standard in at least one class size.

2.4.11 The reported concentration of organisms in the compliant discharges were typically found to be very low (often close to method detection limits), with averages below 1 organism/m^3 for the ≥ 50 µm size class and 2 organisms/mL for the 10 - 50 µm size class, suggesting that compliant discharges are most often clearly below the D-2 discharge standard. Conversely, concentrations of organisms in non-compliant discharges were often found to be high, with up to 8,150 org/m^3 for the ≥ 50 µm size class and 70 org/mL for the 10 - 50 µm size class, clearly above required limits (Figure 7).

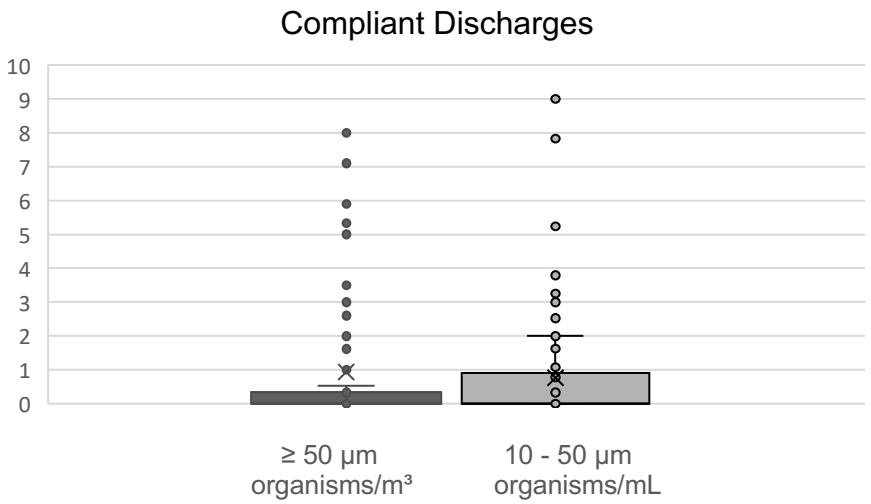

Figure 7: Concentrations of viable organisms in compliant discharges by size class

2.4.12 Ballast water discharges found to be non-compliant typically exceeded the D-2 standard for the largest size class; organisms ≥ 50 µm were involved in 97% of failures (38 of 39). Only 8% of failures to meet the D-2 standard involved samples that exceeded the D-2 standard for the 10 - 50 µm size class (3 of 39), while all tests with reported results for indicator microbes found concentrations below that specified by the D-2 standard.

2.4.13 Sixty one percent (61%) of failures in the ≥ 50 µm size class were failures greater than ten times the discharge limit. However, all failures in meeting the discharge standard for the 10 - 50 µm size class were within one order of magnitude of the limit (less than 10 times the D-2 performance standard limit).

2.4.14 Not all Administrations sampled and analysed all regulated size classes in every sampling event. A few tests were carried out using grab samples and therefore the relevant Administrations did not provide data for the analysis of the larger size class of organisms, and other submissions did not report microbiological information.

2.4.15 No definitive explanations for causes of failures to meet the D-2 standard were provided. This is consistent with document MEPC 76/INF.56 (Australia), which stated that "[t]he root causes of the failures of the BWMS to meet the D-2 performance standard were not able to be clearly determined through this study...[T]he observed non-compliances in organisms of size class ≥ 50 µm in minimum dimension could be related to the incorrect operation or installation of the BWMS, a reduction in efficacy if various temporal zones are encountered and/or ineffective filtration."

2.4.16 Of the 123 detailed tests, 26 of these tests were carried out on discharges from ships that combined ballast water exchange in conjunction with ballast water treatment. It is unknown why the combination of exchange and treatment performed (e.g. due to the implementation of contingency measures for ships failing to treat at the port of origin, the implementation of a treatment strategy to decrease the risk of non-compliant discharge, or a misunderstanding from the ship about the regulations or internal procedures).

2.4.17 Seven data sets examining the D-2 discharge standard were submitted that had used indicative analysis. Given the low number of samples analysed (all from a single Administration) and limited details provided, it was not possible to draw any meaningful conclusions with regard to indicative analysis.

Ballast water exchange

2.4.18 Administrations provided 71 sets of data with respect to regulation D-1. As mentioned previously (see footnote 9), this figure included 22 discharges from ships with an installed BWMS that was not in use. Though there is no requirement for quantifying organisms in discharges from ships managing their ballast water using ballast water exchange (regulation D-1), the data submitted with tests performed on samples from ships meeting the D-1 standard provide some insights.

2.4.19 While most of these samples were 20 L or less (far below the 3 m^3 sample volume typically needed to provide statistical confidence for the > 50 µm size class), some samples from discharges that had undergone ballast water exchange were analysed with respect to the D-2 standard with using detailed or indicative analysis (in the latter case, results were reported as pass or fail). Though a sample of 20 L or less would be considered invalid when looking for very few organisms in very large volumes (i.e. ≥ 50 µm size class in treated ballast water), small sample volumes with very high concentrations of organisms would indicate clear exceedance of the D-2 standard. The submitted observations suggest that only 33% of ships conducting ballast water exchange (for compliance with regulation D-1) had levels of organisms in discharged ballast water that could be considered in compliance with the D-2 standard, a significantly lower percentage than that of discharges from ships using a BWMS (68% or 78% as reported by Administrations and testing organizations, respectively, as discussed in paragraph 2.4.10 and paragraph 3.5.6). In fact, it was reported that ballast water discharges from ships having conducted ballast water exchange could have as many as 55,800 organisms/m^3 in the ≥ 50 µm size class, more than 5,000 times the discharge limit.

Ballast water oxidant analysis

2.4.20 Information related to chemical discharges (in particular, oxidizing compounds) during BWMS operations were partially reported in part 3 of the Supplementary Interface. Part 3 allowed the reporting of an average of total residual oxidant (TRO) measurements across multiple discharges and multiple ships. Furthermore, part 4 also allowed Administrations to report a simple yes or no response to the question of whether the maximum allowable discharge concentration (MADC) of the discharged treated ballast water had been exceeded.

2.4.21 Of all submitted data with ships confirmed to have an oxidant-based BWMS, 27% of the discharges reported TRO levels above the MADC. The frequency of TRO discharges exceeding MADC varied greatly from slightly above the limit to very high concentrations (up to > 3 mg/L). It is important to note that the MADC limit has been updated following the GESAMP-BWWG Sixth Stocktaking Workshop (MEPC 68/2/8, paragraph 30.2), as MEPC 68 agreed that the value of MADC for TRO should be changed from 0.2 to 0.1 mg/L (expressed as Cl_2; MEPC 68/21, paragraph 2.41). This change may explain some of the failures observed in meeting the more recent 0.1 mg/L limit during discharges but cannot explain failures with very high TRO levels. It also should be noted that Administrations submitting data have not provided information for the possible cause(s) of TRO failures.

Request by MEPC 77

2.4.22 MEPC 77 requested that this report include an assessment of the relationship between the biological efficacy of BWMS and whether the type approval was carried out in accordance with the BWMS Code or earlier versions of the Guidelines (G8) (MEPC 77/16, paragraph 4.18). Since the Committee's request was not originally included in the EBP, Administrations had not been explicitly asked to provide relevant information in the DGAP interfaces. Additionally, this request was introduced after the established deadline for submission of information (MEPC 77/4/5). Consequently, the specific approval details were not initially available to the WMU team.

2.4.23 However, efforts were made to collect this data. Administrations were asked to submit any documentation, such as copies of Type Approval Certificates, that would allow the WMU team to identify whether the BWMS was approved in accordance with the BWMS Code or earlier versions of the Guidelines (G8).

2.4.24 Out of 123 D-2 sampling and detailed analysis events, whether the type approval was carried out in accordance with the BWMS Code or earlier versions of the Guidelines (G8) was determined for 75 BWMS. The following table summarizes the data and the failures for those BWMS.

Table 4: Compliance with the D-2 standard against known type approval resolution

BWMS approved in accordance with:	Resolution	Number of fails	Number of passes
Earlier versions of the Guidelines (G8)	MEPC.125(53)	0	1
	MEPC.174(58)	27	42
	Total	**27**	**43**
BWMS Code	MEPC.279(70)	2	0
	MEPC.300(72)	2	1
	Total	**4**	**1**

2.4.25 The uneven distribution of data (particularly the lack of data for the BWMS Code) prohibited meaningful comparisons between earlier versions of the Guidelines (G8) and the BWMS Code. In addition, because many independent factors may affect whether a ship's ballast water discharge meets the D-2 standard, such an analysis might not be meaningful without knowing the complete history of the BWMS and its operation (particularly years after installation).

2.4.26 While, in theory, whether the type approval of BWMS was carried out in accordance with the BWMS Code or earlier versions of the Guidelines (G8) could play a role in their performance and reliability on board ships, many other variables impact a ship's ability to comply with discharge standards, including selection and installation, system integration, contamination risk, system limitations, adherence to operational instructions, maintenance and repair, history of use, uncertainties in sampling and analysis, etc.

Additional considerations and information

Feedback from ships' crews

2.4.27 In part 4 of the supplementary interface, the DGAP invited feedback from ships' crews such as "ship reports difficulty with BWMS operation/maintenance in general (Y/N)".

2.4.28 Of the responses received, 12.5% of ships' crews reported "difficulty with BWMS operation/maintenance in general" (19 out of 151 responses from ships installed with a BWMS, whether in use or not). From the 19 crews who reported difficulties to maintain/use the BWMS, 37% of those ships (seven) failed to meet the discharge standard.

2.4.29 This feedback from Administrations regarding ship crew perspectives suggested a significantly lower frequency of difficulties (12.5%) than the data reported in an industry survey, which indicated 73% of BWMS had problems or were not in good order (as reported in the stakeholder submissions, paragraph 3.6.5). With the information available, it is not possible to reconcile these to varying levels of difficulties or problems reported; individual interpretations on what is considered in good order, difficulties, problems, etc., preclude a more detailed assessment.

Ballast water holding time

2.4.30 There was no correlation between the length of time ballast water was held in ships' ballast tanks and the number of organisms in the ≥ 50 µm size class for discharge samples found to be either in or out of compliance. This analysis was not carried out for the 10 - 50 µm size class or indicator bacteria because there were too few failures in these categories to have statistically significant results.

BWMS alarms

2.4.31 The information provided by Administrations indicated that BWMS alarms occurred during 10% of the ballast water discharges tested. In 59% of non-compliant discharges some sort of alarm informed the operators that issues may be present with the treatment. This suggests that 41% of non-compliant discharges occurred when the BWMS appeared to be operating as intended (at least during the discharges for which testing teams were on board).

2.4.32 However, the structure of the DGAP interface did not offer the opportunity for Administrations to record the type of alarms, which may vary from one system to the next. To

date, there is no standard terminology or interface/reporting structure developed to render the work of the crew and the PSC easier (MEPC 77/INF.16).

BWMS sensor calibration

2.4.33 BWMS include multiple types of sensors to manage operations and treatment performance. Therefore, instrument calibration is important for ensuring that BWMS are operating appropriately and within specifications. The BWMS Code requires that a calibration certificate,[13] confirming the date of the last sensor calibration check, shall be retained on board for inspection purposes (resolution MEPC.300(72), paragraph 4.10).

2.4.34 The information reported by submitting Administrations regarding sensors is difficult to assess because it lacks clarity in calibration frequency. For example, some Administrations submitted information with dates as stated on the calibration certificate but the date of the inspection was unknown. Other Administrations used time ranges since the last inspection was conducted, though not all ranges were exact and thus not comparable. In addition, the calibration of some sensors were reported as being much older than 12 months (including some up to 9 years old) and some simply recorded as "not calibrated". Therefore, it was not possible to establish the number or proportion of ballast water sensor certificates that were consistent with the BWMS Code.

Additional information from one Administration

2.4.35 One Administration submitted information directly to WMU as a presentation rather than in the DGAP format. The presentation advocated for mandatory monitoring of ballast water to ensure that ships operate the BWMS in accordance with their specifications and maintenance requirements. This Administration suggested that, due to their consistent enforcement of testing for compliance, their level of compliance (97%) is much higher that reported by other Administrations.

2.4.36 However, the submission did not detail the methods and protocols used for compliance verification, though it suggested sampling from in-line sampling ports. Given the structure of this submission and its content, it was not possible to assess this information in the context of data submitted by other Administrations.

2.5 TRIAL PERIOD INTERFACE

2.5.1 Three Administrations submitted data for the trial period interface providing information on sampling, analysis and compliance monitoring devices (CMDs) and, in some cases, comparing indicative analysis results with those of detailed analysis. Administrations reported that indicative sampling using CMDs and detailed analysis were both feasible in relatively short times after the collection of a representative sample.

2.5.2 One Administration noted that sampling large volumes of ballast water could be considered the main limitation of compliance testing (whether indicative or detailed analysis was used) and no straightforward practical guidelines on how to take samples exist (e.g. addressing minimum volumes and recommendations for replicates). Another Administration reported that it is relatively common for sampling port arrangements on ships to be installed incorrectly and that they are not standardized, which can affect or hinder the sampling process. When comparing sampling approaches, one Administration reported that discrete or grab samples (as opposed to representative in-line sampling) can result in highly variable

[13] Refer to General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025:2017).

measurements (e.g. between the beginning, middle and end of the ballast water discharge). It should be noted that ISO has been developing standards for different aspects of ballast water sampling and compliance monitoring.[14]

2.5.3 One Administration reported that the cost of compliance testing using detailed analysis could be relatively low, if laboratories were equipped with appropriate staff and equipment (e.g. epifluorescence microscopes for analysis using FDA/CMFDA), but could become expensive if the equipment did not already exist in the laboratories. Setting up analytical capabilities (indicative and/or detailed) could be cost prohibitive.

2.5.4 One Administration reported their conclusion that CMD analysis for compliance testing of the 10 – 50 µm size class is currently unreliable, based on comparisons with detailed analysis. However, as described in section 2.4, the results from detailed analyses submitted to the EBP suggest that failures in this size class are rare.

2.5.5 Only one CMD referred to in the submitted data employed a method capable of analysing all size classes of the D-2 standard. However, it was reported that false positives for indicator bacteria may be a concern for this type of CMD.

2.5.6 It was also reported that the costs of CMDs evaluated by Administrations ranged from €5,000 to €20,000.[15] The provided information also suggests that the cost of consumables may impact the overall operational costs of using these devices.

2.5.7 One Administration reported that, following a potential non-compliance using indicative analysis, the sampling process for detailed analysis may require the discharge of significant quantities of ballast water into the receiving port environment. In this scenario, given the possibility of significant discharge before results are available, proceeding with detailed sampling may present an unacceptable risk for both biological and chemical related discharge. Thus, sampling and analysing for compliance may not always be possible during PSC inspections.

2.5.8 Document MEPC 77/4/3 (Canada) suggested improving the practicality of compliance assessment and enforcement from the perspective of ships, flag States, and port States by considering the feasibility of three items. These are (a) assessing and enforcing compliance with the performance standard through sampling and analysis during PSC, (b) assessing and enforcing correct installation, operation and maintenance of a BWMS during PSC, and (c) independently verifying BWMS performance on a regular basis outside of PSC.

2.6 STAKEHOLDER INTERFACE

2.6.1 One Administration submitted two comments by stakeholders originating from shipowners. One suggested that, given the extensive BWMS type approval testing prior to their use on ships, the scope of commissioning testing should be reconsidered in the future. The other mentioned potential value to shipowners in being able to refer to GISIS for maintenance items regarding a BWMS.

[14] Ships and marine technology — Aquatic nuisance species — Part 1: Ballast water discharge sample port; Part 2: Ballast water sample collection and handling - https://www.iso.org/standard/74748.html

[15] Document MEPC 74/INF.18 (IMarEST) suggested a similar range of equipment costs.

3 COMPLEMENTARY DATA

3.1 INTRODUCTION

3.1.1 To complement the information from stakeholders provided through the Administrations, the WMU team identified and engaged with potential sources of complementary data for the EBP, and provided an avenue for stakeholders to submit input directly to WMU (MEPC 76/4/3 and BWM.2/Circ.74). Anonymity was prioritized per paragraph 3.5 of the DGAP and, thus, only summaries and trends from stakeholder submissions are reported here, with no names of individuals or organizations.

3.1.2 This chapter presents a summary of data and information submissions that were submitted in response to specific requests for information issued by the WMU team. Data was submitted by a port State that is a non-Party to the Convention, six non-governmental organizations (NGOs) with consultative status at IMO, and two port State control Memorandums of Understanding (MoUs). Additionally, this chapter summarizes additional information received related to the EBP that was collected for other purposes and/or end users.

3.2 DATA FROM RECOGNIZED ORGANIZATIONS

Introduction and data summary

3.2.1 The secretariat of an NGO with consultative status at IMO contacted its members with a request to provide consolidated data on surveys performed on behalf of flag States by recognized organizations (ROs). The NGO was invited to submit consolidated data in the same format used by flag States, which was amended slightly to facilitate data reporting by its members.[16] The submission contains 12 datasets and is summarized in Table 5. Differences from Appendix A of the DGAP are identified in italics and explained in footnotes.

3.2.2 The consolidated data from ROs is presented separately from the flag State data presented in section 2.2 because there is an inherent risk of data duplication with flag State data[17] and potential transfer of class during the reporting period.

3.2.3 Importantly, the findings from this supplementary data are, in general, consistent with those from the data provided by flag States.

[16] In addition to these amendments, Part 3 of this template (reported accidents and defects) was not included.

[17] Members of this NGO are often contracted to carry out inspections on behalf of flag States, thus, data provided by some ROs may have already been reported by the flag States.

Table 5: Summary of data submitted by ROs

Part 1: Fleet and its ballast water management plans			**Response**
Members submitting data			12 ROs
Ships to which Convention applies:	Total number of ships	Container ships	4,156
		Bulk carriers	9,221
		Tankers	7,931
		Ferries	375
		Cruise ships	326
		Other (attached details)	11,318
	Number currently certified to regulation D-2		16,700
	Number fitted with BWMS	Electro-chlorination	5,874
		Ozonation	161
		Other chemical injection	874
		Ultraviolet	5,883
		Other	788
Approved ballast water management plans	Total number of approved plans		25,995
	Number of approved plans that include:	D-1 procedures	14,866
		Contingency measures	1,926
		Exemptions (regulation A-4)	8
		Other methods (regulation B-3.7)	21
		Use of reception facilities (regulation B-3.6)	1
		Prototype BWMS (regulation D-4)	8
Part 2: Outcome of ballast water surveys			
Number of surveys undertaken		Initial	25,622
		Annual	85,374
		Renewal	22,789
		Intermediate	24,105
		Additional[18]	*13,562*
Deficiencies noted during these surveys (even if later resolved)		Mechanical	386
		Physical	24
		Treatment process	85
		Electrical	185
		Piping	13
		Location	1
		Maintenance and cleaning	80
		Sampling facilities	2
		Other (attach details)	512
		Unspecified[19]	*110*

[18] The NGO included a category for additional surveys, in line with regulation E-1 of the Convention.
[19] This section was added to incorporate data with uncategorized deficiencies.

Part 1: Fleet and its ballast water management plans

Ships to which the Convention applies

3.2.4 The data provided by this NGO comprises a total number of 33,327 ships to which the Convention applies. The distribution of ship types inspected is similar to that provided by flag States, as shown in Figure 8, with bulk carriers, tankers and containerships representing the largest categories. Some members of this NGO listed a number of ship types in the "other" category, which included various cargo and passenger carriers, fishing vessels, and other specialized ship types.

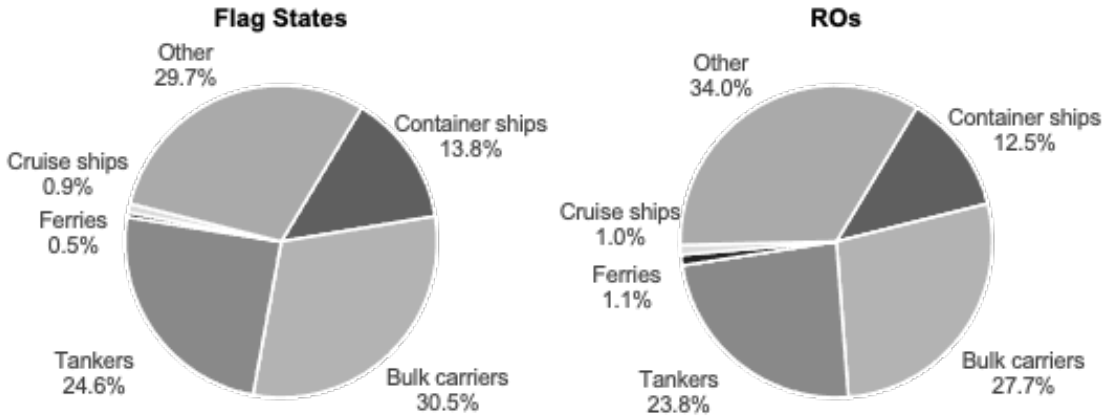

Figure 8: Distribution of ships by type as reported by flag States (left) and ROs (right)

3.2.5 The NGO recorded a total of 16,700 ships "currently certified to regulation D-2" which constitutes 50.1% of the ships to which the Convention applies at the time of reporting.

3.2.6 When distributing the BWMS by technology or treatment types, the consolidated data shows 13,580 ships fitted with BWMS compliant with the D-2 standard.[20]

3.2.7 The distribution of treatment types provided by ROs indicates that BWMS based on either ultraviolet irradiation or electro-chlorination disinfection are the most common currently in use (Figure 9), which is consistent with the flag State data (section 2.2), known industry trends, and recent peer reviewed publications.[21] Under "other", the NGO members listed numerous treatment types including pasteurization, membrane separation, and deoxygenation.

[20] This number differs from the total number of D-2 certifications reported (16,700), which may be due to factors including a lack of data on types of systems installed or difficulties in obtaining records.

[21] Gerhard, W. A., Lundgreen, K., Drillet, G., Baumler, R., Holbech, H., & Gunsch, C. K. (2019). Installation and use of ballast water treatment systems–Implications for compliance and enforcement. Ocean & Coastal Management, 181, 104907.

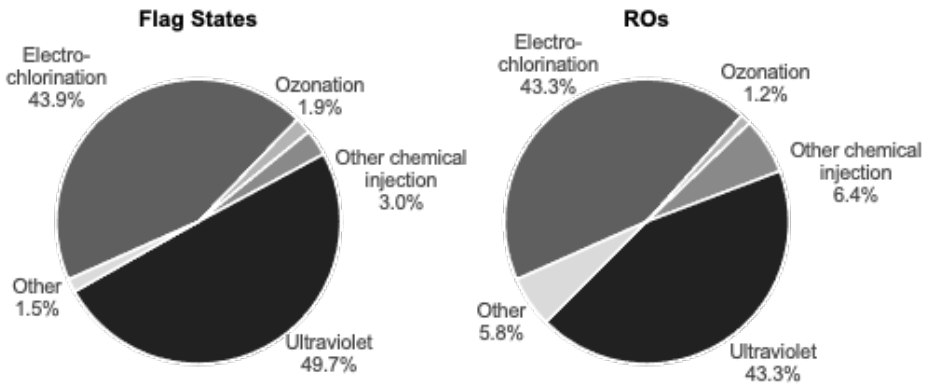

Figure 9: Ballast water management systems by type for flag States (left) and ROs (right)

Approved ballast water management plans

3.2.8 Members of the NGO reported a total of 25,995 approved BWMPs. Of these, the majority of the approved BWMPs (57.2%) included ballast water exchange in accordance with D-1 procedures while 7.4% included contingency measures. These percentages were somewhat smaller than those submitted by flag States (71.6% and 49.2%, respectively).

3.2.9 A small number of ships were reported to have received an exemption in accordance with regulation A-4 (0.03%) by ROs, which was even lower than the exemption figure provided by Administrations (1.2%, paragraph 2.2.12).

3.2.10 The number of approved BWMPs does not match the total number of ships to which the Convention applies (33,327 ships reported) because certain ROs were unable to provide information on the total number of approved BWMPs due to difficulties in retrieving the data in time to be included in this report.

Part 2: Outcome of ballast water surveys

Number of surveys undertaken

3.2.11 The NGO reported 171,452 surveys undertaken. The most common type of surveys are annual surveys (49.8%). This was consistent with that reported by flag States (55.2%), as shown in Figure 10, while noting that the ROs also included additional surveys in line with regulation E.1 of the BWM Convention.

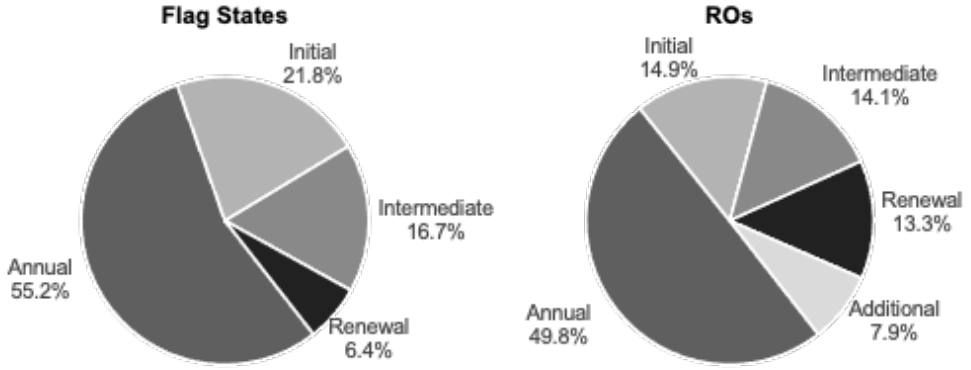

Figure 10: Distribution of surveys by type for flag States (left) and ROs (right)

Deficiencies noted during surveys

3.2.12 The NGO reported a total of 1,398 deficiencies out of 171,452 surveys, representing a maximum rate of non-compliant surveys based on the reported data of 0.8%. Though one deficiency per survey cannot necessarily be assumed, this would represent a conservatively high estimate of non-compliant surveys. This value is consistent with the maximum rate of non-compliant surveys based on data from flag States (1.1%, section 2.2).

3.2.13 The known identified deficiencies gathered by the NGO indicate that mechanical, electrical, treatment process, and maintenance and cleaning deficiencies are the most common, which is also similar to the data from flag States, as shown in Figure 11.

3.2.14 Issues listed in the "other" category included, inter alia, missing entries in the ballast water record book and inoperative BWMS. However, unknown faults were also classified under "other", suggesting an unknown amount of overlap with the "unspecified" category. The "other" and "unspecified" categories rank first (36.6%) and fourth (7.9%), respectively.

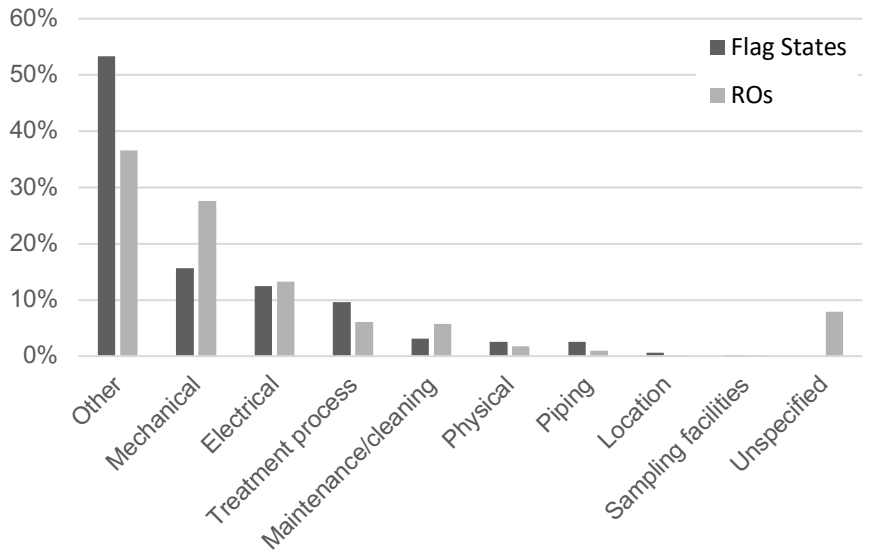

Figure 11: Reported deficiencies by type noted during surveys as reported by flag States and ROs

3.3 PORT STATE CONTROL DATA FROM AN ADMINISTRATION NOT PARTY TO THE CONVENTION

3.3.1 One Administration not Party to the Convention provided data in response to the EBP request for information. The data was compiled from the Administration's Port State Control Annual Reports from 2017 to 2020 in cooperation with the Administration's Port State Control Division.[22]

3.3.2 The data covers 16,369 ballast water management related inspections from 2017 to 2018, and, based on available data, the total estimate for the number of BWM inspections was estimated to be approximately 30,000 for 2017 to 2020.[23] The conservative hypothesis of a

[22] Detailed deficiency data from 2019 was not available except for the total number of ballast water deficiencies. Thus, the subtotal for deficiencies by category does not match the total number.

[23] While the exact number of ballast water inspections was available for 2017 and 2018 only, the total number during the period from 2017 to 2020 was estimated based on the known total number of PSC inspections per year and stable trends with regard to enforcement action during this period.

single deficiency per inspection suggests that, as a minimum, approximately 98% of inspections are satisfactory, which is in the same range as reported by the port States in section 2.3.

3.3.3 Deficiencies reported using the categories of the port State are listed in Table 6 and shown graphically in Figure 12.

Table 6: Reported deficiencies by port State category

Deficiencies	From 2017 to 2020
Total number of ballast water deficiencies	**588**
Subtotal of deficiencies identified by category	444
BWMS deficiencies	45
BWMP deficiencies	42
Ballast water reporting deficiencies	19
Mandatory practices deficiencies	65
Discharges deficiencies	63
Implementation schedule deficiencies	5
Training deficiencies	5
Record keeping deficiencies	1
Alternative management method	64
Sediments	12
Extraordinary condition claims	3
Water management	4
Ballast water exchange	17
Ballast water retention	1
Submission of report	26
Ballast water reporting form	17
Ballast water logs/records	55

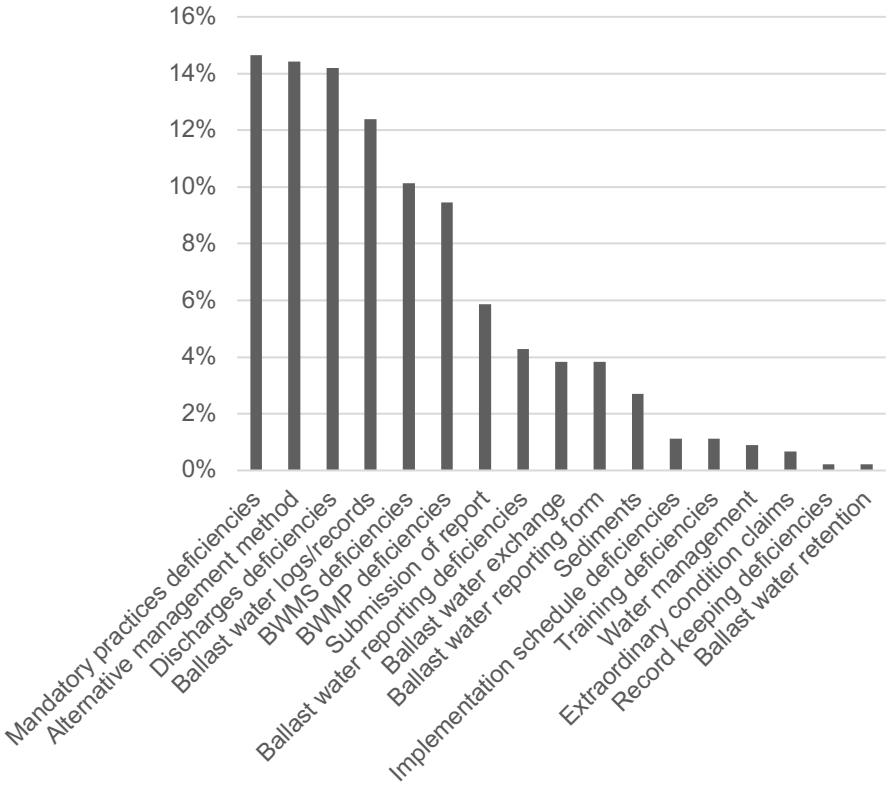

Figure 12: Reported deficiencies by port State category

3.3.4 As the categories of deficiencies were not identical to those set out in the DGAP, direct comparisons were not made with the port State data from Parties to the Convention (section 2.3) or MoUs (section 3.4).

3.3.5 In addition to reported deficiencies, this port State provided information related to enforcement action. Notably, this port State has implemented civil penalties for violations, as reflected in Table 7.

Table 7: Enforcement actions (2017 to 2020)

Enforcement actions	From 2017 to 2020
Letter of Warning	28
Notice of Violation	46
Civil Penalty	32
Total number of enforcement actions	**106**

3.4 DATA FROM PORT STATE CONTROL MEMORANDUMS OF UNDERSTANDING

3.4.1 Two port State control (PSC) Memorandums of Understanding (MoUs) submitted data to the EBP. The following table categorizes the deficiencies related to the BWM Convention from 1 November 2020 to 31 October 2021 for MoU One and from 1 November 2017 to 31 November 2021 for MoU Two. This data is summarized in Table 8.

Table 8: Summary of ballast water related deficiencies noted by MoUs

Deficiencies	MoU One	MoU Two
Number of unsatisfactory ballast water inspections	527	2,970
Number of ships with unsatisfactory ballast water inspections	512	2,495
Ballast water deficiencies noted during PSC		
Ballast water management plan	97	495
Ballast water record book	354	1,926
Construction dates applicable for BWM	3	2
Ballast water exchange	67	174
Sediment removal and disposal	3	6
Crew training and familiarization	60	466
Performance standard not met	4	1
Prototype ballast water treatment	1	1
Conditions for exemptions	1	3
Ballast water discharge violation in port	18	16
Ballast water management system	20	61
Other	11	139
Certificate and documentation	32	131
Total deficiencies	**671**	**3,421**

3.4.2 Generally, the results show similar trends between both MoUs. Issues with the ballast water record book, ballast water management plan, crew training and familiarization, and ballast water exchange are the four main areas with the highest numbers of deficiencies registered, which is consistent with PSC data from individual Administrations (section 2.3).

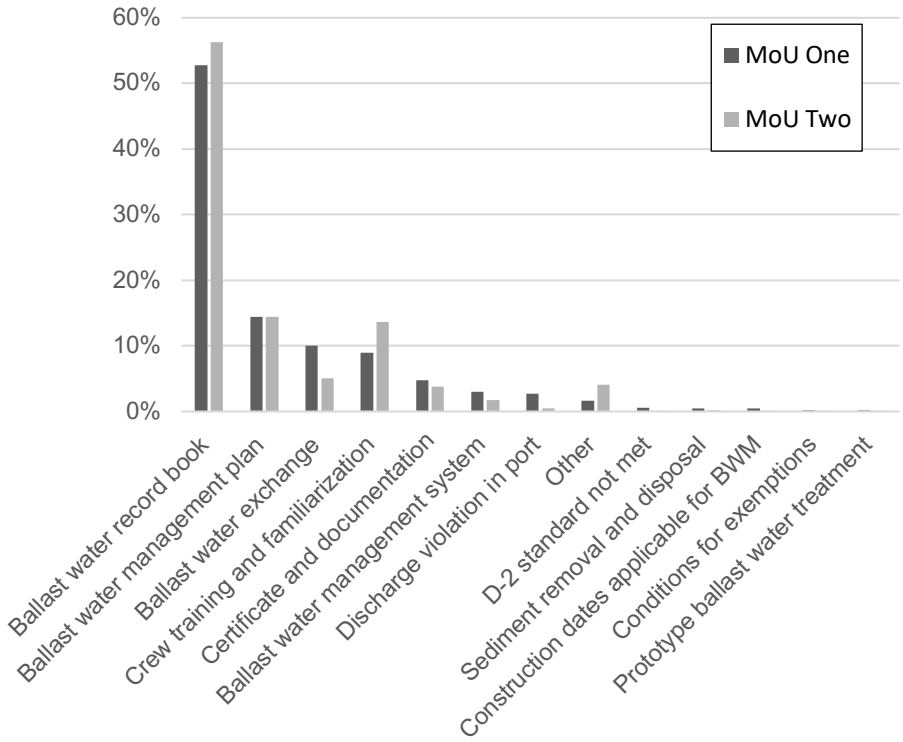

Figure 13: Reported deficiencies by category for the two MoUs

3.5 DATA FROM TESTING ORGANIZATIONS

3.5.1 Consolidated data was submitted by an NGO with IMO consultative status on behalf of seven of its members (independent testing organizations). The data submitted was from the sampling and analysis of discharged ballast water from ships, and indicated the proportion of ballast water discharge samples that did or did not meet the D-2 performance standard. This dataset provided information from 838 discharges from ships (excluding shipboard type approval testing data) which was collected after the entry into force of the Convention.

3.5.2 Separately, one testing organization not a member of the NGO above, submitted 18 sets of D-2 test data, for a total of data from 856 ballast water discharges.

3.5.3 In total, these combined discharge records came from 722 ship BWMS commissioning tests (designed for assessment of proper BWMS initial installation) and 134 compliance monitoring tests (designed to identify if a ship's discharge meets the D-2 standard during normal operation). Of the 134 compliance monitoring tests, 11 were identified as already having shared data/results with IMO as part of document MEPC 75/INF.11 and corrigendum (Singapore) and 24 were already shared with IMO as part of document MEPC 76/INF.56 (Australia).

3.5.4 Information on the protocols used for the commissioning tests and compliance monitoring tests was shared by the association of independent testing organizations. Some information on the protocols was also shared by the additional testing organization.

3.5.5 Since the fundamental purposes of commissioning tests and compliance tests are different, and often employ different sampling and analytical methods (sampling procedure, volume of samples, indicative/CMD vs. detailed analyses), data from the two types of tests was kept separate. A summary of the combined submissions from testing organizations is presented in Table 9.

Table 9: Summary of data submitted by test organizations

Parameters	Commissioning tests	Compliance tests
Total number of tests	722	134
Percentage of discharges meeting the D-2 standard	80%	78%
Percentage of discharges exceeding Maximum Allowable Discharge Concentration (MADC) for total residual oxidants (TRO) (for ships with BWMS making use of Active Substances)	8%	34%
Percentage of failed tests involving exceedance in the ≥50 µm size class	81%	93%
Percentage of failed tests involving exceedance in the ≥10 µm and <50 µm size class	8%	14%
Percentage of failed tests involving exceedance for *E. coli*	7%	0%
Percentage of failed tests involving exceedance for Enterococci	6%	0%
Percentage of failed tests involving exceedance for *V. cholerae*	0%	0%

3.5.6 The proportion of discharges compliant with the D-2 standard as reported by the testing organizations is broadly similar to, though slightly higher than, that reported by Administrations (78-80% from testing organizations versus 68% from Administrations, paragraph 2.4.10). However, the specific causes of individual samples exceeding the D-2 standard could not be discerned from the data available.

3.5.7 Though commissioning testing data were considered separately from compliance testing, the ≥ 50 µm size class was consistently the source of most failures across the different submissions to the EBP. This is in line with the findings from the supplementary interface (paragraph 2.4.12).

3.5.8 Some testing organizations reported that, when a discharge failed to meet the limit for the 10 - 50 µm size class, it was always accompanied by a failure to meet the discharge standard for the ≥ 50 µm size class as well.

3.5.9 Bacteria were found to exceed the discharge standards in less than 10% of tests. *V. cholerae* failures were not observed in any data submitted, but it is unclear how often samples were analysed for toxigenic strains of *V. cholerae*.

3.5.10 While specific causes of (and solutions to) failures to meet the D-2 standard could not be identified in this report, the submission from the NGO highlighted seven potential sources of failures to use as a basis for further investigations:

.1 contamination inherent to presence of organisms in tanks (no cleaning of tanks at commissioning and regrowth);

.2 BWMS running outside system design limitations (SDLs);

.3 BWMS holding time not met;

.4 BWMS not maintained (spare parts and consumables not up to date);

.5 BWMS not used in accordance with manufacturer instructions (including untrained crew);

.6 contamination from mixing treated water with untreated water; and

.7 inadequate BWMS installation (e.g. sizing, installation of sensors, wrong 3D installations, contamination from leaky valves)

3.5.11 One individual member of this NGO also submitted additional information noting that, when failures were found using indicative analysis, a subsequent detailed analysis of the same samples frequently found compliance with the D-2 standard. This observation is similar to a statement from testing organizations supporting the use of detailed analysis as a priority assessment approach, because of current uncertainties associated with indicative analysis (and CMDs) and the fact that detailed analysis is used in the type approval testing of BWMS (thus providing direct comparability between BWMS type approval testing and ship compliance testing).

3.5.12 In addition to information on meeting the D-2 standard, data was also provided on discharge of biocides (specifically oxidants) to local waters associated with treated ballast water. The frequency of discharges with TRO levels higher than the MADC is similar to what Administrations reported (27% exceeding MADC, paragraph 2.4.21). Without additional extensive information from testing organizations, it was not possible to explain the observed failures of some ships to discharge treated ballast water with TRO levels below MADC.

3.6 ADDITIONAL DATA RELATED TO THE EBP

3.6.1 Over the past few years, several independent stakeholders have collected data on the implementation of the Convention for their own internal use and consideration or to satisfy specific objectives. Some stakeholders submitted information to the WMU for consideration as part of the EBP.

3.6.2 Three of the stakeholder submissions focused on implementing the Convention and BWMS operational considerations from the shipping industry's perspective. Without complete access to methodology and raw data, the quality and consistency of the submission's supporting claims and conclusions could not be assessed, but industry surveys and individually submitted comments identified perceptions and trends.

3.6.3 While some specifics and details were provided (e.g. issues with control and alarm systems; software, filters, and sensors performance; spare parts and maintenance), in general the most common mentioned concerns, revealed by industry surveys conducted during the EBP period, were with:

.1 significant percentage of BWMS installations presenting operational problems (including some inoperative BWMS);

.2 lack of sufficient ship crew training on installed BWMS; and

.3 insufficient vendor support for maintenance and calibration of installed BWMS.

3.6.4 One extensive industry operational experience survey was completed in 2020. This survey was intended to understand industry progress toward compliance with the Convention and to assemble insights and opinions on operational challenges associated with different BWMS. Survey responses were received from more than 60 ship owners from around the world, representing a total of 943 BWMS installed on 845 ships.

3.6.5 From the information collected, 10 treatment technology types and 21 BWMS models were specified. Their survey results suggested that, at the time (2020), 16% of BWMS installations were "not working" while another 57% were working but with "some issues experienced", often related to control systems or filtering operations. Conversely, 27% of BWMS were reported in "good order" with no problems experienced. The survey results also suggested that BWMS retrofits may operate more reliably than BWMS installed during ship construction.

3.6.6 Finally, this industry survey also suggested that: (a) there is no "one-size-fits-all" BWMS solution; (b) rigorous BWMS type approval testing and certification does not guarantee trouble-free operation; and (c) proper installation and commissioning, crew training, maintenance and operation (within the system design limitations) are all critical for achieving compliance.

3.6.7 Another stakeholder submission was a series of combined ambient water quality information, for water from 44 countries where port waters are considered challenging for BWMS operations. The data set included observations received from 366 individual events using subjective descriptors of the water quality (e.g. "muddy", "clear", "turbid"). The observations shared suggest that BWMS operational problems can occur during ballasting or deballasting in such challenging waters. This is in line with previous reporting (e.g. filter clogging or high differential pressure, low UV-I alarms, TRO alarms at inlet and discharge), and supports the idea that highly variable water quality conditions (in ports around the world) can present obstacles to consistent and effective BWMS operations for certain technologies.

3.6.8 Conclusions based on the specific information provided for challenging water conditions could not be made at this stage. Indeed, "challenging water" has not been defined by the Convention beyond type approval testing conditions described in the BWMS Code (resolution MEPC.300(72)). Additionally, it remains unclear if water quality characteristics are the only factor affecting BWMS efficiency if designed, installed, operated and maintained appropriately. Some BWMS approved technologies with System Design Limitations/operational limitations may be fully functional under such conditions.

3.6.9 Another stakeholder submission provided information on CMDs based on the stakeholder's own internal evaluations of instrument or kit performance for the indicative analysis of organisms (10 – 50 µm size class) in UV treated ballast water and compared to detailed analyses. While this information may be useful in the development of test protocols for the approval of such technologies for compliance monitoring purposes, it was not possible to draw definitive conclusions on the performance of each of these CMDs to be used by testing organizations and port States in this report.

4 ACKNOWLEDGEMENTS

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Moreover, the authors wish to equally acknowledge the participation of all PSC MoUs and other stakeholders that contributed to and/or supported the EBP, noting that some PSC MoUs were not able to contribute data directly but, through their intervention, some of their individual Member States did.

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