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Self-diagnosis method as an assessment tool for environmental management of Brazilian ports *

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ABSTRACT

This study aimed to provide an alternative approach for the use of a situational diagnosis to evaluate the environmental management systems of the main Brazilian ports. Through this diagnosis, both the enabling factors and barriers to the implementation of an effective environmental management system were identified. The study design was based on Self-Diagnosis Method (SDM) developed by EcoPorts, with the application of a survey on issues involving the various aspects of environmental management scenarios. The responses to the surveys were analyzed using the SWOT matrix in order to identify the strengths, opportunities, weaknesses and threats to the environmental management of the ports under study. Then, gap analysis was performed in order to determine the actions that should be taken for management to evolve from an unsatisfactory status to a desired status. Analysis of the questionnaires revealed a tendency of respondents to minimize the negative aspects of environmental management, and to emphasize the positive aspects. There was also an inconsistency between the responses to the questionnaire and the actions that have actually been taken by the port authorities. This disparity suggests that managers are not willing to confront their problems publicly. The results demonstrated that there is a need for an adoption of the conceptual pillars of Environmental Management in the management of Brazilian ports, as well as for the awareness among all stakeholders involved in the activities, from workers to senior management.

Keywords: environmental management; ports; environmental diagnosis; environmental checklist

RESUMO

Método de auto-diagnóstico como ferramenta de avaliação da gestão ambiental em portos brasileiros

Este trabalho teve como principal objetivo oferecer uma alternativa metodológica para a realização de um diagnóstico da Gestão Ambiental Portuária dos principais portos brasileiros. Através desse diagnóstico foi possível determinar os aspectos facilitadores e os entraves para a implantação de uma gestão ambiental. O método utilizado foi baseado no auto-diagnóstico desenvolvido pela ECOPORTS, com a aplicação de um questionário envolvendo questões relacionadas à gestão ambiental portuária. Foram avaliados os portos de Santos (SP), Itaguaí (RJ), Rio de Janeiro (RJ) e Fortaleza (CE). A análise das respostas ao questionário foi realizada através da matriz SWOT, que permite identificar os pontos fortes, oportunidades, fraquezas e ameaças à gestão ambiental dos portos em estudo. Em seguida, foi utilizada análise Gap para determinar as ações que devem ser tomadas para evoluir de uma gestão insatisfatória para uma gestão desejada. A análise dos questionários evidenciou uma tendência dos respondentes em minimizar os aspectos negativos da gestão ambiental portuária, enfatizando os positivos. Além disso, pode-se identificar uma inconsistência entre as respostas dadas ao questionário e as ações que realmente são tomadas pelas autoridades portuárias, ficando claro que os gestores não estão dispostos a confrontar seus problemas publicamente. Os resultados demonstraram que há uma necessidade urgente de internalização dos pilares conceituais da gestão ambiental na gestão dos portos brasileiros, com a conscientização de todos os atores relacionados com a atividade, desde a alta administração, incluindo todos os níveis de trabalhadores.

Palavras-chave: gestão ambiental; porto; diagnóstico ambiental

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1. Introduction

Port activities can have both effective and potentially negative environmental impacts during their installation and operation phases. Such impacts include the suppression of vegetation, emission of particulates and gases into the atmosphere, noise generation, the production and release of solid and dangerous wastes, discharge of effluents and wastewater into the environment, and negative effects resulting from dredging, soil contamination, and oil and chemical spills (Wooldridge *et al.*, 1999; Xue *et al.*, 2004, Caplat *et al.*, 2005, Saengsupavanich *et al.*, 2009). Due to these consequences, the stakeholders responsible for and involved in port management have recently begun to consider new actions to support environmental sustainability of port activities. These measures form an extensive list that includes environmental certification, an environmental agenda for the port, the implementation of programs and/or environmental management systems, and environmental licensing.

Environmental management of the ports is made up of administrative and operational programs that seek to protect the environment, workers, the port community, and users of the port, as is the case of some environmental management programs conducted mainly in European ports as ECO-Information, NOMEPorts, PEARL and PORTOPIA. This management plans considers aspects such as the management of solid and liquid wastes, air emissions, and the management of dangerous cargo, in addition to the synthesis of port development, regional environmental contexts, and public policies (Kitzmann and Asmus, 2006). Environmental management of ports represents an important tool for supporting port managers in the minimization or mitigation of environmental impacts caused by port activities.

Despite the importance of conducting environmental management of ports, few Brazilian ports have a satisfactory environmental management systems (Cunha *et al.*, 2006; Kitzmann and Asmus, 2006). The necessity of keeping the port activities going hinders the imposition of sanctions, as do political interferences and the lack of enforcement of environmental laws. All of these factors contribute to the inadequacy of the ports' environmental management systems.

The lack of information on port environments and their agents and users, as well as the deficiencies in the flow of internal and external information, all lead to difficulties in the establishment of efficient environmental management. Problems such as the lack of senior management committed to environmental goals and the difficulty in understanding what sustainability is hinder

the establishment of a culture of environmental management in Brazilian ports (Donaire, 2009).

The steps for implementing an environmental management system include planning, action, evaluation, and, if necessary, corrections to these plans and a new cycle of planning and action, in which the measures established during the planning stage will be put into practice. In the planning stage, the environmental aspects, their potential impacts, the action plans, and the goals and objectives must all be identified. Thus, the preparation of an environmental diagnosis should be the first step taken in the environmental management of ports (Roman and Royston, 2007). In the case of ports, the environmental diagnosis must consider all aspects to be controlled by the port in order to allow for the implementation of control and management plans that are based on reliable, detailed, and robust knowledge (Wooldridge *et al.* 1999; Grota, 2009.).

There are different approaches to achieving environmental diagnosis for ports, and one is Self-Diagnosis Method (SDM), developed by EcoPorts. EcoPorts was created through an initiative of the European Sea Ports Organization (ESPO) in an attempt to integrate the environmental and economic needs of European ports (Roman and Royston, 2007). The diagnosis generated through this analysis can determine both the enabling factors and the barriers to the implementation of effective environmental management systems. An important feature of this method is the ease of implementation and therefore the straightforwardness of the evaluation, since it was formulated by the port itself. Moreover, this method is flexible and can be adapted to the specific conditions of each port.

Despite the importance of environmental diagnoses in the environmental planning of ports, the Brazilian ports have not made efforts toward this issue. This lack of effort represents a barrier to environmental management. The main objective of this investigation was to make a situational diagnosis of the environmental management systems in some of the main Brazilian ports based on Self-Diagnosis Method, which was adapted in order to take Brazil-specific factors into account.

1.1. Study area

The choice of ports to be studied was based on the largest amount of traffic during the execution of the research and application of questionnaires (2011). The data on the movement of the main Brazilian ports was obtained from the National Agency of Waterway Transportation - ANTAQ (www.antaq.gov.br).

According to the agency, the ports with the largest amount of traffic in Brazil are the Port of Santos (SP-86

millions of tons), the Port of Itaguaí (RJ-58.1 millions of tons). Other ports that presented great movement in 2011 as the Port of Paranaguá (37.4 millions of tons) and Port of Rio Grande (17.9 millions of tons) were contacted unsuccessfully for the questionnaire. The Port of Rio de Janeiro (RJ-7.706.623t) and the Port of Fortaleza (CE-4.231.826t) was also an object of study in this investigation, since it constitutes important ports of the Brazilian southeast and northeastern region, respectively (Figure 1).



Figure 1 - Locations of the Port of Santos (SP), the Port of Itaguaí (RJ), the Port of Rio de Janeiro (RJ) and the Port of Fortaleza (CE).

Figura 1 - Localização do Porto de Santos (SP), Porto de Itaguaí (RJ), Porto do Rio de Janeiro (RJ) e Porto de Fortaleza (CE).

The Port of Santos is located between the cities of Santos, Guarujá and Cubatão, on the Sao Paulo State coast, and occupies an area of approximately 7.7 million m², according to information provided by the port authority (<http://www.portodesantos.com.br>). The main cargoes handled by the Port of Santos are: sugar, soybeans, containers, coffee, corn, wheat, salt, citrus pulp, orange juice, paper, automobiles, ethanol, and other liquid bulk.

The Port of Itaguaí is located in the Sepetiba Bay, on the coast of Rio de Janeiro state, and occupies a territory of 5.1 km². Its main cargoes are coal, iron ore, mineral concentrates, perishable goods, general cargo, and containers. Meanwhile, the Port of Rio de Janeiro is located in the city of Rio de Janeiro (RJ), presenting 6740 m of wharves and a pier of 883 meters, according to the port authority. The main cargoes handled by this port are grain, scrap iron, pig iron, salt, ore concentrates, liquid chemicals, mineral oils, vehicles, perishable goods, general cargo, crude oil, lubricating oil,

naphtha, and containers (www.portosrio.gov.br). The Port of Mucuripe is located in the Fortaleza Bay, in Fortaleza (CE), and its main cargoes are cashew nuts, carnauba wax, metal, fabrics, fruits, wheat, malt, lubricants, and fuels and petroleum derivatives.

2. Method

To assess the environmental management systems of the ports being studied, a questionnaire was developed based on Self Diagnosis Method (SDM) (Darbra *et al.*, 2004; ECOPORTS, 2004.). This method consists of the application of a questionnaire on the aspects involved in the port authority's environmental management of the ports in order to identify risks and establish priorities for action.

Because the EcoPorts questionnaire was originally developed for European ports, the questions were revised and adapted to Brazilian ports. Issues of legal compliance of the ports were inserted after the main Brazilian environmental regulations were consulted.

Thus, issues related to environmental licensing, development of Environmental Agenda, black smoke control, control of ballast water and project developments for characterization and monitoring of the area where the port is inserted process were included, according to requirements of legislation Brazilian. The remaining questions were maintained according to the original SDM.

The questionnaire includes questions on environmental policy, personnel management and organization, environmental training, internal and external communication, operational management, emergency planning, monitoring and recording of environmental data, and environmental auditing. Most of the questions were multiple choice, in which the manager checked off the most appropriate option for the port he or she represented. The questionnaire also presented a space for other observations to ensure that the particularities of each port would be considered in the analysis (Figure 2). SDM was designed to be both implemented and answered by the manager of the port, but in this study, the questionnaire was administered by a third person (the authors of this paper). Thus, in this case, transparency on the part of respondents was required – we assumed, on principle, that the information provided would be true.

2.1. Data analysis

The information provided by the ports was individually analyzed for each specific topic in order to obtain an overview of the actions, planning and performance of each port. In order to identify flaws, or gaps, in the environmental management of ports, the information obtained was used as input data for gap analysis, which allowed for the establishment of priorities so that the

Subsection A.3. - Environmental Regulation, Port Activities and Aspects

6) Does the Port Authority have an inventory of the most important environmental regulations and requirements related to port activities?

☐ Y ☐ P ☐ N

If NO, go to question 11.

- Is there a specific procedure for revising and updating this inventory?

☐ Y ☐ N

- Is this inventory easily accessible?

☐ Y ☐ N

- Is this inventory distributed to persons of concern in the port?

☐ Y ☐ N

Observations: _____

Figure 2 - Example of questions from the environmental management assessment checklist. (Y) Yes; (P) Partly; (N) No.

Figura 2 - Exemplo de questão presente no questionário de avaliação da gestão ambiental portuária. (Y) Sim; (P) Parcialmente; (N) Não.

issues identified could be incorporated into the environmental management system. Gap analysis is a technique used to determine the actions that should be taken to evolve from an unsatisfactory management system to a desired management system. Gap analysis is performed by comparing the characteristics of the current administration (attributes, skills, performance) with the characteristics necessary to achieve the desired objectives. This process highlights the existing gaps that need to be fulfilled. Identifying these gaps in compliance with legal environmental requirements, such as ballast water management, waste management, audits, environmental permits, and preparation of emergency plans, makes it possible for managers to establish and take the necessary actions in pursuit of legal compliance, thus avoiding penalties or lawsuits. Compliance with the law is a basic condition for any environmental management system, and a lack of compliance with legal environmental requirements can lead to restrictions on the domestic products that can be handled in the ports (Kitzmann and Asmus, 2006).

After Gap analysis, the data was evaluated from a strategic perspective using the SWOT (Strength Weakness Opportunities Threats) matrix. For this analysis, good environmental management practices were classified as "force," the elements that can be avoided or treated as a priority within a program of environmental management were classified as "weakness," and "opportunities" were those actions that have the potential for immediate improvement. "Threats" were defined based on gap analysis and are the issues related to legal non-conformities.

This approach is widely used in the planning of management systems, since it allows for the identification of internal aspects that are both positive (strengths) and negative (weaknesses) and also the external factors that pose threats that would weaken management or opportunities that can strengthen management. The forces should be explored in order to obtain maximum results, as should the other variables. The weaknesses must be eliminated or overcome and, if possible, converted into internal forces. Opportunities should be exploited and the threats must be annulled, avoided or mitigated through appropriate measures (Valeriano, 2001).

3. Results and Discussion

This investigation made it possible to identify aspects that were both specific to certain ports and common among all ports evaluated in terms of the positive and negative aspects of environmental management. Gap analysis showed that the ports studied comply with most of the legal requirements considered in the self-diagnosis. The Port of Mucuripe met 92% of the legal requirements; the ports of Santos and Itaguaí met 84% of the requirements; and the Port of Rio de Janeiro met 62% of the requirements. However, it is important to note that all legal requirements should be met as part of the basic premise of efficient environmental management. There were gaps in terms of the environmental permits (required by law): only the Port of Mucuripe was found to possess what is known as an Operating Environmental License (OL). The ports of Santos, Rio de Janeiro and Itaguaí do not have OLs, but two of these ports (Santos and Rio de Janeiro) reported that

they are in the process of obtaining the license. Another legal requirement is the conduction of studies on the archaeological heritage of the area of influence of the port. This study was conducted by the port of Santos and by the Passengers Terminal at the Port of Mucuripe. The other ports did not meet this legal requirement. The control of black smoke from vehicles that travel in ports is a legal requirement that is met only by the port of Santos.

The Environmental Agenda of the port is an important tool for the planning of actions to be taken in order to comply with the environmental laws for ports and port facilities. The ports of Rio de Janeiro, Mucuripe and Itaguaí each possess a Port Environmental Agenda,

whereas the agenda of the Port of Santos is currently under preparation.

Ports are legally required to manage ballast water from vessels, since this water can introduce exotic species into the environment and thus lead to the suppression of native species and the overpopulation of exotic species. Therefore, all ports must submit a Ballast Water Management Plan. However, none of the four ports possess this document. According to legal provisions, environmental audits should be performed at every two years by an outside representative of the port. The Port of Santos's last audit was carried out over two years ago, and the remaining ports are in compliance with the environmental audit laws. Failure to comply with legal

Table 1 - Aspects classified as "force", common to all four ports studied.

Tabela 1 – Aspectos classificados como “força”, comuns a todos os portos estudados.

A	Existence of reports with the inventory of impacts and environmental performance in the port area, facilitating the identification of priorities and encouraging the establishment of monitoring protocols and control measures.
B	Existence of easily accessible inventory of the most important environmental regulations and their requirements for port activities, which promotes compliance with these regulations.
C	Existence of a Zoning and Development Plan that considers environmental issues, which reflects a commitment to and interest in the quality of the environment where the port is located.
D	Existence of objectives and targets set for environmental improvement, which allow for an evaluation of the effectiveness of actions taken in pursuit of achieving these goals and targets.
E	Existence of a specific budget for environmental issues to ensure necessary resources for implementing programs and environmental initiatives.
F	Existence of procedures for internal communication of environmental information.
G	Existence of procedures to communicate environmental information from the port to partners of interest and to get opinions from outside groups.
H	Environmental management plans and action plans being prepared or already in use.
I	Existence of a Plan for Solid Waste Management and an employee who is responsible for its maintenance and operation.
J	Control and treatment of sanitary waste.
K	The transport of solid waste is done in a vehicle that is appropriate for the characteristics of each residue, and meets the legal constraints for protecting the environment and public health.
L	Legal requirements are met in relation to the presentation of the Environmental Risk Prevention Program (PPRA) and Emergency Control Plan (PCE).
M	Existence of procedures for dealing with non-conformities; existence of the Emergency Plan and Individual Emergency Plan (IEP).
N	Environmental aspects are monitored, and monitoring is used as support for the decision.
O	The monitoring of noise generated by port activities and the quality of water bodies under the influence of these activities is performed in accordance with standards established by law.
P	Existence of an employee in charge of environmental issues who reports to senior management.

In the SWOT analysis, the studied ports had many aspects in common in terms of the characteristics of their management, which were classified as "forces." These commonalities are described in Table 1. For example, the port of Mucuripe presents an environmental management manual, and this manual is rated as "strength" of that port.

The managing "weaknesses" that were common to the four studied ports include the fact that not all employees are informed about the importance of adjusting port operations to meet environmental policies; the potential environmental impacts of the ports' activities; and the responsibility of each port to act in accordance with environmental policies and the objectives of the environmental management. Also, the employees were not aware of the environmental programs, objectives and actions conducted by the respective Port Authorities. The ports of Santos, Rio de Janeiro and Itaguaí do not have their own environmental management manual, and this aspect was rated as "weakness".

Issues classified as "opportunities" included those that can be easily converted to "strengths." Three of the ports studied (ports of Santos, Port of Rio de Janeiro and Itaguaí) showed commonalities in what could be classified as "opportunities": (a) the inventory of environmental regulations is not distributed to the respective port's stakeholders; and (b) the specific environmental responsibilities are not documented. The knowledge of relevant environmental legislation for port activities encourages a greater commitment to complying with the legal and internal requirements.

One aspect classified as a common "opportunity" for the four ports studied is the environmental training of employees. The ports of Fortaleza and Santos offer environmental training to less than 25% of their employees; thus, actions are required to increase the number of employees served by the training programs. The ports of Itaguaí and Rio de Janeiro do not control of the number of employees who have received such training; thus, these ports first need to quantify the number of employees already served by the training programs, and then need to establish goals to increase the number of trained staff, if necessary.

The need to prevent the port from being subjected to lawsuits and legal penalties often leads to actions to turn the threats into opportunities. The adoption of a proactive stance on the part of the institution is required; they must act before being charged by the environmental agency or public prosecutor. The responses provided by the port managers made it possible for them to identify priority actions for their respective ports. These priority actions included the preparation of ballast water management plans, the conduction of studies on the archaeological heritage sites that may be affected by the port activities, the

monitoring and controlling of black smoke emissions by the vehicles in the port area, and the compliance with all conditions required for each of the licensing processes.

Ports worldwide normally present strengths and weaknesses, as is the case of the strengths reported for some ports from the United States, Belgium, Holland and Germany. These ports monitor the species of birds in the port areas and have implemented recovery programs for the aquatic environments as compensation for the environmental impact caused by the port activities (Snep and Ottburg, 2008). However, according to the authors, such programs are concerned only with the aquatic environments, and they disregard other environments that are impacted by port activities. This disregard represents a "weakness" in the environmental management of the respective ports. Other examples of weaknesses are provided by the port of Maptaphut, in Thailand, where the water quality around the port is unsuitable for the legal requirements of the country. In addition, the environmental programs do not consider the specific parameters of industrial activities, and there is no program to control pollution from vessels (Saengsupavanich *et al.*, 2009).

The use of SDM for these Brazilian ports also revealed some aspects that must be addressed when this approach is used. The first issue involves adaptations for local specificities. In Brazil, the ports built before the laws on environmental licensing are not subject to obtaining Provisional Licenses (PLs) or Installation Licenses (ILs), but they must present the Operating License (OL), or a document known as the "Terms of Conduct Adjustment" (TCA) which are documents that may replace the OL for legal purposes and which are requested by the Brazilian Environmental Agency (IBAMA). This detail was not considered during the preparation of the questionnaire, but throughout the analysis, the need for improving the questionnaire became evident. This topic should be included, with options for ports built before and after the legislation for environmental licensing, and questions on the existence of TCAs should be included as well. Therefore, the use of SDM requires that the questionnaires be adjusted to the specific conditions of the site or topic being studied.

The second issue was found to be the use of SDM by a third party that is not the port's environmental manager. Because SDM was created to be employed by the manager, the presence of the researcher during the questionnaires, and more importantly, the fact that the questionnaires are analyzed by people outside of the port authority, may bias the responses. During the questionnaires, we noticed a clear tendency of the respondents to minimize negative aspects and emphasize the positive ones. Responders often seek to present scenarios in which the problems were already

solved or were in the process of being resolved. Thus, topics that were considered problematic may have caused the respondents to respond insincerely, to undervalue negative aspects, or to overvalue positive aspects. This factor made the analysis difficult. This bias probably will not occur when SDM is conducted directly by the port's environmental manager. Thus, SDM tends to be more efficient when conducted by the port authority itself. Moreover, it is important that the senior management teams of ports improve the corporate mentality and encourage the development of a culture that is more transparent to the stakeholders and which recognizes the importance of implementing an environmental management system for the port.

The focus on positive responses (although not consistent with reality) and the omission of negative aspects demonstrate the ports' difficulties in dealing with adverse situations. This problem becomes evident when the given responses are compared to the information in the literature. The Port of Santos, for example declared that it performs environmental monitoring and management, but it presents serious problems of sediment contamination as a result of dredging operations (Torres *et al.*, 2009).

The analysis of the responses provided by the ports showed inconsistencies in some aspects of management, such as the non-compliance with some laws or regulations, or the fact that the existence of environmental management in a specific port was not accompanied by the establishment of respective environmental policies. Considering the fact that environmental management systems rely on the company's environmental policy, and because this policy constitutes a main guideline for all of those involved in the environmental management, it is improbable that the goals of the environmental management plan would be achieved without an environmental policy.

The inconsistencies between discourse and effective actions demonstrate difficulties in adopting a transparent approach and increasing the governance of environmental management at ports. The port authorities did not demonstrate a willingness to publicly confront their problems, which may lead to inefficient management that is more focused on covering up the problems than facing and resolving them.

According to Kitzmann and Asmus (2006), it is necessary that a change occur in the Brazilian port management culture. Port authorities must begin to include environmental issues in the processes, actions, goals, and objectives. This change must be part of a larger adjustment of the regulations of the port in general and it must also include support tools to enable the perception and understanding of the port's conditions and its effect on the environment (Koehler and Asmus, 2010).

The institutions presented difficulties in recognizing the importance of environmental issues. Few port employees were found to be trained in environmental management, and the corporate stance was often reactionary; it was largely motivated by the immediate need to comply with the legal regulations (e.g., solving the issues which may result in immediate economic problems for the ports).

By not adopting proactive stances in general, the ports studied will end up having trouble setting goals for the continuous improvement of environmental performance (a fundamental condition of any environmental management system). Currently they seem to be motivated to comply minimally with legislation, and they tend to disregard some activities that generate impacts on the port system (Adamenas, 2009).

This reactionary stance of seeking to only minimally fulfill the legal requirements can help the port to avoid penalties and actions by environmental agencies and public prosecutors, and thus prevent bad press on the ports in the media. However, this behavior does not prevent strains in relationships with close stakeholders, and it substantially impairs the effective adoption of processes geared toward sustainability in port management. The lack of pro-activity in the development of environmental management is a common characteristic in different types of Brazilian, European, and American companies, in which most acts are based on legal requirements or market pressure (Sanches, 2000).

Therefore, this study demonstrated that there is an urgent need for both the internalization of the conceptual pillars of Environmental Management in the management of Brazilian ports and the awareness of all stakeholders involved, including senior management and all levels of workers. For this to happen, ports must systematically provide environmental data and training programs (which must also be evaluated), so that each port has a sufficient amount of information to support decision making. The lack of data is an obstacle to the development of the environmental management systems at ports (Grotta, 2009). Thus, the application and analysis of the questionnaire used herein provides important information that can help ports to implement environmental management systems.

4. Conclusion

SDM is a suitable tool for beginning and/or continuing the establishment of a port's environmental management plan, since aspects specific to the port are considered and since the approach is conducted by the port authority. This approach allows for the analysis of different aspects of environmental performance in order to obtain an overall understanding of the actions, plans, and performance, of the port that is assessed. SDM can show when ports have problems and challenges that

may be faced by adopting improvement strategies. These strategies should be practical, economically feasible, and consistent with the specific conditions of the port in question. The combined use of SDM and Gap and SWOT analyses allows managers to better visualize the challenges and to plan strategies to improve the environmental management of their ports. This study on Brazilian ports revealed problems that were common to all of the ports evaluated, the most significant of which was the inconsistency between reported answers and reality; this truncated flow of information both inter-

nally and externally represents institutional difficulties in adopting more transparent actions and facing their problems publicly.

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The article “Self-diagnosis method as an assessment tool for environmental management of Brazilian ports”, by Romero *et al.* (2014), contains supporting information online at http://www.aprh.pt/rgci/pdf/rgci-520_Romero_Supporting-Information.pdf