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► To cite this version:

N. C Davidson, L. Dinesen, S. Fennessy, C. M. Finlayson, P. Grillas, et al.. A review of the adequacy of reporting to the Ramsar Convention on change in the ecological character of wetlands. *Marine and Freshwater Research*, 2019, 71 (1), pp.117-126. <10.1071/MF18328>. <hal-02505611>

HAL Id: hal-02505611

<https://hal.science/hal-02505611v1>

Submitted on 11 Mar 2020

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A review of the adequacy of reporting to the Ramsar Convention on change in the ecological character of wetlands

N. C. Davidson^{A,B,J}, L. Dinesen^C, S. Fennessy^{D,C}, M. Finlayson^{B,E}, P. Grillas^F, A. Grobicki^G, R. J. McInnes^{B,H} and D. A. Stroud^I

^ANick Davidson Environmental, Queens House, Ford Street, Wigmore, HR6 9UN, UK.

^BInstitute for Land, Water & Society, Charles Sturt University, Elizabeth Mitchell Drive, PO Box 789, Albury, NSW 2640, Australia.

^CNatural History Museum of Denmark, Section of Biodiversity, University of Copenhagen, Universitetsparken 15, Building 3, 3rd floor, DK-2100 Copenhagen, Denmark.

^DKenyon College, Biology Department, 202 North College Road, Gambier, OH 43022, USA.

^EIHE Delft, Institute for Water Education, PO Box 3015, NL-2601 DA Delft, Netherlands.

^FTour du Valat, Research Institute for Mediterranean wetlands, LeSambuc,F-13200Arles,France.

^GGreen Climate Fund, Songdo Business District, 175 Art Center-daero Yeonsu-gu, Incheon 22004, South Korea.

^HRM Wetlands & Environment Ltd, 6 Ladman Villas, Littleworth, Oxfordshire, SN7 8EQ, UK.

^IJoin tNature Conservation Committee, MonkstoneHouse, CityRoad,Peterborough,PE11JY,UK.

^JCorresponding author. Email: arenaria.interpres@gmail.com

How to cite : Davidson N.C., Dinesen L., Fennessy S., Finlayson C.M., Grillas P., Grobicki A., McInnes R.J., Stroud D.A. 2019. *A review of the adequacy of reporting to the Ramsar Convention on change in the ecological character of wetlands*. Marine and Freshwater Research 70:11. doi: 10.1071/MF18328

Abstract

We review the mechanisms established by the Ramsar Convention for reporting on the status and change in the ecological character of wetlands. We assess the extent of their implementation and compliance, but not issues of the adequacy of their design nor the consequences of their extent of implementation. We conclude that, with the exception of qualitative national-scale reporting in triennial Contracting Party National Reports, there is inadequate implementation and compliance with most of these mechanisms, notably concerning required reporting under Article 3.2 of the Convention and the updating of the Information Sheet on Ramsar Wetlands (RIS). This limits the ability of the Convention to assess the status, and trends in status, of designated Wetlands of International Importance (Ramsar Sites), and to inform future decision-making and priority-setting for the wise use of all wetlands. As has been recognised by the Ramsar Convention, unless compliance with these mechanisms is improved, sufficient information will not be gathered through the mechanisms of Ramsar Convention to assess fully the Sustainable Development Goal 6.6.1 indicator supported by the Convention on change in the extent of water-related ecosystems over time.

Additional keywords: compliance, ecological character, Ramsar Sites, reporting mechanisms, Sustainable Development Goals, wetland assessment.

Introduction

Although recognition of environmental degradation is widespread and of major concern to many (Ripple et al. 2017), gaining a better understanding about what is happening to the world's environment, and where, is needed to inform and support delivery inter alia of the 2020 Aichi Targets (Convention on Biological Diversity 2010), the 2030 Sustainable Development Goals (SDGs; UNGA 2015) and the Ramsar Convention Strategic Plan 2016–2024 (Ramsar Convention 2015). The attention under these mechanisms focuses chiefly on changes in the extent of the ecosystem (AichiTarget5andSDGTarget6.6), and the protection and restoration of ecosystems (Aichi Targets 11 and 15; Ramsar Strategic Plan Targets 5 and 12). The SDG indicator6.6.1currently covers only changes in the extent of the wetland and the quantity and quality of water in ecosystems (United Nations Environment Programme 2018).

To guide delivery of these targets and to assess whether they are being met, it is also important to understand what is the state of health of our remaining ecosystems. Under SDG 6.6.1, it is also recommended that countries incorporate an indicator component on change over time of ecosystem health in their ecosystem-monitoring programs (United Nations Environment Programme 2018).This is critical for wetlands, which have over the past four to five decades been shown to be adversely affected by humans, with many being destroyed (Davidson 2014;

Gardner et al. 2015; Dixon et al. 2016) and others facing increasing pressure from a range of human drivers (Ramsar Convention Secretariat 2018a; Finlayson et al. 2019).

The maintenance of the 'ecological character' of wetlands, reporting on threats to and changes in ecological character, and addressing such threats and changes are fundamental to the implementation of the Ramsar Convention on Wetlands by its Contracting Parties. Over time, the Convention has adopted a suite of guidance on describing and addressing change, in terms of both area change and quality change in wetland ecological character (Ramsar Convention Secretariat 2010a, 2010b). Given the ongoing global deterioration of wetlands, the adequacy of the guidance provided by the Convention for ensuring that Contracting Parties are maintaining or restoring wetlands has been questioned (Finlayson et al. 2011; Finlayson 2012), although other factors may also be hampering full implementation.

Although at the outset of the Convention, the maintenance of wetland 'ecological character' applied only to designated Wetlands of International Importance (Ramsar Sites), in 2005, the Convention recognised that the concept of ecological character is the key mechanism to achieve the wise use of all wetlands (Ramsar Convention 2005). At that time, it defined wise use as 'the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development', and redefined the earlier (Ramsar Convention 1996a) definition of wetland ecological character to:

the combination of the ecosystem components, processes and benefits/services that characterise the wetland at a given point in time.

They further defined change in ecological character as:

for the purposes of implementation of Article 3.2 [...] the human-induced adverse alteration of any ecosystem component, process, and/or ecosystem benefit/service.

For designated Ramsar Sites, Article 3.2 of the Convention text (Ramsar Convention 1971) places specific obligations on Contracting Parties concerning their ecological character. These are as follows:

- (1) to make arrangements to be informed at the earliest possible time if the ecological character of a site 'has changed, is changing or is likely to change as the result of technological developments, pollution or other human interference'; and
- (2) to advise the Ramsar Secretariat, without delay.

Change in the ecological character under Article 3.2, thus, refers only to a human-induced adverse change in the wetland, and not to any change from natural processes or a positive human-induced change (Ramsar Convention 2005; Pritchard 2014, 2018) and, so, can tell only part of the ecological character-status story. This was specifically agreed in 1996, to ensure that Contracting Parties distinguished human-induced change from natural change, which is also part of the ecological character (Finlayson 1996), but it would be some time before successional change and natural variation were included within the conceptualisation of ecological character (Ramsar Convention 2005). However, the formulation of Article 3.2 also includes an important dimension not generally included in status assessments, namely, that of a 'likely change' to ecological character. In other words, if a Contracting Party is made aware of a 'likely' future change to a wetland (e.g. from a proposed development on or near the site), that should also be reported 'without delay'.

The Convention has further recognised the need to gather information on all types of change in ecological character, whether positive or negative, natural or human-induced. In 2008, the Convention adopted 'a framework for Ramsar data and information needs', which recognised the importance of collecting 'change in ecological-character time series (through monitoring and surveillance)', for all wetlands and, specifically, for Ramsar Sites (Ramsar Convention 2008b).

A reporting mechanism established in 1990 was proposed to be the sole vehicle for reporting and addressing of Article 3.2 by the Contracting Parties, namely, that of the Ramsar Bureau [Secretariat] maintaining a list of Ramsar Sites under human-induced threat (Ramsar Convention 1990). In 1993, Parties decided that this list should be

referred to as ‘the Montreux Record’ (Ramsar Convention 1993). However, placing a Ramsar site on the Montreux Record is the voluntary prerogative of a Contracting Party, notwithstanding the obligations on parties under Article 3.2 reporting. Since 2008, the Montreux Record is now primarily expected to be invoked when international advice and assistance (including through a Ramsar Advisory Mission) would benefit resolving human-induced negative ecological character-change issues at a Ramsar Site (Ramsar Convention 2008a).

Ramsar Advisory Missions (RAMs) are undertaken by a team contracted by the Ramsar Secretariat at the request of a Contracting Party, to assist the party to address negative ecological character issues at a Ramsar Site. Most, but not all, RAMs have concerned Sites already placed on the Montreux Record. Their reports provide detailed information on the ecological-character status of these Ramsar Sites (Gardner et al. 2018).

Other reporting mechanisms for change in wetland ecological character have been established by the Convention, and include the following:

(1) For Ramsar Sites, the requirement since 1996 for Parties to provide an update of the Information Sheet on Ramsar Wetlands (RIS) at intervals of no longer than 6 years (Ramsar Convention 1996b). Since 2006, the RIS, when being updated, requires the provision of information on the change in ecological character: whether the Site area or Site boundaries have changed, and a free-text description of any changes or likely changes to the ecological character of the Site).

(2) An indicator question in Contracting Parties’ triennial National Reports on implementation (to the 11th Meeting of the Conference of the Parties (COP11) in 2012 and COP12 in 2015) concerning, at national scale, change in the ecological character of all wetlands and of Ramsar Sites: ‘Has the condition [i.e. ecological character] of wetlands in your country, overall, changed since the last triennium?’ Answer options are ‘improved’, ‘no change’ or ‘deteriorated’. The same indicator question is included in COP13 (2018) National Reports, but these are not yet available for analysis.

(3) The same indicator question for individual Ramsar Sites, in an optional section of Parties’ COP11, COP12 and COP13 National Reports.

A summary of these ecological character-assessment and -reporting mechanisms and the timing and periodicity of reporting expected is given in Table 1.

Reporting mechanism	What aspect(s) of ecological character reported?	Reporting requirement
Article 3.2: Convention text (Ramsar Convention 1971)	Human-induced negative change, or likely change, in ecological character: Ramsar sites	Through Contracting Party (CP) administrative authority arrangements, to be informed at the earliest possible time of such change or likely change, and report to the Ramsar Secretariat, without delay. Third parties also report potential Article 3.2 issues to the Ramsar Secretariat, which are then verified (or otherwise) by the CP.
Montreux Record: Recommendation 4.8; Resolutions 5.4, X.16 (Ramsar Convention 1990, 1993, 2008a)	Human-induced negative change, or likely change, in ecological character of Ramsar sites needing international assistance to resolve	When needed by contracting party, voluntarily placed on the Montreux Record.
National reports: see Recommendation 2.1 (Ramsar Convention 1984)	Qualitative change in ecological character: all wetlands and Ramsar sites	Three-yearly, to each conference of the contracting parties (COP)
Information sheet on Ramsar wetlands (RIS) updates: Resolutions VI.13, XI.8, Annex 1 (Ramsar Convention 1996b, 2012)	Change in ecological character of Ramsar sites since previous RIS	At intervals of no more than 6 years
Data and information needs: ecological character. Resolution X.14. (Ramsar Convention (2008b))	Change in ecological character time series: all wetlands and Ramsar sites	None

Tableau 1. Summary of Ramsar Contracting-Party mechanisms for assessing and reporting wetland ecological character status and trends

Here, we assess the extent to which these wetland ecological character reporting mechanisms have been complied with by Contracting Parties. It was outside the scope of the present paper to review the design of these mechanisms and the extent to which their design may be contributing to the adequacy of compliance. Because the data and information needed to assess change in ecological character over time (Ramsar Convention Secretariat 2010b) is not

yet included within reporting requirements, it is not considered further here. Status and trends in wetland ecological character derived from these Convention reporting mechanisms are reported in Davidson et al. (2020).

Materials and methods

The extent of, and trends in, Article 3.2 reporting and Montreux Record listing for designated Ramsar Sites were assessed from official Ramsar documents prepared by the Ramsar Secretariat (Ramsar Convention Secretariat 1999, 2002, 2005, 2008, 2012, 2015a, 2018b).

The extent of national-scale qualitative ecological character-change answers to National Report Indicator question 1.1.3 provided by Contracting Parties in their COP11 and COP12 National Reports (available on the Ramsar website at <http://www.ramsar.org>, accessed 20 March 2018) was assessed from data supplied by the Ramsar Secretariat, extracted from their databases of National Report information, and the extent of reporting on individual Ramsar Sites provided by Parties in the optional National Report Section 4 was assessed from individual National Reports for COP11 and COP12 (available at [https://www.ramsar.org/search?f\[0\]=type%3Adocument&f\[1\]=field_tag_body_event%3A366&f\[2\]=field_tag_body_event%3A415&f\[3\]=field_document_type%3A532&search_api_views_fulltext=](https://www.ramsar.org/search?f[0]=type%3Adocument&f[1]=field_tag_body_event%3A366&f[2]=field_tag_body_event%3A415&f[3]=field_document_type%3A532&search_api_views_fulltext=) for COP11 NRs and [https://www.ramsar.org/search?f\[0\]=type%3Adocument&f\[1\]=field_tag_body_event%3A366&f\[2\]=field_tag_body_event%3A509&f\[3\]=field_document_type%3A532&search_api_views_fulltext=](https://www.ramsar.org/search?f[0]=type%3Adocument&f[1]=field_tag_body_event%3A366&f[2]=field_tag_body_event%3A509&f[3]=field_document_type%3A532&search_api_views_fulltext=) for COP12 NRs, both last accessed 11 June 2019).

From information provided in Ramsar Convention Secretariat (2012, 2015a, 2018b), we assessed the extent of the required updating of Information Sheets on Ramsar Wetlands (RISs).

The extent and adequacy of the information provided in the text fields of updated RISs on changes in ecological character were tested by reviewing all RISs for two Ramsar regions (Asia and Oceania), downloaded individually from the Ramsar Sites Information Service (RSIS) at <http://www.ramsar.wetlands.org> (accessed 11 June 2019). These cover 18% of all Ramsar Sites (391 Ramsar Sites) designated at that time (September 2018).

Statistical analyses were conducted using VassarStats (<http://vassarstats.net/index.html>, accessed 11 June 2019).

Results and discussion

Article 3.2 reporting

Although Article 3.2 is a Contracting-Party reporting requirement, with such reports being made to the Ramsar Secretariat, the Secretariat also receives information on potential Article 3.2 cases from third parties such as non-governmental organisations (NGOs) and concerned citizens. When a third-party report is received, the Secretariat contacts the Contracting Party concerned to seek its verification or otherwise of the issue, and, if so verified, the case is added to the formal list of Contracting Party Article 3.2 reports. The percentage of all Article 3.2 reports that were first received from Contracting Parties was only 21–50% in 2002–2012, but has been higher more recently, i.e. 69–72% in 2012–2018 (but see issues of reporting inconsistency identified below). Conversely, higher percentages of reports were first received from third parties in 2002–2012 (50–79%) than after 2012 (28–30%), although the number of third-party reports has been relatively similar over time, being 56–77 reports per triennium from 2002 to 2018 (Table S2, Fig. S1, both available as Supplementary material to this paper).

Article 3.2 reports provided by Contracting Parties and others are held in a database by the Ramsar Secretariat; however, this is not publicly accessible for analysis because some reports from third parties have not been verified by the Contracting Party concerned. Thus, this system relies on the Secretariat receiving accurate verifications by Contracting Parties concerning third-party reports. Recent Secretariat summaries of Article 3.2 reports (Ramsar Convention Secretariat 2015a, 2018b) mostly indicate the nature of the threat(s) posed to the site, but, for most sites, do not make it clear what aspects of ecological character are being or are likely to be affected or negatively changed.

There is no standard template currently in regular use for providing Article 3.2 reports, although this was called for in Resolution VIII.8 (Ramsar Convention 2002). Since Article 3.2 reporting provides information updating the ecological-

character status of a Ramsar Site, the development of a standard reporting format consistent with the relevant data and information fields in the RIS would mean that such reports could contribute to the updating of information in the RIS when relevant, and the information provided included in the RIS. However, if a mechanism is established, it is important that Parties understand that Article 3.2 reporting does not replace the commitment to fully update each RIS at intervals of no more than 6 years (see below), because the requirement of Article 3.2 concerns making an immediate report of a negative ecological character issue, in contrast to the requirement for periodic updating of the RIS for a Ramsar Site.

Article 8.2 of the Convention (Ramsar Convention 1971) requires the Ramsar Secretariat to report to each COP on changes in the ecological character of Ramsar Sites. However, this has not been done consistently. Prior to COP9 (2005), the Secretariat reports to COP did not list Ramsar Sites with Article 3.2 reports; reports to COP9 (2005) and COP10 (2008) were based largely on information provided by Contracting Parties in their National Reports; however, at the time of the analyses, not all such reports had been submitted by Parties, and some of the reports submitted did not individually list all Ramsar Sites with Article 3.2 issues. For example, in its National Report to COP9, the United Kingdom reported that there were 63 (39% of its 163 Ramsar Sites at that time) that had Article 3.2 issues, but these Sites were not individually identified. With this earlier form of reporting, it is not clear whether a given Article 3.2 issue arose during the reporting period concerned, or was instead a repeat of information first reported in an earlier period.

Only since COP11 (2012) reporting (Ramsar Convention Secretariat 2012) have the number and Site names of 'closed cases' (i.e. Sites removed from the list of Article 3.2 reports) been provided; the number of new Sites with such reports added to the list was not reported until COP12 (Ramsar Convention Secretariat 2015a). Furthermore, from comparison of those Sites listed as having Article 3.2 report for even the most recent three triennia and those reported earlier, there are inconsistencies (Table S1). Of the 183 Sites reported as having Article 3.2 reports before the 2005–2008 triennium, 64 (35%) do not appear on more recent lists. It is possible that some of these cases may have been 'closed', but this has not been publicly reported.

Notwithstanding these many inconsistencies and discrepancies in reporting on Article 3.2 issues, we have identified a minimum of 371 Ramsar Sites with at least one Article 3.2 report submitted to the Ramsar Secretariat at some time since 2002 (Table S1). These reports have addressed Ramsar Sites in 112 (66%) of the then 169 Contracting Parties of the Convention. The reports for the 371 Sites represent only 16% of all designated Ramsar sites and can be interpreted as implying (1) that 84% of all Ramsar Sites are regarded by Contracting Parties or third parties as not facing any human-induced negative changes or likely changes to their ecological character, (2) that there are no such issues for Ramsar Sites in one-third of Contracting Parties or (3) that monitoring of Ramsar Sites is not happening as it should be under the terms of Article 3.2.

Ramsar Sites with Article 3.2 reports are distributed broadly across all six Ramsar regions. All three Contracting Parties in North America (Canada, USA and Mexico) have had Article 3.2 reports. Elsewhere, 79% of 48 European Contracting Parties have had Article 3.2 reports, with 62–67% of the 50 Contracting Parties in Africa, 32% in Asia and 27% in Latin America and the Caribbean, but only one (Australia) of the eight Oceania Contracting Parties, having had such reports.

In total, 243 Ramsar Sites were reported as having Article 3.2 reports in either the 2012–2015 or the 2015–2018 reporting periods. This includes nine Sites reported as 'open cases' in 2012–2015 in Ramsar Convention Secretariat (2015a), but for which there was no update provided for 2015–2018 (Ramsar Convention Secretariat 2018b). In total, 46 cases (19% of cases) were reported as being closed between 2012 and 2018. So, currently, 197 Ramsar Sites are being reported as facing negative human-induced changes or likely changes in ecological character, which is only 8.8% of all Ramsar Sites.

Given the reports of widespread poor and deteriorating status of Ramsar Sites provided by Contracting Parties through other Ramsar reporting mechanisms (see Davidson et al. 2020) and wetland-area losses (Davidson 2014; Dixon et al. 2016), this appears to be an implausibly low figure and is suggestive of a lack of reporting rather than an actual absence of change.

Lack of Article 3.2 reporting being an issue is supported by the following:

- (1) one-third (32.4%) of Contracting Parties have reported to COP12 that they do not have in place the required national mechanism to be informed of any human-induced negative change to their Ramsar Sites, and
- (2) even fewer (18.9%) have advised COP12 that they had reported all their Article 3.2 issues to the Ramsar Secretariat (Ramsar Convention Secretariat 2015b).

Given the fundamental importance under the Convention of monitoring and maintaining the ecological character of Ramsar Sites, this represents a serious and widespread failure in implementation of the Convention by many of its Contracting Parties. Consequently, Article 3.2 reporting does not currently provide an adequate assessment of the status of the ecological character of Ramsar Sites worldwide.

In addition, in relation to assessing change or likely change in Ramsar-Site ecological character, the information provided in Ramsar Convention Secretariat (2018b) largely concerns the type of the human-induced threat to the Site and not what aspects (ecological components or processes or ecosystem services) of the ecological character of the Site will be affected, has changed or would be likely to change.

Montreux Record listing of Ramsar Sites

The voluntary placing of Ramsar Sites on 'the Montreux Record' has been little used by Contracting Parties. Currently (as at February 2018), only 48 (2% of all designated Ramsar Sites) in 27 countries (16% of Contracting Parties) are reported to be on the Record (Ramsar Convention Secretariat 2018b). Ramsar Secretariat reports to COPs indicate that since 1996, only 17 Ramsar Sites have been placed on the Montreux Record, and, more positively, that 19 Sites have been removed from the Record following the successful resolution of negative ecological-character issues (i.e. a net decrease of two Sites on the Record). However, trends in the numbers of sites on the Montreux Record reported by Ramsar Convention Secretariat (2018b; Fig. 1a, Table S3, available as Supplementary material to this paper) indicate that there has been a net decrease since 1996 of 22 sites. The reason for this discrepancy is unclear.

The use by Contracting Parties of the Montreux Record as a Convention tool to report and address a negative change or likely change in the ecological character of Ramsar Sites has progressively decreased over time since 1990, from a peak of 63 Ramsar Sites in 1995 (Fig. 1a). The decrease in the number of Ramsar Sites on the Record since 1993 is statistically significant ($r = -0.9477$; $t = -14.24$; d.f. 1/4 23; $P < 0.0001$). There has also been a statistically significant decrease in the percentage of Sites on the Record relative to the increasing total number of designated Ramsar Sites globally ($r_{1/4} = -0.9464$; $t_{1/4} = -15.23$; d.f. 1/4 27; $P < 0.0001$), from between 7 and 10% of designated Ramsar Sites in the early 1990s to less than 3% since 2008 (Fig. 1b, Table S3).

Only three Ramsar Sites have been placed on the Montreux Record since 2008. This might be a consequence of the narrower focus for the Record adopted by Contracting Parties in 2008, of invoking the Record only when it is considered that international expertise and advice can help resolve the matter (Ramsar Convention 2008a).

Official reports of Ramsar Advisory Missions (RAMs) provide detailed assessments of the ecological-character issues faced by those Ramsar Sites that have been subject to a RAM. However, only 82 RAMs have so far been conducted (some covering more than one Ramsar Site; Jones and Pritchard 2017), and, so, can provide only limited information on the overall ecological status and trends of Ramsar Sites.

If the number of Ramsar Sites on the Montreux Record is treated as an accurate reflection of Ramsar Sites facing human-induced ecological-character change or likely change, then it suggests that, currently, 98% of all Ramsar Sites are not facing such change and that 84% of Contracting Parties have no human-induced problems with the ecological character of their Ramsar Sites. This is highly implausible, given the evidence of widespread Ramsar-Site deterioration from other Ramsar reporting mechanisms, such as Contracting-Party information provided in their National Reports (Davidson et al. 2020), and also from citizen-science surveys, which have reported that human-induced change is on-going in many Ramsar Sites (McInnes et al., in press), and demonstrates that the Montreux Record mechanism is not functioning as intended (see also Pritchard 2014).

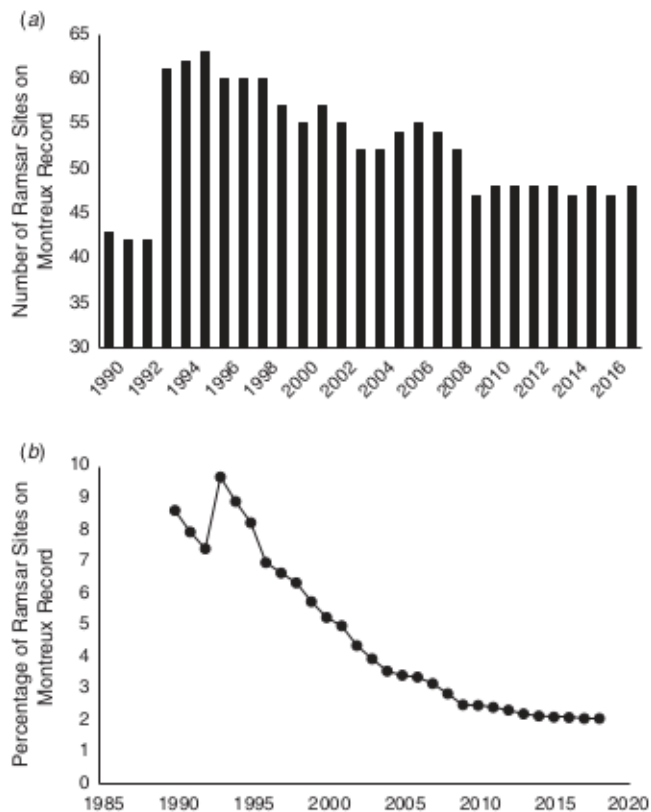


Figure 1 Trends in (a) the numbers and (b) the percentages of Ramsar sites on the Montreux Record since 1990. Fig. 1a is redrawn from data provided in Ramsar Convention Secretariat (2018b)

Contracting-Party National Reports: national-scale reporting

National reporting has been an informal Ramsar Convention process since the conference in 1971, which agreed the Con-vention text, with formal national reporting and the need to improve this reporting mechanism being first recognised at Ramsar COP2 in 1984 (Ramsar Convention 1984; Matthews 1993). In total, 145 (86% of the Contracting Parties) and 150 (89% of the Contracting Parties) provided such reports in 2011 to COP11 and in 2014 to COP12 respectively.

Of the various Ramsar reporting mechanisms on wetland ecological character, national-scale qualitative reporting in National Reports provides the most widespread information source. Of the 150 COP12 reports, 139 Contracting Parties reported on the ecological-character status of all wetlands in their country and 147 on the status of all Ramsar Sites. A similarly high level of reporting was provided by Contracting Parties in their previous (2011) National Reports to COP11, with 122 Parties reporting on all wetlands and 137 on Ramsar Sites. A total of 111 Parties reported to both COP11 and COP12 on all wetlands and 128 on Ramsar Sites.

Contracting-Party National Report: individual Ramsar Sites

Although this optional reporting mechanism was established at the request of Contracting Parties, only eight Contracting parties

Ramsar region	Number of CPs	Number of Ramsar Sites	Total RSs (%)
Africa	11	78	19.8
Asia	5	26	8.3
Europe	9	145	13.2
Latin America and Caribbean	5	15	7.7
Oceania	4	68	86.1
All regions	34	324	15.6

Tableau 2 :Numbers of individual Ramsar Sites (RSs) reported on by Contracting Parties (CPs) in their COP12 National Reports, Section 4. No CPs from North America provided information on individual Sites

(6% of the 144 Parties reporting to COP11) reported on a total of 152 individual Ramsar Sites in their National Reports, Section 4. By Ramsar region, these were from four European Parties and two each from Africa and Latin America and the Caribbean. No Parties from Asia, North America or Oceania reported on their individual Ramsar Sites to COP11.

Only 18 (12%), of the 148 Contracting Parties reporting to COP12 provided this information on the ecological-character status of each of their Ramsar Sites, for a total of 308 Ramsar Sites. Only two Parties provided these reports to both COP11 and COP12.

In addition, a further 16 Contracting Parties each with only a single designated Ramsar Site answered the overall National Report indicator for Ramsar Site status in their COP12 reports. Combining these sources, the status of 324 (15.6% of all Ramsar Sites) individual Ramsar Sites in 34 (20.0%) Contracting Parties were reported to COP12 (Table 2). The largest numbers of reports for individual Ramsar Sites were from Europe, Africa and Oceania. However, for most regions, these represent only a small proportion of all Ramsar Sites, from 7.7% in Latin America and the Caribbean to 19.8% in Africa (Table 2). The exception is Oceania, for which 86.1% of the Sites were reported, owing largely to reports being provided for 65 Australian Ramsar sites.

Currently, the extent of national reporting on individual Ramsar Sites is too limited to provide a comprehensive assessment of their ecological-character status and trends.

Information Sheet on Ramsar Wetlands (RIS): updates

Although RIS updates are required to be made by Contracting Parties at intervals of no more than 6 years (Ramsar Convention 1996b), there has been very limited compliance with this commitment.

Information provided in Ramsar Convention Secretariat (2018b) shows that RIS updates are overdue for a large number and a large proportion of Ramsar Sites (Table 3). Globally, 1173 Ramsar Sites (over half (51%) of all Ramsar Sites) are overdue an update. Large numbers of RIS updates are overdue from Parties in all Ramsar regions, with the highest percentages being overdue from North America (64%) and Asia (54%) and the lowest from Oceania (41%; Table 3).

This reflects a situation worse than that in 2015 (COP12) when 964 Sites (44%) were overdue an update, but an improvement on the 2012 (COP11) situation of 1356 Sites (67%) being due updating (Ramsar Convention Secretariat 2012, 2015a).

Ramsar region	Number of RISs overdue update	Percentage of RISs overdue update
Africa	180	45.6
Asia	171	53.6
Europe	561	51.2
Latin America and the Caribbean	89	45.9
North America	139	64.1
Oceania	33	40.7
Global	1173	51.3

Tableau 3: Numbers and percentages of Ramsar Sites with an Information Sheet on Ramsar Wetlands (RIS) update being overdue, as at December 2017. Data from Ramsar Convention Secretariat (2018b)

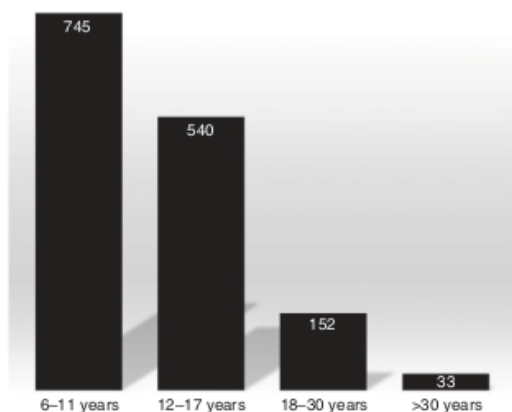


Figure 2: The number of Ramsar Sites for which Information Sheet on Ramsar Wetland (RIS) updates are overdue in relation to the number of years for which the update is overdue, as at December 2017. Redrawn from Ramsar Convention Secretariat (2018b).

Fig. 2 shows that although most of the overdue RISs are between 6 to 11 years overdue (32% of all Ramsar Sites), a considerable number are much older, with RISs for almost one-quarter (24%) of all Ramsar Sites being 12–17 years out of date, and RISs of 8% of all Ramsar Sites being more than 17 years out of date. Thirty-three of these RISs, from nine Contracting Parties, are now more than 30 years old.

The lack of RIS updating may, at least in part, be a consequence of a lack of capacity in Contracting Parties to compile many such updates, because there is a strong correlation between the total number of Ramsar Sites designated by each Party and the number of their RIS updates overdue ($r = 0.8426$; $N = 169$; P (two-tailed) < 0.0001 ; Fig. 3).

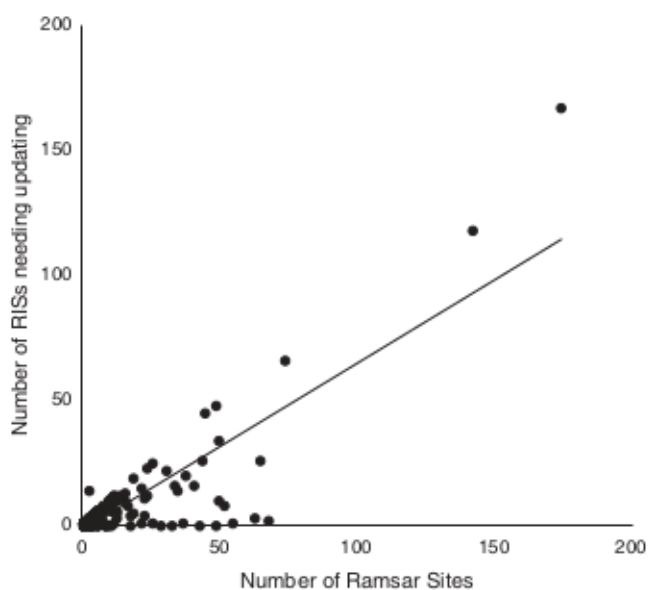


Figure 3: The relationship between the number of Ramsar Sites designated by each Contracting Party and the number of their Information Sheets on Ramsar Wetlands (RISs) that are overdue an update. Data for overdue RIS updates from Ramsar Convention Secretariat (202018b); data for numbers of Ramsar Sites from the Ramsar Sites Information Service (RSIS) at <https://rsis.ramsar.org/ris-search/> (accessed 11 April 2019)

Given this major lack of the required updating of the RISs by Contracting Parties, it is not possible to make an up-to-date comprehensive assessment of the ecological-character status of Ramsar Sites from the currently available RISs.

However, to establish whether some information on change in the ecological character of Ramsar Sites can be assessed from those RISs that have been updated since 2006, we reviewed all individual RISs for two Ramsar regions (Asia and Oceania) for the extent and adequacy of ecological character-change information they provide (Table 4).

As indicated in Table 3, RIS updates for a large percentage of Ramsar Sites in these regions are overdue, and, as a consequence, the size of the available dataset for assessing topical change in ecological character is limited.

From this review of updated RISs, we have also identified further challenges in using RIS updates to assess Ramsar-Site ecological-character change, and these include the following:

- (1) the text descriptions of change are frequently vaguely worded and do not state clearly whether any change being reported is considered positive or negative; and
- (2) in several cases, more information on ecological-character change was provided only in other RIS information fields, notably that concerning threats to the Site.

In addition, because individual RIS fields, such as those concerning ecological-character change, are not searchable online on the RSIS, it is extremely time-consuming to make these assessments because each individual RIS has to be separately downloaded and reviewed.

The RIS 2012 revision (Ramsar Convention 2012) requires more precise coding of changes in the ecological character, so that, in the future, a clearer analysis may be possible from updated RISs. However, given the very limited extent and current slow rate of RIS updating (Tables 3, 4), it is unlikely that RISs will be a major source of information on the change in the ecological character of Ramsar Sites for the foreseeable future.

Conclusions and recommendations

Although the Ramsar Convention has established several reporting mechanisms for different aspects of wetland ecological status and trends, this analysis has shown that most are being under-applied and are currently inadequate to assess fully wetland and Ramsar Site ecological-character status and trends.

Most notable are the inadequacies associated with Article 3.2 reporting for designated Ramsar Sites, and the lack of timely updating of RISs.

The only Ramsar reporting mechanism that has been responded to by most Contracting Parties is the indicator question in COP11 and COP12 National Reports on change in ecological character of all wetlands, and of Ramsar Sites. This is a valuable, although qualitative and non-elaborative, source of information and, with its inclusion in the COP13 report format, now has the potential for longer time-series analyses (see Davidson et al. 2020).

On the basis of our analyses, we recommend the following, concerning improving Ramsar Convention reporting mechanisms, and the wetland-status information they provide:

- (1) the many overdue updates to Ramsar Site RISs should be provided by Contracting Parties as a matter of urgency;
- (2) Article 3.2 reporting requirements need to be more fully complied with by the Contracting Parties; a standard reporting format, consistent with the RIS data and information fields, should be established; and Article 3.2 reports should be made publicly accessible by the Ramsar Secretariat, so as to support improving awareness and of analyses of wetland ecological-character change; and
- (3) the national-scale National Report question on wetland ecological-character change, for wetlands generally and for Ramsar Sites, should be retained in future National Report formats, so as to permit longer time-series analyses.

Although the National Report format section for reporting on the ecological-character change of individual Ramsar Sites has the potential to yield useful information, there is a concern that this option for triennial reporting may have established a confusing parallel reporting process to the formal commitment adopted by Parties of updating their RISs at intervals of no more than 6 years, and that this might be deterring Parties from focussing on providing their required RIS updates. As a priority, parties should be urged to meet their commitment to update all their RISs.

Given that these various ecological-character Ramsar reporting mechanisms have been developed, and have evolved, over time and in parallel, it may be appropriate for the Convention to undertake an in-depth review of

these mechanisms and the values of ecological-character reporting, building on Pritchard's (2014) review, with a view to potentially streamlining reporting in the future.

Given the evidence of increasingly widespread declines in the area and status of the world's wetlands (Davidson 2014; Dixon et al. 2016; Ramsar Convention Secretariat 2018a; Darrah et al. 2019; Davidson et al. 2020; McInnes et al., in press), fully reporting on wetland ecological character should be treated as a very high priority for the Convention and its Contracting Parties, including in relation to reporting on SDG Target 6.6 (see below).

Ramsar region	Number of Ramsar sites	Number of Ramsar sites with update since 2006	Percentage of Ramsar sites with update since 2006	Updated 2006–2011	Updated 2012–2016
Asia	312	31 ^A	6.7	14	16
Oceania	79	38	48.1	11	27
Asia and Oceania	391	69	17.6	25	43

Tableau 4 Numbers and percentages of Ramsar Sites in Asia and Oceania with Information Sheet on Ramsar Wetlands (RIS) updates since 2006, as at September 2016. Data from RIS accessed from the Ramsar Sites Information Service (RSIS) at <https://rsis.ramsar.org/ris-search/> One Asia RIS update provided no ecological-change information.

Under SDG Target 6.6 reporting under Indicator 6.6.1, concerning change over time of ecosystem health of water-related ecosystems, is not yet included in SDG reporting (UN-Water 2018). Given that the Ramsar change in wetland ecological-character mechanisms reviewed in this paper are all reported at the national level by governments, they appear to meet the conditions for inclusion as a SDG 6.6.1 indicator, even if not all such mechanisms yet provide comprehensive national information. The joint custodians of Indicator 6.6.1 (the Ramsar Convention Secretariat and UN Environment) could extend the existing SDG reporting mechanisms by incorporating the Ramsar wetland ecological-character reporting, and the change in wetland ecological-character results for all wetlands and for Ramsar Sites (see also Davidson et al. 2020) into SDG processes.

Conflicts of interest

Nick Davidson, Robert McInnes, C. Max Finlayson, Patrick Grillas and Siobhan Fennessy are editors for Marine and Freshwater Research but did not at any stage have access to this manuscript while in peer review, as is the standard practice when handling manuscripts submitted by an editor to this journal. Marine and Freshwater Research encourages its editors to publish in the journal and they are kept totally separate from the decision-making processes for their manuscripts. Nick Davidson was Deputy Secretary General of the Ramsar Convention from 2000 to 2014. Ania Grobicki was Deputy Secretary General from 2015 to 2017 and Acting Secretary General from November 2015 to August 2016. Nick Davidson (2015–2018), Lars Dinesen (2012–present), Siobhan Fennessy (2015–present), C. Max Finlayson (1993–2018), Robert McInnes (2005–2018) and David Stroud (2003–present) have formally been part of the Convention's Scientific and Technical Review Panel (STRP), in line with its appointment procedures. David Stroud was also the UK Government's STRP National Focal Point from 1999 to 2018.

Declaration of funding

We thank the Institute for Land Water & Society, Charles Sturt University, Australia, for financial support to the lead author, which facilitated the drafting of this paper.

Acknowledgements

We thank the Ramsar Convention Secretariat for providing data from their in-house databases of Contracting Party National Reports' information, which would otherwise have been extremely time-consuming to compile from each separate National Report. The development of the ideas presented in this paper were greatly helped by the presentations and discussions in three symposia and workshops organised by the Society of Wetland Scientists' (SWS) Ramsar Section: at SWS annual conferences in 2015 (Providence, Rhode Island, USA) and 2016 (Corpus Christi, Texas, USA) and at the INTECOL 10th International Wetlands Conference (2016, Changshu, China). We thank all participants in these sessions for their most valuable contributions and views on wetland assessment issues. We also thank two anonymous reviewers for their valuable and insightful comments which have helped to improve the paper.

References

- Convention on Biological Diversity (2010). Decision X/2. Strategic plan for biodiversity 2011–2020. Available at <https://www.cbd.int/decision/cop/?id=12268> [Verified 18 April 2019].
- Darrah, S. E., Shennan-Farpôn, Y., Loh, J., Davidson, N. C., Finlayson, C. M., Gardner, R. C., and Walpole, M. J. (2019). Improvements to the wetland extent trends (WET) index as a tool for monitoring natural and human-made wetlands. *Ecological Indicators* 99, 294–298. doi:10.1016/J.ECOLIND.2018.12.032
- Davidson, N. C. (2014). How much wetland has the world lost? Long-term and recent trends in global wetland area. *Marine and Freshwater Research* 65, 934–941. doi:10.1071/MF14173
- Davidson, N. C., Dinesen, L., Fennessy, S., Finlayson, C. M., Grillas, P., Grobicki, A., McInnes, R. J., and Stroud, D. A. (2020). Trends in the ecological character status of wetlands reported to the Ramsar Convention. *Marine and Freshwater Research* 71(1), 127–138. doi:10.1071/MF18329
- Dixon, M. J. R., Loh, J., Davidson, N. C., Beltrame, C., Freeman, R., and Walpole, M. (2016). Tracking global change in ecosystem area: the wetland extent trends index. *Biological Conservation* 193, 27–35. doi:10.1016/J.BIOCON.2015.10.023
- Finlayson, C. M. (1996). The Montreux Record: a mechanism for supporting the wise use of wetlands. In 'Proceedings of the 6th Meeting of the Conference of the Contracting Parties of the Convention on Wetlands, Technical Sessions: Reports and Presentations', Brisbane, Australia. Vol. 10/12 B, pp. 32–37. (Ramsar Convention Bureau: Gland, Switzerland.)
- Finlayson, C. M. (2012). Forty years of wetland conservation and wise use. *Aquatic Conservation* 22, 139–143. doi:10.1002/AQC.2233
- Finlayson, C. M., Davidson, N., Pritchard, D., Milton, G. R., and MacKay, H. (2011). The Ramsar Convention and ecosystem-based approaches to the wise use and sustainable development of wetlands. *Journal of International Wildlife Law and Policy* 14, 176–198.
- Finlayson, C. M., Davies, G. T., Moomaw, W. R., Chmura, G. L., Natali, S. M., Perry, J. E., Roulet, N., and Sutton-Grier, A. E. (2019). The second warning to humanity: providing a context for wetland management and policy. *Wetlands* 39(1), 1–5. doi:10.1007/S13157-018-1064-Z
- Gardner, R. C., Barchiesi, S., Beltrame, C., Finlayson, C. M., Galewski, T., Harrison, I., Paganini, M., Perennou, C., Pritchard, D. E., Rosenqvist, A., and Walpole, M. (2015). State of the World's Wetlands and their Services to People: a compilation of recent analyses. Ramsar Scientific and Technical Briefing Note number 7, Ramsar Convention Secretariat, Gland, Switzerland.
- Gardner, R. C., Jones, T. A., Pritchard, D. E., and Stroud, D. A. (2018). Ramsar Advisory Missions: a mechanism to respond to change in ecological character of Ramsar Sites. Ramsar policy brief number 3. (Ramsar Convention Secretariat: Gland, Switzerland.) Available at https://www.ramsar.org/sites/default/files/documents/library/rpb3_ramsar_advisory_missions_e.pdf [Verified 16 April 2019].
- Jones, T., and Pritchard, D. E. (2017). Comprehensive review and analysis of Ramsar Advisory Mission (RAM) reports. (Ramsar Convention Secretariat: Gland, Switzerland.) Available at <https://www.ramsar.org/document/comprehensive-review-and-analysis-of-ramsar-advisorymission-ram-reports> [Verified 16 April 2019].
- Matthews, G. V. T. (1993). 'The Ramsar Convention on Wetlands: its History and Development.' (Ramsar Convention Bureau: Gland, Switzerland.)
- McInnes, R. J., Davidson, N. C., Rostron, C., and Simpson, M., Valuable insights or fake news? A citizen-science state of the world's wetlands survey. *Wetlands*, in press.

Pritchard, D. E. (2014). Changes in ecological character of wetland sites: a review of Ramsar guidance and mechanisms. (Ramsar Convention Secretariat: Gland, Switzerland.) Available at https://www.ramsar.org/sites/default/files/documents/library/ecological_character_report_long_18112914_e.pdf [Verified 15 April 2019].

Pritchard, D. E. (2018). Ecological character concept of the Ramsar Convention. In 'The Wetland Book. I. Structure and Function, Management, and Methods'. (Eds C. M. Finlayson, M. Everard, K. Irvine, R. J. McInnes, B. A. Middleton, A. A. van Dam and N. C. Davidson.) pp. 473–476. (Springer: Dordrecht, Netherlands.)

Ramsar Convention (1971). Convention on Wetlands of International Importance especially as waterfowl habitat. Final text adopted by the International Conference on the Wetlands and Waterfowl at Ramsar, Iran, 2 February 1971. Available at http://ramsar.rgis.ch/cda/en/ramsardocuments-texts-convention-on-20708/main/ramsar/1-31-38%5E20708_4000_0__ [Verified 11 April 2019].

Ramsar Convention (1984). Recommendation 2.1: submission of national reports. Available at https://www.ramsar.org/sites/default/files/documents/library/key_rec_2.01e.pdf [Verified 11 April 2019].

Ramsar Convention (1990). Recommendation 4.8: change in ecological character of Ramsar sites. Available at http://www.ramsar.org/sites/default/files/documents/library/key_rec_4.08e.pdf [Verified 11 April 2019].

Ramsar Convention (1993). Resolution 5.4: the record of Ramsar sites where changes in ecological character have occurred, are occurring, or are likely to occur (Montreux Record). Available at http://www.ramsar.org/sites/default/files/documents/pdf/res/key_res_5.4e.pdf [Verified 11 April 2019].

Ramsar Convention (1996a). Resolution VI.1: working definitions of ecological character, guidelines for describing and maintaining the ecological character of listed sites, and guidelines for operation of the Montreux Record. Available at http://www.ramsar.org/sites/default/files/documents/pdf/res/key_res_vi.01e.pdf [Verified 11 April 2019].

Ramsar Convention (1996b). Resolution VI.13. Submission of information on sites designated for the Ramsar List of Wetlands of International Importance. Available at http://www.ramsar.org/sites/default/files/documents/pdf/res/key_res_vi.13e.pdf [Verified 11 April 2019].

Ramsar Convention (2002). Assessing and reporting the status and trends of wetlands, and the implementation of Article 3.2 of the Convention. Resolution VIII.8. Available at https://www.ramsar.org/sites/default/files/documents/pdf/res/key_res_viii_08_e.pdf [Verified 16 April 2019].

Ramsar Convention (2005). A conceptual framework for the wise use of wetlands and the maintenance of their ecological character. Resolution IX.1. Annex A. Available at http://www.ramsar.org/sites/default/files/documents/pdf/res/key_res_ix_01_annexa_e.pdf [Verified 11 April 2019].

Ramsar Convention (2008a). Resolution X.16: a framework for processes of detecting, reporting and responding to change in wetland ecological character. Available at https://www.ramsar.org/sites/default/files/documents/pdf/res/key_res_x_16_e.pdf [Verified 11 April 2019].

Ramsar Convention (2008b). Resolution X.14: a framework for Ramsar data and information needs. Available at http://www.ramsar.org/sites/default/files/documents/pdf/res/key_res_x_14_e.pdf [Verified 11 April 2019].

Ramsar Convention (2012). Resolution XI.8, Annex 1: Ramsar Site Information Sheet (RIS): 2012 revision. Available at <http://www.ramsar.org/sites/default/files/documents/pdf/cop11/res/cop11-res08-eanx1.pdf> [Verified 11 April 2019].

Ramsar Convention (2015). Resolution XII.2. The Ramsar strategic plan 2016–2024. Available at https://www.ramsar.org/sites/default/files/documents/library/cop12_res02_strategic_plan_e_0.pdf [Verified 11 April 2019].

Ramsar Convention Secretariat (1999). COP7 DOC. 5. Report of the Secretary General. Available at <https://www.ramsar.org/sites/default/files/documents/cop7-docs/NON-RESRECS%20FINAL/COP7%2005E.pdf> [Verified 11 April 2019].

Ramsar Convention Secretariat (2002). COP8 DOC. 6. Report of the Secretary General pursuant to Article 8.2 (b), (c), and (d) concerning the List of Wetlands of International Importance. Available at https://www.ramsar.org/sites/default/files/documents/pdf/cop8/cop8_doc_06_e.pdf [Verified 11 April 2019].

Ramsar Convention Secretariat (2005). Ramsar COP9 DOC. 6. Report of the Secretary General pursuant to Article 8.2 (b), (c), and (d) concerning the List of Wetlands of International Importance. Available at https://www.ramsar.org/sites/default/files/documents/pdf/cop9/cop9_doc06_e.pdf [Verified 11 April 2019].

Ramsar Convention Secretariat (2008). Ramsar COP10 DOC. 7. Report of the Secretary General pursuant to Article 8.2 concerning the List of Wetlands of International Importance. Available at https://www.ramsar.org/sites/default/files/documents/pdf/cop10/cop10_doc07_e.pdf [Verified 11 April 2019].

Ramsar Convention Secretariat (2010a). Inventory, assessment, and monitoring. Available at <https://www.ramsar.org/sites/default/files/documents/pdf/lib/hbk4-13.pdf> [Verified 11 April 2019].

Ramsar Convention Secretariat (2010b). Addressing change in wetland ecological character. Available at <https://www.ramsar.org/sites/default/files/documents/pdf/lib/hbk4-19.pdf> [Verified 11 April 2019].

Ramsar Convention Secretariat (2012). Ramsar COP11 DOC. 8. Report of the Secretary General pursuant to Article 8.2 concerning the List of Wetlands of International Importance. Available at <https://www.ramsar.org/sites/default/files/documents/pdf/cop11/doc/cop11-doc08-e-status.pdf> [Verified 11 April 2019].

Ramsar Convention Secretariat (2015a). Ramsar COP12 DOC. 7. Report of the Secretary General pursuant to Article 8.2 concerning the List of Wetlands of International Importance. Available at <https://www.ramsar.org/document/cop12-doc7-report-of-the-secretary-general-pursuant-toarticle-82-concerning-the-list-of> [Verified 16 April 2019].

Ramsar Convention Secretariat (2015b). Report of the Secretary General to COP12 on the implementation of the Convention. Ramsar COP12 DOC.8. Available at http://www.ramsar.org/sites/default/files/documents/library/cop12_doc08_report_sg_e.pdf [Verified 11 April 2019].

Ramsar Convention Secretariat (2018a). Global wetland outlook. State of the world's wetlands and their services to people 2018. (Ramsar Convention Secretariat: Gland, Switzerland.) Available at https://static1.squarespace.com/static/5b256c78e17ba335ea89fe1f/t/5ca36fb7419202af31e1de33/1554214861856/Ramsar+GWO_ENGLISH_WEB+2019UPDATE.pdf [Verified 16 April 2019].

Ramsar Convention Secretariat (2018b). COP13 DOC 12. Report of the Secretary General pursuant to Article 8.2 concerning the List of Wetlands of International Importance. Available at <https://www.ramsar.org/document/cop13-doc12-report-of-the-secretary-general-pursuant-toarticle-82-concerning-the-list-of> [Verified 15 April 2019].

Ripple, W. J., Wolf, C., Newsome, T. M., Galetti, M., Alamgir, M., Crist, E., Mahmoud, M. I., and Laurance, W. F. (2017). World scientists' warning to humanity: a second notice. *Bioscience* 67, 1026–1028. doi:10.1093/BIOSCI/BIX125

UN-Water (2018). Sustainable Development Goal 6. Synthesis report on water and sanitation. Draft, 2 May 2018. Available at http://dialogue.unwater.org/app/uploads/2018/05/SDG-6-Synthesis-Report-2018-on-Water-and-Sanitation_UNEDITED.pdf [Verified 11 April 2019].

United Nations Environment Programme (2018). Indicator 6.6.1: water-related ecosystems. Available at <http://www.sdg6monitoring.org/indicators/target-66/indicators661/> [verified 11 April 2019].

United Nations General Assembly (2015). Resolution 70/1. Transforming our world: the 2030 agenda for sustainable development. Available at http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E [Verified 11 April 2019].