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Wetland Management and Monitoring: Adequacy of Ramsar information sheets for detecting change in ecological character

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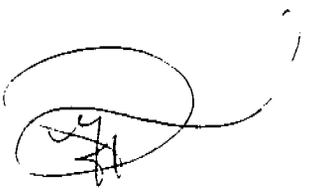
supervising scientist

Declaration

All work presented in this thesis is my own, unless otherwise indicated.



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N421: Advanced Environmental Management

Wetland Management and Monitoring:

Adequacy of Ramsar Information Sheets for Detecting Change in Ecological Character

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Abstract

Selected Ramsar Information Sheets (RIS's) were examined to determine their adequacy for detecting changes in ecological character. Twenty nine RIS's were selected by Wetlands International for being the most complete and also to represent the seven Ramsar regions.

A semi-quantitative matrix was developed to examine whether the RIS's met the purpose for which they were initially designed. That is, whether they provided information on, and fulfilled criteria by which a wetland is considered internationally important. This information also provided a description of the wetland's ecological character. It was concluded that RIS's did provide a good general description of a wetland site, that is they appeared to fulfill the purpose for which they were designed.

Four additional matrices were compiled to examine whether the RIS's provided sufficient information for detecting changes in ecological character. The first two matrices recorded the values and threats occurring at each wetland. This information describes the individual components of ecological character, and indicates whether or not the 'processes' and 'functions' components of ecological character are adequately described.

The final two matrices were used to examine whether the selected RIS's supplied information on baseline data and monitoring for the values and threats listed. They indicated that, in general, information on baselines and monitoring was poorly addressed. In addition, baseline data was mainly qualitative with a few RIS's also supplying limited quantitative information. Future RIS's need to include the following if they are also to provide information on ecological change:

- sufficient parameters to describe baselines for individual values and threats;
- important details on parameters including: when the information was recorded (i.e. date, time, season); the location of the information recorded; the equipment utilized; who recorded the information; and for what purpose;
- a description of seasonal and natural variation in key baseline parameters;
- information on 'processes' and 'functions'; and
- a clear linkage of baseline information with values and threats to ensure that appropriate information is recorded.

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Acronyms

ERISS	Environmental Research Institute of the Supervising Scientist
RIS	Ramsar Information Sheet
IWRB	Wetlands International (formerly known as international Waterfowl and Wetlands Research Bureau)

1. Introduction

1.1 Objective

The primary objective of this project was to assess the usefulness of the Ramsar Information Sheet (RIS) as a means of providing a baseline or reference against which a change in ecological character of a wetland can be assessed. The RIS is a standardised document for recording Ramsar wetland data. This document is used in designating wetlands for inclusion on the 'Ramsar List of Wetlands of International Importance' (Article 2.1 of the Convention). The designation of at least one such wetland is necessary for a country's membership to the Ramsar Convention.

1.2 Aims and Scope of the Research

The following aims were necessary to achieve the primary objective of this project:

- to determine whether the RIS met the purpose for which it was initially designed. That is to describe Ramsar sites and provide criteria by which wetlands are considered internationally important.
- to list and examine the information supplied in the RIS in regard to threats and values of each wetland;
- to assess whether or not the threats will adversely affect the uses and/or ecological values of the wetland;
- to ascertain details of any existing monitoring programs which address the values and threats listed at each wetland; and
- to analyse whether the site description provides sufficient information to describe either a baseline or reference condition for the wetland in relation to values and threats.

And, from this information,

- to assess the adequacy of RIS for providing the baseline/reference information against which a change in ecological character can be determined.

A knowledge base of information relating to the Ramsar Convention was initially developed from extensive library, electronic and World Wide Web database searches. Further information relating to ecological character resulted from the analysis of twenty nine RIS's. Theses were selected for both their completeness, and in order to represent a number of sites from each of the seven Ramsar regions.

The first analysis in this document, described in section two, is concerned with determining whether the RIS meets the purpose for which it was initially designed, (i.e. to describe Ramsar sites and provide criteria by which a wetland is considered internationally important). This was achieved by comparing the information categories contained within the RIS against the guidelines and explanatory notes using a semi-quantitative matrix analysis.

Contracting Parties to the Ramsar Convention are required to list at least one wetland as internationally important and to maintain the ecological character of the listed wetland. The second analysis, described in section three of this document, explores the adequacy of the RIS guidelines in displaying and determining changes in ecological character. This is achieved through the use of four, two-dimensional matrices which list key components of ecological character including values and the threats at each wetland. The matrix analysis provides a means of assessing whether the RIS can be used to detect a change in ecological character. This is achieved by providing information on monitoring and baseline data for each of the values and threats at the selected wetlands. The information obtained should assist the better management of Ramsar wetlands, particularly with respect to the development of monitoring guidelines.

1.3 The Ramsar Convention

The Convention on Wetlands of International Importance especially as Waterfowl Habitat is more commonly known as the Ramsar Convention. It was named after the small Iranian town where the initial meeting of the Convention was held in 1971. Currently, the Convention has signatories from over one hundred different nations of the world, and over eight hundred wetland sites are included on the Ramsar List of Wetlands of International Importance (James, 1996; Davis, 1994; Matthews, 1993; Stone, 1996; James & Phillips, 1995).

The Ramsar Convention provided one of the first modern instruments for the conservation of wetlands on a global scale. It is defined in the Ramsar Convention Manual (Davis 1994, p1), as, "the intergovernmental treaty which provides the framework for international cooperation for the conservation and wise use of wetland biomes".

Initial concerns for the conservation of wetlands resulted from declining waterfowl populations in Europe and North America in the 1960's as a product of excessive hunting activities. Further investigation into the diminishing waterfowl numbers also discovered the impact humans were having on the entire ecology of wetlands through drainage, pollution and unsuitable land use. As a result the Ramsar goals evolved to encompass the protection of the entire wetland ecosystem (Matthews, 1993; Davis, 1994; James & Phillips, 1995).

Wetlands are one of the most threatened habitats in the world. This is largely due to their importance, in general, being poorly documented and understood. Historically, wetlands were considered to be unsightly wastelands that encouraged the breeding of pests, parasites and diseases, resulting in them having little value to society. As such they have often been used as dumping grounds for pollutants and are considered unproductive unless drained and used for agriculture. As a result of this, wetlands in developed countries have disappeared, leading to the loss of groundwater reserves, shoreline erosion and a loss of many useful plants and animals (Matthews, 1993; Kingsford, 1997).

The main concerns for the establishment of the Ramsar Convention related to the protection and conservation of wetlands and their resources, as well as the need to develop international agreements to achieve successful protection and

conservation. International agreement between Contracting Parties is particularly important when considering migratory flyways of birds, catchment areas extending into the boundaries of neighbouring countries, and the different breeding grounds that might be required for the lifecycles of fish and other organisms (Stone, 1996; Davis, 1994).

Why wetlands are important

Wetlands are one of the most productive environments in the world providing a large range of benefits not only to the plants and animals that inhabit them but also to the health, safety and welfare of people who live in or adjacent to them. The conservation of wetland ecosystems and the protection of wetland habitats, wildlife and endangered species is necessary to protect their related functions, values and attributes. This is vital for maintaining ecological processes for future generations as well as to conserve the migration and breeding grounds contained within the wetland habitats. (Mitsch & Gosselink, 1986; Matthews, 1993; Davis, 1994).

Many important functions are provided by wetlands, including:

- water storage;
- storm protection and flood mitigation;
- shoreline stabilization and erosion control;
- groundwater recharge - the movement of water from the wetland down into the underground aquifer;
- water purification, retention of nutrients and retention of sediments;
- retention of pollutants, and
- stabilization of local climatic conditions, particularly rainfall and temperature (Davis, 1994).

In addition to the above, wetlands also assist in providing economic benefits to different people in different ways, including;

- fisheries;
- agriculture;
- timber production;
- wildlife resource;
- transport; and
- recreation and tourism opportunities (Davis, 1994).

Wetlands are also important for supporting the biodiversity of many plants and animals unique to these environments, as well as for maintaining cultural heritage and local traditions (Matthews, 1993; Davis, 1994).

How the Ramsar Convention functions

The day to day administration of the Convention activities is carried out by a permanent secretariat referred to as the Convention Bureau, whose headquarters are located in Gland, Switzerland. A work outline and business plan is prepared each year to address the general programmes approved at the Conference of Contracting Parties for that triennium (Matthews, 1993; Davis, 1994).

Every three years representatives of the member states meet at the Conference of the Contracting Parties to review, promote and implement the Convention. The Conference provides a forum for discussion and allows the presentation of workshops, overview of papers, abstracts, and national reports. To facilitate the way in which the Convention works, decisions are adopted in the form of Resolutions and Recommendations. Resolutions include decisions relating to the operation of the internal functioning of the Convention, while Recommendations are expressions by the Conference to the Contracting Parties, other States, or organizations to see certain actions carried out (Matthews, 1993; Davis, 1994).

The Contracting Parties of the Ramsar Convention have adopted many mechanisms through the Resolutions and Recommendations made at subsequent Conferences. These are used to interpret and improve the implementation of the Convention (Kingsford, 1997). Those mechanisms considered to be important in the implementation of the Ramsar Information Sheets (RIS) include: criteria and guidelines for identifying wetlands of international importance; the global classification system of wetland types; and the guidelines for wise water use. A brief discussion of these key documents follows.

1.3.1 Criteria for identifying wetlands of international importance

The Convention text requires Contracting Parties to designate at least one wetland within its territory to the 'List of Wetlands of International Importance' upon joining the Convention. The Convention text (Article 2.2) goes on to further state that wetlands should be selected for their, "international significance in terms of ecology,

botany, zoology, limnology or hydrology" (Davis 1994, p46). The criteria for identification of wetlands and the guidelines for their application were developed to assist the Contracting Parties in assessing the suitability of wetlands for inclusion on the list (Davis 1994; Ramsar Convention Bureau, 1996a).

The criteria originated from a Conference organized by Wetlands International (IWRB) at Heiligenhafen, Germany in 1974 (Matthews, 1993; Smart, 1974). Further development and refinement of the criteria and guidelines resulted from resolutions of subsequent meetings of the Contracting Parties at Sardinia in 1980, Canada in 1987, Switzerland in 1990, and Australia in 1996 (Matthews, 1993; Davis, 1994; Ramsar Convention Bureau, 1996a).

Currently, for a wetland to be identified as being of international importance it must meet at least one of the following:

1. Criteria for representative or unique wetlands;
2. General criteria based on plants or animals;
3. Specific criteria based on waterfowl; and
4. Specific criteria based on fish (Ramsar Convention Bureau, 1996a).

1.3.2 Classification system for wetland type

The Convention text (Article 1.1) broadly defines wetlands as, "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres " (Davis 1994, p3).

Additional information on the description of wetlands is provided in Article 2.1 of the Convention, which states that a wetland "may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands" (Davis 1994, p3). This allows wide coverage of a variety of habitat types to be incorporated into the Convention (Ramsar Convention Bureau, 1994).

A coded system was developed by the Bureau as a more appropriate means of recording wetland type on the RIS. This allows the rapid identification of wetland habitats represented at each site. The Montreax Convention of 1990, approved Recommendation C.4.7 that provides a broad framework of wetland types under the following three main headings: Marine/Coastal, Inland Wetlands, and "Man-Made" wetlands. For larger sites this enables the recording of a variety of habitats within

them, so as to provide a better understanding of the processes that might be taking place (Ramsar Convention Bureau, 1990a)

1.3.3 Guidelines for the implementation of wise use of water

The Convention text (Article 3.1) requires Contracting Parties to formulate and implement their planning to promote the wise use of wetlands in their region. A workshop on the wise use of wetlands was established at the third meeting of the Contracting Parties at Regina, Canada in 1987. After extensive debate a definition of 'wise use' and a set of guidelines for its implementation were developed and adopted under Recommendation C.3.3 (Ramsar Convention Bureau, 1987; Davis, 1994; Davis, 1993).

The definition for the "wise use" of wetlands:

> "is their sustainable utilization for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem" (Davis 1994, p61).

The term 'sustainable utilization' of a wetland is further defined as:

> "Human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations" (Davis 1994, p61).

'Natural properties of the ecosystem' are further defined as:

> "Those physical, chemical and biological components, such as soil, water, plants, animals and nutrients, and the interactions between them" (Davis 1994, p61).

In this way the definition defines conservation in terms of the management of biospheres for human use rather than saving wetlands for the conservation of plants and other animals. This provides an economic argument to deter governments, especially those in developing countries, from degrading or draining wetlands (Matthews, 1993; Davis, 1993).

The guidelines also provide five groups of action for the establishment of comprehensive national wetland policies. The following gives a brief overview of these actions:

1. improvement of institutional and organizational arrangements to facilitate a coordinated approach on a national scale;
2. addressing aspects of legislation and government policies including mechanisms to assist in the implementation of wise use practices;
3. increasing the knowledge and awareness of wetlands through inventories, monitoring, research, training and education;
4. to review, in a national context, the priorities of every wetland site; and
5. address the problems at particular sites with regard to ecological aspects, human activities and management plans (Matthews, 1993; Smart & Canters, 1991; Davis, 1993).

1.4 The Ramsar Information Sheet (RIS)

The Ramsar Information Sheet (RIS) was designed to provide a standardized format for recording Ramsar site data and to provide criteria by which a wetland is considered internationally important. Contracting Parties that designate wetlands for the 'List of Wetlands of International Importance' are expected to complete an RIS and provide a site map so that information may be recorded on the Ramsar database (Davis, 1994; Ramsar Convention Bureau, 1990b).

The RIS resulted from Recommendation C.4.7 of the Montreux Convention, Switzerland in 1990, and also provided explanatory notes and guidelines to assist Contracting Parties in completing the data sheets. Furthermore, Resolution C.5.3 of the Kushiro Conference, Japan in 1993, reaffirmed the requirement of an RIS and site map to be completed once a wetland is designated to the Ramsar List (Davis, 1994; Ramsar Convention Bureau, 1993, Ramsar Convention Bureau, 1990c). The explanatory notes and guidelines were further updated in 1996, at the Brisbane

Convention in Australia to provide additional details on the following:

- a working definition for ecological character and change in ecological character;
- guidelines for describing and maintaining the ecological character at Ramsar sites;
- improvements to guidelines for the RIS;
- a framework for designing an effective wetland monitoring programme; and
- guidelines for implementing the Montreux Record (Ramsar Convention Bureau, 1996b; Ramsar Convention Bureau, 1996c).

The database for storing the RIS information was established in 1990, and is maintained by the Convention's partner organisation, Wetlands International, in the Netherlands. It enables the list to be easily maintained and updated and facilitates a rapid response to inquiries. It also provides essential data on national inventories of wetlands. Once an RIS has been designated to the list it is allocated a code for easy identification.This comprises of: the number of the Ramsar region it belongs to, followed by the first few letters of the country name, and it ends with a numbering sequence as shown in Table 2 (Davis, 1994; Matthews, 1993).

As shown in Table 4 the RIS is comprised of thirty categories, commencing with general information on the wetlands name, area, and location, followed by more detailed information concerning conservation measures, threats, disturbances, and values. The explanatory notes and guidelines alert the Contracting Parties to the type and amount of information required for each of the categories, and, where necessary, the required units. Additional and more detailed information referred to in the guidelines includes documentation on: the criteria for identifying wetlands of international importance; the classification system for wetland type; and guidelines for the implementation of the wise use of water (Davis, 1994; Davis (ed.), 1993; Ramsar Convention Bureau, 1990b).

The information on the data sheets is required to be updated through national reports at the triennial meetings of the Conference. As some of the Contracting Parties may not have the resources or data required to complete the RIS they are requested to pay particular attention to the sections on conservation measures, functions and values, and criteria for designation (Davis, 1994; Ramsar Convention Bureau 1990b).

1.5 Ecological Character

The requirement of Article 3.2 of the Ramsar text, requests Contracting Parties to inform the Convention at the earliest possible time if the ecological character of a wetland on the List has changed, is changing, or is likely to change as a result of human interference. The 'Montreux Record' was established in 1990 at Montreux, Switzerland to highlight wetland sites on the List, which displayed such change in ecological character (Davis, 1994; Ramsar Convention Bureau, 1996b & c; Ramsar Convention Bureau, 1990c).

Contracting Parties are required to conserve and protect their wetlands and to put into place remedial actions should a change in ecological character occur, especially when changes affect the characteristics for which they were selected as internationally important. Unfortunately, there were no mechanisms in place for Contracting Parties to identify what constituted ecological character and therefore a change in ecological character. The Conference at Kushiro, Japan in 1993, through Resolution C.5.2, emphasized the need for further studies into the complex Ramsar concepts of 'ecological character' and 'change in ecological character' to assist Contracting Parties in this matter (Ramsar Convention Bureau, 1993).

As a result, the Conference in Brisbane, Australia in 1996, produced an Annex to Resolution C.6.1 on ecological character, to assist Contracting Parties with the implementation of Article 3.2 of the Convention text. The Annex provided working definitions for ecological character and change in ecological character along with guidelines for describing and maintaining ecological character of listed sites. In addition, the Annex also provided guidelines for the operation of the Montreux Record. (Ramsar Convention Bureau, 1996b & c).

Ecological character is defined as:

> "the structure and inter-relationships between the biological, chemical, and physical components of the wetland. These derive from the interactions of individual processes, functions, attributes and values of the ecosystem(s) " (Ramsar Convention Bureau 1996c, p2).

The term 'change in ecological character' of a wetland is defined as

> "the impairment or imbalance in any of those processes and functions which maintain the wetland and its products, attributes and values" (Ramsar Convention Bureau 1996c, p2).

Descriptions of the individual components encompassing the attributes of ecological character taken from Resolution C.6.1 are outlined in Table 1 (Ramsar Convention Bureau, 1996b & c; Finlayson, 1996a).

Table 1. Definition of the individual components of ecological character.

ATTRIBUTES OF ECOLOGICAL CHARACTER	DEFINITION OF INDIVIDUAL ATTRIBUTES
Processes	Changes or reactions which occur naturally within a wetland ecosystem. These may be physical, chemical, or biological.
Functions	Activities or actions which occur naturally in wetlands as a product of the interactions between the ecosystem structure and processes e.g. flood water control; nutrient, sediment and contaminant retention; food web support; erosion controls; storm protection; and stabilization of local climatic conditions.
Values	The perceived benefits to society, either direct or indirect, that result from wetland functions. These values include human welfare, environmental quality and wildlife support.
Products	Generated by wetlands through interactions between the biological, chemical and physical components. These include: wildlife resources; fisheries; forest resources; forage resources; agricultural resources; and water supply.
Attributes	Features which may lead to certain uses or the derivation of particular products, but they may also have intrinsic, unquantifiable importance. These include biological diversity and unique cultural and heritage features.

The Annex to Resolution C.6.1 also provides minor modifications to the already existing guidelines and explanatory notes on the RIS. These modifications are designed to increase the value of information gathered in describing and assessing ecological character of listed sites. Therefore, they provide a basis by which a change in ecological character can be more readily recognized. In achieving this aim, point 2.1.9 of the Annex indicates that the guidelines should emphasize the importance of the following:

I. establishing a baseline by describing the functions, products and attributes of the site that gives it benefits and values of international importance. This is necessary because the existing Ramsar criteria do not cover the full range of wetland benefits and values which should be considered when assessing the possible impact of changes at a site;

II. providing information on human-induced factors that have affected or could significantly affect the benefits and values of international importance;

III. providing information on monitoring and survey methods in place (or planned) at the site; and,

IV. providing information on the natural variability and amplitude of seasonal and/or long-term "natural" changes (e.g. vegetation succession and episodic/catastrophic ecological events such as hurricanes) that have affected or could affect the ecological character of the site (Ramsar Convention Bureau, 1996b & c, Finlayson, 1996a).

2. RIS and Guideline Analysis

2.1 Introduction

The RIS were designed to provide a standardised format for the Contracting Parties to record site information and provide criteria by which wetlands are considered to be internationally important. A matrix analysis utilizing a subjective semi-quantitative scoring system was used to determine whether the RIS met the purpose for which they were originally designed and to examine the comprehensiveness and availability of the data.

2.2 Methods

2.2.1 Site selection

The analysis of RIS in this document does not seek to identify the response by Contracting Parties to using the RIS, rather, the analysis is related to the information contained within RIS. It is for this reason that sites were selected on the basis that they were good examples of an RIS which addressed the requirements of the current guidelines. This ensured that a representative sample of the data contained within the RIS was selected which may not have been achieved if a random selection of sites was undertaken.

Staff at the Convention's partner organization, Wetlands International, situated in the Netherlands, where the Ramsar database is maintained, assisted with the selection process. The RIS were selected not only for their completeness, but also to represent a number of sites from each of the seven Ramsar regions listed in Table 2.

A subjective analysis of the completeness of the data sheets was undertaken with those that appear to provide the most information being selected. Staff at Wetlands International in the Netherlands have advised that the following steps were followed for the selection process:

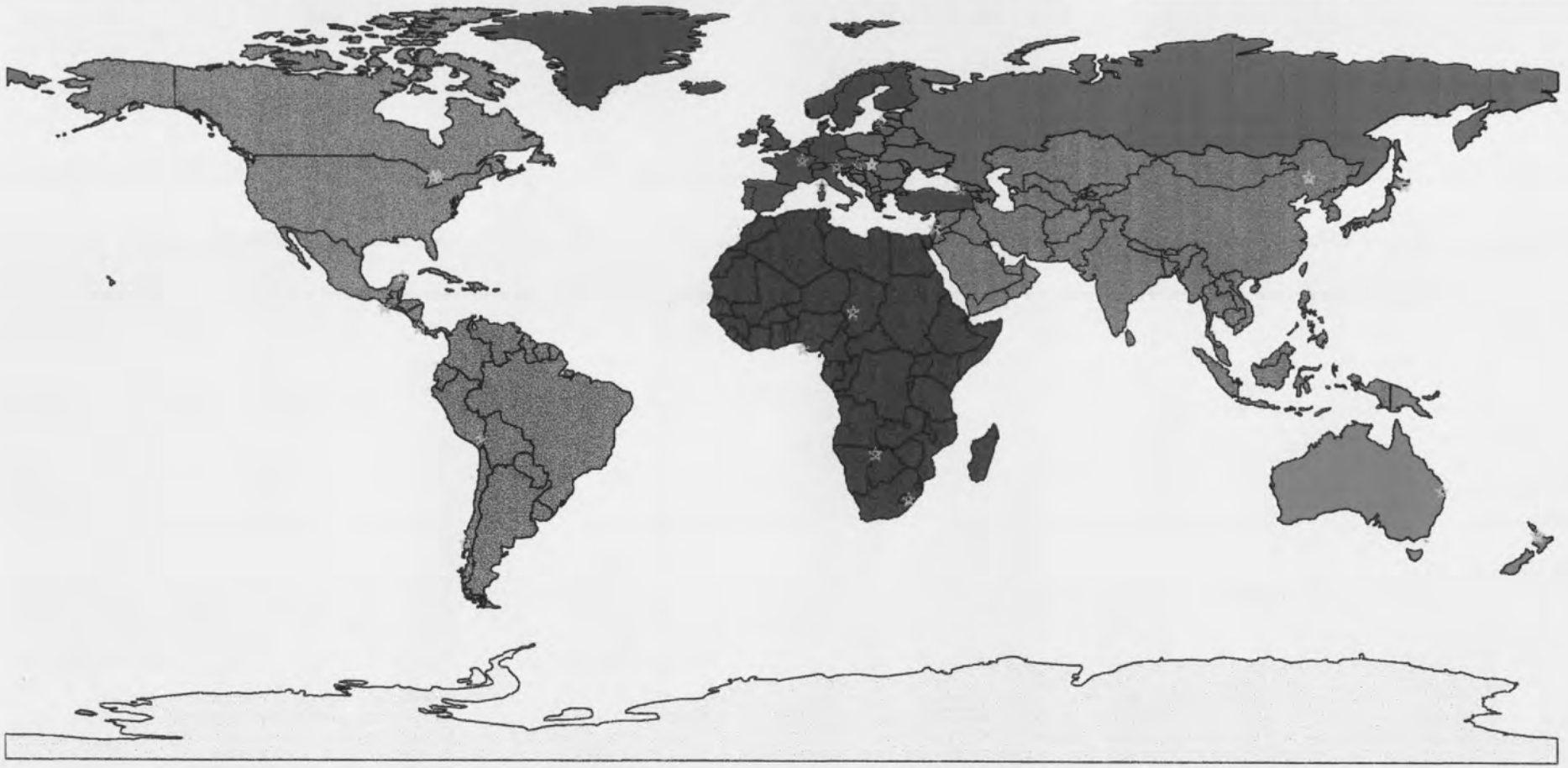
- records were selected for having data presented in the RIS format;
- the data set was filtered for RIS records supplying information on: criteria, wetland type, physical features, ecological features, land uses, threats, hydro-physical values, noteworthy fauna, noteworthy flora, and social/cultural values;

- this resulted in the production of a list entitled 'Prospective RIS Site Data for Testing Guidelines' giving details of the best RIS (Appendix 1);
- data sheets from these records were manually scanned for content volume e.g. all categories contained some written information, and those scoring the most highly in this regard were selected (unless there were other problems with parts of the data e.g. map was unavailable);
- these were listed for each region and country, and rated under the "initial assessment" column of the table entitled "RIS Assessment for Testing Ecological Character" (Appendix 2);
- initially manually selected sheets were re-scanned and a "final manual assessment" (see column of same name in Appendix 2) without a rating, was made. In some cases, RIS that were initially rated highly were discarded owing to some problem while others, less highly rated were selected.

This resulted in the selection of the twenty four RIS shown in Table 2 for analysis from the Ramsar database. Difficulties in translating the RIS for the Costa Rica site of Humedal Caribe Noreste resulted in it being excluded from the analysis. However, the example of an RIS and map in the Conventions manual comprising of a compilation of data from different sites was included in the analysis. In addition, the wetland site of Hortobagy in Hungary was large enough to warrant six individual RIS, bringing the total number of RIS for analysis to twenty nine. The wetland sites selected are represented on a global map in Figure 1, which also indicates the extent of the seven Ramsar regions.

Table 2 provides information on the country and name of each wetland site selected in addition to the site code assigned by the Bureau of the Ramsar Convention when a site is designated to the List.

Figure 1.0 Location of Ramsar wetland sites selected for this study



Ramsar Regions

- North America
- Neotropics
- Eastern Europe
- Africa
- Oceania
- Western Europe
- Asia
- N/A
- Selected Ramsar Wetland Sites

Table 2 Wetland sites included in the analysis of the Ramsar Information Sheets.

(For convenience the underlined section of the original site name will be used as an abbreviation throughout the document.)

REGION & COUNTRY	NAME OF SITE	SITE CODE
1. AFRICA		
BOTSWANA	Okavango Delta System	1BW001
COTE D'IVOIRE	Parc national d'Azagny	1CI001
SENEGAL	Delta du Saloum	1SE003
SOUTH AFRICA	Natal Drakensberg Park	1ZA013
2. ASIA		
CHINA	Xianghai	2CH001
ISRAEL	Hula Nature Reserve	2IL002
JAPAN	Kushiro-shitsugen	2JP001
3. EASTERN EUROPE		
HUNGARY	Hortobagy	3HU008
GEORGIA	Wetlands of Central Kolkheti	3GE001
LATVIA	Lake Engure	3LV001
SLOVAK REPUBLIC	Cicovske mrtve rameno	3SV003
4. NORTH AMERICA		
CANADA	Minesing Swamp	4CN034
CANADA	Matchedash Bay	4CN035
5. OCEANIA		
AUSTRALIA	Moreton Bay	5AU041
NEW ZEALAND	Whangamarino	5NZ003
NEW ZEALAND	Kopuatai Peat Dome	5NZ004
6. NEOTROPICS		
CHILE	Carlos Anwandter Sanctuary	6CL001
COSTA RICA	Humedal Caribe Noreste	6CS006
GUATEMALA	Manchon-Guamuchal	6GU002
PERU	Lago Titicaca (Peruvian sector)	6PE004
MEXICO	Ria Lagartos	6ME001
7. WESTERN EUROPE		
AUSTRIA	Rotmoos im Fuschertal	7AS008
FRANCE	Etangs de la Champagne humide	7FR002
FRANCE	Etang de Biguglia	7FR008

2.2.2 Semi - quantitative matrix analysis

A matrix analysis was undertaken for each RIS to determine whether it provided the relevant site data requested in the guidelines, along with the criteria, which identifies a wetland as internationally important. The left hand side of the matrix details the thirty information categories listed in the RIS with the reference number and abbreviated name of the individual wetlands being provided at the top of each column (Appendix 3).

A subjective semi-quantitative scoring system, presented in Table 3, was developed to closely follow the requirements set out in the "Information Sheet on Ramsar Wetlands (RIS): Explanatory Note and Guidelines" (Davis, 1994). This will be referred to in the scoring system as the RIS guidelines. These guidelines alert the Contracting Parties to the type and amount of information required for each of the categories, and, where necessary, the required units.

Additional and more detailed information referred to in the guidelines and utilized in this analysis includes: the criteria for identifying wetlands of international importance; classification system for wetland type; and guidelines for the implementation of the wise use of water (Ramsar Convention Bureau, 1990a; Ramsar Convention Bureau, 1996a; Davis, 1993l).

Table 3 The scoring system developed to determine whether the RIS's meet their original purpose.

SCORE	DESCRIPTION
5	Meets RIS guidelines.
4	Most of the RIS guidelines are addressed.
3	Some RIS guidelines are addressed.
2	General statement provided, but not in accordance with the RIS guidelines.
1	No information provided.

2.2.3 Manipulation of data

The completed data in Matrix 1 (Appendix 3) was then manipulated to demonstrate the percentage of overall compliance of each RIS to the guidelines. The results were then grouped into different percentage ranges as shown in Figure 2. The following formula applies:

$$\text{Overall compliance (\%)} = \frac{\text{Sum of values in each category for an individual RIS}}{\text{Max. score (5) x No. of categories (31)}} \times 100\ (\%)$$

In addition, the percentage compliance of the RIS to each individual category was also calculated. The results presented in Table 4 are approximate percentages resulting from the following formula.

$$\text{Compliance of RIS individual category (\%)} = \frac{\text{Sum of values of all the RIS for an individual category}}{\text{Max. score (5) x No. of RIS (29)}} \times 100\ (\%)$$

2.3 Results

The results of the semi-quantitative analysis of matrix one, presented in Figure 2, revealed that the twenty nine RIS selected for assessment adequately addressed the information provided in the guideline. The RIS are all within an eighty one to one hundred percent compliance range, with twenty three out of the twenty nine RIS being in the range of eighty six to ninety five percent compliance.

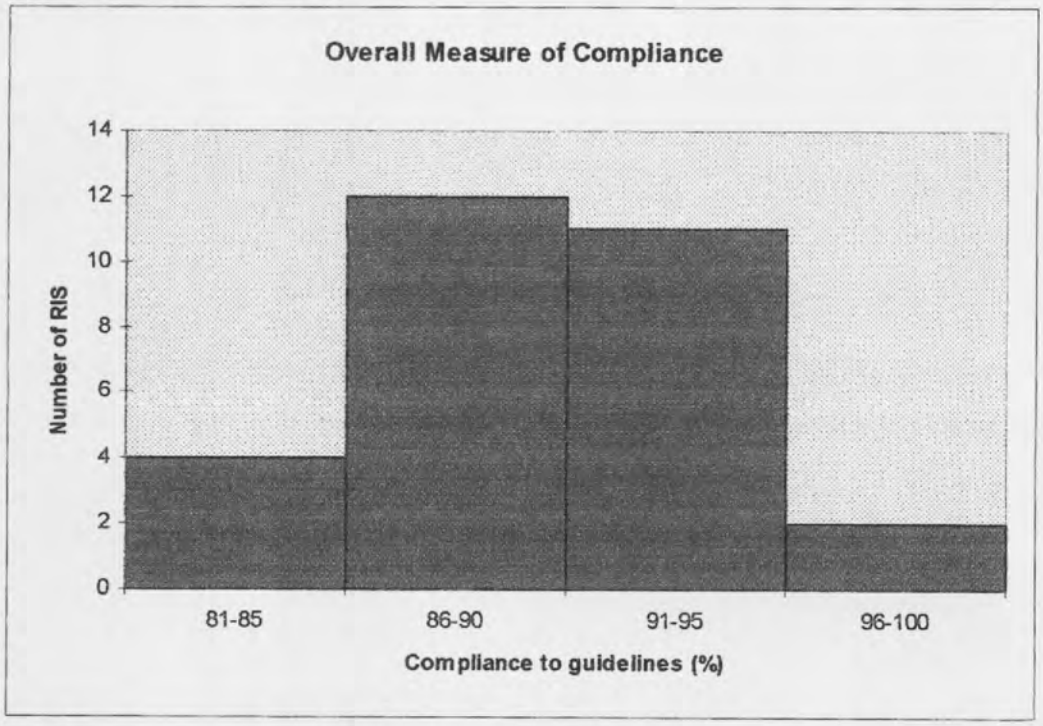


Figure 2 The number of RIS within different percentage ranges of overall compliance to the guidelines.

Further analysis revealed that the individual categories within the RIS also achieved a high level of compliance with the guidelines, ranging from sixty six percent to one hundred percent compliance (Table 4).

Table 4 indicates that twelve of the thirty one categories fell into the ninety six to one hundred percent compliance range. These included: country; date; reference number; name of wetland; area; altitude; land tenure/ownership of (a) site (b) surrounding area; current land use (a) site (b) surroundings/catchment; conservation measures taken; current scientific research and facilities; current conservation education; and management authority.

As shown by Table 4 the percentage compliance range which received the next highest number of categories was the eighty one to eighty five percent range, with seven categories. The following were included in this percentage range: name and address of compiler; wetland type; ecological features; disturbances and threats; hydrological and biophysical values; noteworthy flora; and bibliographical references.

The category to receive the lowest score of sixty six to seventy percent, was map of site (Table 4).

Table 4 Percentage of RIS's complying with requirements of the guidelines for each of the RIS categories.

COMPLIANCE %	CATEGORIES WITHIN THE RIS
66-70	• Map of site
71-75	• Date of Ramsar designation
76-80	• General location
81-85	• Name and address of compiler • Wetland type • Ecological features • Disturbances and threats • Hydrological and biophysical value • Noteworthy flora • Bibliographical references
86-90	• Physical features • Social and cultural values • Noteworthy fauna • Jurisdiction
91-95	• Geographical coordinates • Overview of site • Conservation measures proposed but not yet implemented • Current recreation tourism • Reasons for inclusion (criteria)
96-100	• Country • Date • Reference number • Name of wetland • Area • Altitude • Land tenure/ownership of (a) site (b) surrounding area • Current Land use (a) site (b) surroundings/catchment • Conservation measures taken • Current scientific research and facilities • Current conservation education • Management authority

2.4 Interpretation of Results

The RIS were designed to provide a standardised format for recording Ramsar site data and to provide criteria by which a wetland is considered internationally important. The results indicate, that, overall the RIS selected for this analysis adequately address the original guidelines of the Ramsar manual. In addition, a more detailed examination of the percentage compliance of each individual category contained within the RIS showed a broader level of compliance, ranging from sixty six percent to one hundred percent.

The categories scoring the highest level of compliance of ninety one to one hundred percent were often less subjective, requiring a more factual response than other categories. The language utilized in the guidelines for these categories is clear and concise often only providing one or two sentences to deliver an unambiguous message. It is apparent when examining the categories of: country, date, reference number, name of wetland, area, altitude, land tenure/ownership, and management authority that a factual response is required.

In general, other categories in the same compliance range, such as current scientific research and facilities, and current conservation education, were filled out well and received a high score. However, as the requested information requires the compiler to give a 'current' account of details in these categories, it is possible that no research, education or facilities are currently being conducted or are available. Therefore, a response such as, 'no educational programs are currently underway' (Kopuatai) or 'no research to date' (Matchedash) received similarly high scores to Manchon and Titicaca which gave detailed accounts of scientific research, educational programs and facilities at their wetland. This may have attributed to the high overall compliance of these categories.

There appears to be a general trend towards categories requiring more detailed information as the level of compliance reduces. In addition, the guidelines may require a subjective response, which can be difficult to quantify. Three of the categories, which scored between an eighty one and eighty five percent compliance, included: disturbances and threats; ecological features; and hydrological and biophysical values.

The guidelines for the category on disturbances and threats contained a substantial amount of material, commencing with a broad request of details regarding changes in land use and major development projects leading to more specific examples of what should be addressed such as drainage or siltation. The guidelines further request, where possible, the distinction between internal and external threats and information on exotic species and why they were introduced. This information does not appear to be as clear and concise as the guidelines provided for the categories scoring high levels of compliance. There are perhaps, too many requests for detailed information in this category, which make it confusing. Although much data is requested the type of responses required are often subjective. This allows the inclusion of threats which are considered to be important to the individual compiling the RIS, while other important threats may be omitted. An example of this occurs in the RIS for Wangamarino, which does not list the recreational activity of duck shooting to be a threat. This appears to contradict information in the noteworthy fauna category on endangered species, which states that the Brown Teal (*Anas aucklandica chlorotis*) is one of the five rarest ducks in the world and is endemic to the area. Shooting ducks in this area would result in the disruption of breeding habitat of this species and possibly death of individual ducks by hunters who are inexperienced at distinguishing between different duck species.

The category on ecological features required a brief description of the main habitats and vegetation types including dominant species and any zonation, seasonal variations and long-term changes. The RIS for Morton supplied two full pages of information for this category which, when examined closely, only provided a few sentences of relevant information covering only some of the guidelines requested. Although a number of RIS's for this category supplied information on most of the requirements in the guidelines, not many were successful in fulfilling all the requirements. The outcomes of this category may be attributed to the individual's lack of understanding of what was required when compiling the RIS. The compiler may have become confused by the use of unfamiliar terminology, especially where language barriers existed. In addition, the requested information may not exist or be readily available, especially in countries where resources are scarce, thus resulting in only a partial completion of the guideline requirements. It may also be possible that

the guidelines ask for details that are generically difficult to obtain, such as those related to long-term changes.

Similarly, the guidelines for hydrological and biophysical values provide a description and examples, which include: the recharge and discharge of groundwater, flood control, sediment trapping and maintenance of water quality. A number of RIS including Saloum and Hortobagy (3HU008d1), provided a general statement that was not in accordance with the guidelines. Saloum supplied information on a storm breaking a littoral strip, and Hortobagy (3HU008d1) indicated that micro-formations and soil development processes were significant areas for research. This information was not required for this category and does not adequately provide a description of the hydrological functions or biophysical values of the wetland as set out by the RIS guidelines. The poor responses to this category may have resulted from confusion regarding what information was actually required, especially if the guidelines do not follow a consistent pattern.

The lowest level of compliance (a score of sixty six to seventy percent) was achieved by the category requesting a map of the site. The information requested in the guidelines is detailed and extensive and includes: scale, date, geographical coordinates, a compass bearing, the boundary of the Ramsar site, topographical information, main roads and other notable features. Azagny and Saloum were the two maps to receive the lowest scores with the exception of Xianghai which did not supply a map. These maps were photocopies of a selected area taken from larger maps, which were designed for other purposes. Most of the requirements of the guidelines were missing and it was extremely difficult to ascertain any information from them. This was because basic descriptive information such as: a key for describing symbols, border of the wetland, and notable features were missing. The only RIS's which provided all the information required in the guidelines were Manchon, Kolkheti and the example. These maps appear to have been constructed for the sole purpose of providing information for the RIS's and therefore, clearly address all the requirements in the guidelines. They go further by also producing a map which is easy to read and is not crowded with information that is not required. Contracting Parties may not always have the required resources to provide a specific map to describe their wetland, however, the analysis indicates maps produced in this way provide information that is clearer and more informative.

The Ramsar Bureau recognizes that not all Contracting Parties will have the resources or data to complete an RIS and they are therefore requested to concentrate their efforts on the sections concerning conservation measures, function and values, and criteria for designation (Davis, 1994; Ramsar Convention Bureau 1990b). It is interesting to note that the RIS guidelines in the Convention's manual only request the code to be given for the criteria against which they are considered internationally important. The instructions are clear and give examples such as 1(a), 2(b), with information also being supplied on where to find the criteria. Although some RIS provide even more detail than was required such as Hula and Engure, others including Minesing and Okavango, have provided a paragraph on why the wetland should be included on the list but did not provide the requested codes. In addition, the RIS for Cicovske did not supply any details at all.

2.5 Conclusion

Overall, the RIS selected for evaluation, met the purpose for which they were originally designed. That is, they successfully provided a standardized format for recording Ramsar site data on the Ramsar database, and criteria by which a wetland is considered to be internationally important. As a consequence, the ecological character has also been described through the details provided in the criteria and other categories.

The examination of the compliance of individual categories indicates that those with the highest level of compliance are less subjective, require a factual response and deliver information in a clear and concise manner. The guidelines for the categories at the lower end of the compliance range tend to require information that is subjective and open to interpretation from the individual compilers. The guidelines for these categories may often require specific and detailed information to be recorded. This information may not be readily available, especially in countries that lack the appropriate resources to obtain the data in the first place. There could also be concerns regarding the ability of the compiler in comprehending the type of information required, especially if unfamiliar terminology is used or where language barriers exist.

Therefore, if the guidelines are to be utilized successfully they need to be written in such a way request that the information provided is in a clear and concise manner that is not ambiguous or confusing to the compiler.

A closer examination of the attributes that make up the components of ecological character (listed in Table 1) is described in section three of this study.

3. Ecological Character Analysis: Baseline and Monitoring Information

3.1 Introduction

The requirement of Article 3.2 of the Ramsar text, basically requests Contracting Parties to inform the Convention if the ecological character of a wetland on the List has changed, is changing, or is likely to change as a result of human interference. The second analysis described here explores the adequacy of the old RIS guidelines in displaying, and determining changes in ecological character. As no formal definition for ecological character and change in ecological character were provided in the original RIS guidelines, this analysis will utilize the definition presented in the Annex to Resolution C.6.1 of the Brisbane, Australia Conference in 1996.

3.2 Methods

3.2.1 Site selection

As described in section 2.2.1.

3.2.2 Matrices

The analysis was achieved through the use of a series of two dimensional matrices, which identify the values, threats, monitoring and baseline data available in each of the twenty nine RIS's.

This analysis consisted of two stages, utilizing four, two dimensional matrices. The first stage comprised two matrices, the first identifying the values and the second identifying the threats for each of the twenty nine RIS. This gives a basic understanding of the ecological character of the wetlands and of factors which might affect them. The second stage also comprised two matrices and explores whether baseline information or details of monitoring are provided for each of the threats and values listed in the first two matrices. This provides information on the ability of the RIS's to provide information from which change in ecological character can be determined. A more detailed account of each matrix is provided as follows:

Values matrix

A two dimensional matrix analysis was undertaken for each RIS to determine the values present at each of the wetlands. The left hand side of the matrix details the possible values that may be present at the wetland under the following four broad categories: water regime, exploitation and production, natural heritage, and cultural heritage. The reference number and abbreviated name of the individual wetlands are provided at the top of each column (Appendix 4).

The term 'values' in this analysis is used for convenience and encompasses all the key components of ecological character including: processes; functions; values; products; and attributes as described in Table 1.

The entire RIS document for each wetland was examined to ascertain which values applied to each wetland. Particular attention was paid to the categories which directly dealt with wetland values including: hydrological and biophysical values; social and cultural value; noteworthy fauna and flora; and reasons for inclusion. Identifying the values for each RIS provides important information on the ecological character of the individual wetland, which may need to be further examined further to ascertain whether a change in ecological character is being experienced.

The next step in the analysis determined if any monitoring or baseline information was available for each of the values listed, so as to form a basis from which a change in ecological character could be assessed.

Threats matrix

A two dimensional matrix analysis was undertaken for each RIS to determine the threats present at each of the wetlands. The left hand side of the matrix details the possible threats that may be present at the wetland under the following five broad categories: water regime, water pollution, physical modifications, exploitation and production, and cultural heritage. The reference number and abbreviated name of the individual wetlands are provided at the top of each column (Appendix 5).

The term 'threat' in this analysis is used for convenience and also encompasses issues for each of the wetlands. The definition of 'threats' and 'issues' utilized for this analysis is taken from Ntiamoa-Baidu et al (1997, p16) where:

> "A wetland **issue** is an underlying socio-economic and/or political factor (e.g. agricultural expansion, urbanization, population pressure, sectoral structures) that could lead to adverse change in the ecological character of a wetland."
>
> " A **threat** to a wetland is a human-included factor (e.g. water pollution, siltation, over-exploitation) that could change adversely the ecological character of the wetland."

The entire RIS document for each of the wetlands was examined to ascertain which threats applied to each wetland. Particular attention was paid to the categories, which directly dealt with wetland threats including: disturbances and threats, and current land use.

Identifying the threats and issues for each RIS provides an indication of the particular aspects of each individual wetland that may be experiencing a change in ecological character. The next step to the analysis determined if any monitoring or baseline information was available for each of the threats to form a basis from which a change in ecological character could be assessed.

Baseline and monitoring matrices

A two dimensional matrix analysis was undertaken for each RIS to determine whether baseline information or monitoring could be ascertained from information provided within the RIS. The two matrices in this analysis closely resemble those of the first stage with one providing baseline information and monitoring for the values matrix, and the other providing the same information for the threats matrix. The left hand side of each matrix provides details on the possible values or threats which may be present at the wetland. The reference number and abbreviated name of the individual wetlands provided at the top of each column. (Appendix 6 & Appendix 7). The following symbols were utilized as follows:

- ● Baseline information provided;
- □ Monitoring information provided; and
- * Value or threat is present at this wetland but no baseline or monitoring information is supplied.

A baseline is a collection of data which can be used as an information base or starting point for future analysis (Tomas Vive, 1996). All sections of each RIS were examined for data that could be considered appropriate as baseline information for the individual values and threats listed. The desired information included, qualitative and quantitative parameters, measurements over time, and natural and seasonal variation.

Monitoring involved statements within the document that regular monitoring of parameters was being conducted, which related directly to the values and threats listed. In addition, (with the exception of problems/issues which are covered under the studies definition of threat), evidence of the components for the 'framework for designing a wetland monitoring program' were required to indicate the presence of a monitoring program. The framework embodies the following components: objective, hypothesis, method and variables, feasibility/cost, pilot study, sampling, analyses and reporting (Ramsar Convention Bureau, 1996c). The references mentioned in the bibliography were not considered to be evidence of monitoring in this study. However, all other sections within the RIS for each of the wetlands was examined to determine if monitoring information was present for each of the values and threats to assist in determining if changes in ecological character are taking place.

Identifying and analysing information on baseline data and monitoring provides a more critical analysis of whether the information obtained in the RIS for describing changes in ecological character is adequate or merely superficial.

3.2.3 Manipulation of data

Values and threats matrices

The occurrence of values and threats was tallied to produce a total for each RIS as shown in Table 5. The total number of values was then added and divided by twenty nine, being the number of RIS's in this study, to produce an average number of values. Similarly, the total number of threats was added and divided by twenty nine to produce an average number of threats for the RIS examined.

Baseline and monitoring matrices

The number of values or threats to have the symbol indicating the presence of baseline information were tallied. This figure was then recorded against the total number of occurrences for a particular threat or value displayed in Figures 4 to 14.

3.3 Results

3.3.1 Values and threats

The two dimensional matrices on threats and values given in Table 5 indicate that on average there are twice as many values at the selected wetlands compared with threats. The majority of the values for each of the RIS's in this study fall into the category of natural heritage followed by exploitation and production, and water regime. The majority of the threats for each of the RIS in this study fall into the category of physical modification, followed by exploitation and production, water pollution and lastly water regime.

Table 5 indicates the RIS with the highest number of values was Champagne scoring eighteen, followed by Whangamarino with fifteen and Okavango, Kolkheti, and Kopuatai which all scored a total of fourteen values. The lowest number of recorded values was at Hula, Hortobagy (3HU008b), Hortobagy (3HU008d1), Hortobagy (3HU008d3) which all received a score of seven.

The RIS with the highest number of threats was Titicaca scoring a total of twelve, followed by Hula and Manchon which both received a score of ten. The RIS to score the lowest number of threats include Hortobagy (3HU008a), Hortobagy (3HU008d2), and Hortobagy (3HU008d3) each scoring one threat (Table 5).

The analysis also revealed that Titicaca and Cicovske were the only two RIS's to have equal numbers of threats and values being twelve and eight respectively. Also, Hula and Manchon were the only two RIS's to score more threats than values. The RIS for Saloum indicates six threats were recorded with the majority being in the category of exploitation and production (Table 5).

Table 5 The number of threats and values recorded at each wetland and the category to which the majority of these belong.

(The number of values for each RIS is ranked in descending order with the ranking for threats shown in the brackets ().)

WETLAND	NUMBER OF VALUES	DOMINANT CATEGORY OF VALUES	NUMBER OF THREATS	DOMINANT CATEGORY OF THREATS
Champagne	18	Exploitation & production, Natural heritage	4 ($^{14}/_{29}$)	Physical modifications
Whangamarino	15	Natural heritage	6 ($^{6}/_{29}$)	Physical modifications
Okavango	14	Natural heritage	1 ($^{20}/_{29}$)	Water regime
Kolkheti	14	Natural heritage	5 ($^{10}/_{29}$)	Physical modifications, Exploitation & production
Kopuatai	14	Natural heritage	5 ($^{10}/_{29}$)	Physical modifications
Example	13	Natural heritage	3 ($^{18}/_{29}$)	Physical modification
Lagartos	13	Natural heritage	4 ($^{14}/_{29}$)	Physical modifications
Titicaca	12	Exploitation & production Natural heritage	12 ($^{1}/_{29}$)	Water pollution
Azagny	11	Natural heritage	4 ($^{14}/_{29}$)	Physical modification
Natal	11	Natural heritage	5 ($^{10}/_{29}$)	Physical modification
Xianghai	11	Natural heritage	3 ($^{18}/_{29}$)	Exploitation & production
Kushiro	11	Natural heritage	5 ($^{10}/_{29}$)	Physical modification
Hortobagy 3HU008c	10	Natural heritage	2 ($^{19}/_{29}$)	Water pollution
Morton	10	Natural heritage	7 ($^{5}/_{29}$)	Water pollution
Biguglia	10	Natural heritage	6 ($^{6}/_{29}$)	Water pollution
Carlos	10	Natural heritage	5 ($^{10}/_{29}$)	Physical modifications
Engure	10	Natural heritage	6 ($^{6}/_{29}$)	Physical modifications
Hortobagy 3HU008d2	9	Natural heritage	1 ($^{20}/_{29}$)	Water regime
Manchon	9	Natural heritage	10 ($^{2}/_{29}$)	Exploitation & production
Salouni	8	Exploitation & production Natural heritage	6 ($^{6}/_{29}$)	Exploitation & production
Hortobagy 3HU008a	8	Natural heritage	1 ($^{20}/_{29}$)	Exploitation & production
Cicovske	8	Natural heritage	8 ($^{4}/_{29}$)	Water pollution
Minesing	8	Natural heritage	6 ($^{6}/_{29}$)	Physical modifications
Fuschertal	8	Natural heritage	4 ($^{14}/_{29}$)	Water pollution
Hula	7	Water regime, Natural heritage	10 ($^{2}/_{29}$)	Physical modification
Hortobagy 3HU008b	7	Natural heritage	2 ($^{19}/_{29}$)	Water pollution
Hortobagy 3HU008d1	7	Natural heritage	2 ($^{19}/_{29}$)	Water regime, Exploitation & production
Hortobagy 3HU008d3	7	Natural heritage	1 ($^{20}/_{29}$)	Water regime
Matchedash	7	Natural heritage	4 ($^{14}/_{29}$)	Physical modifications, Exploitation & production
Average number of values/wetland	10	**Average number of threats/wetland**	5	

To assess whether any correlation existed between the number of values and the number of threats present at each wetland, the details outlined in Table 5 were plotted.

As shown in Figure 3 this revealed that there was no obvious correlation between the number of threats and values recorded for each of the RIS in this study.

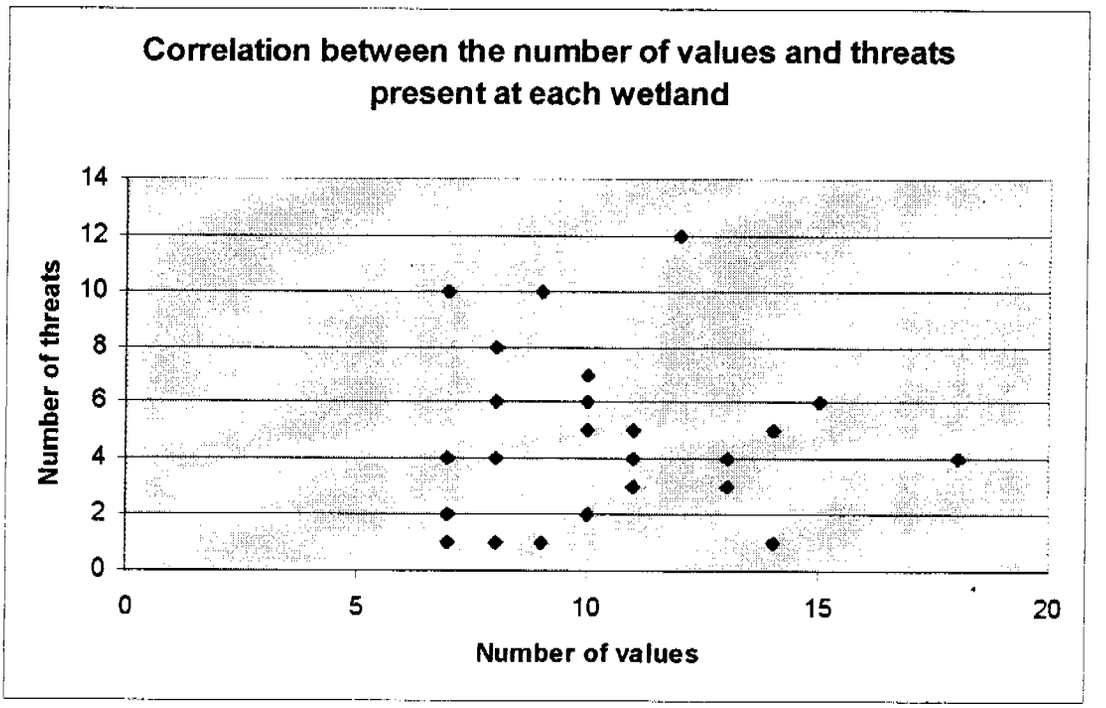


Figure 3 The correlation between the number of values and threats observed for each of the twenty nine RIS.

3.3.2 Baseline information – summary of categories for values & threats

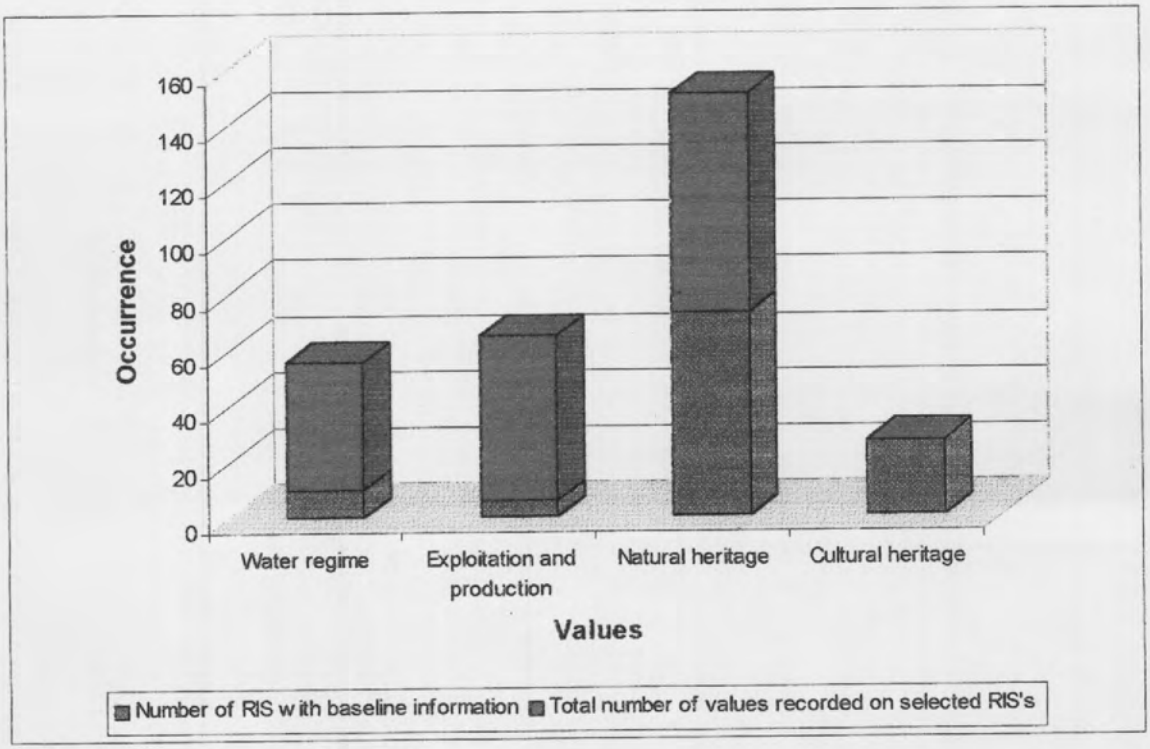


Figure 4 Summary of values within each category scored from selected RIS's .

The results in Figure 4 show that cultural heritage is the only category where all values recorded are also provided with baseline information. This was followed by the category of natural heritage, which scored one hundred and fifty one occurrences of which seventy three provided baseline information.

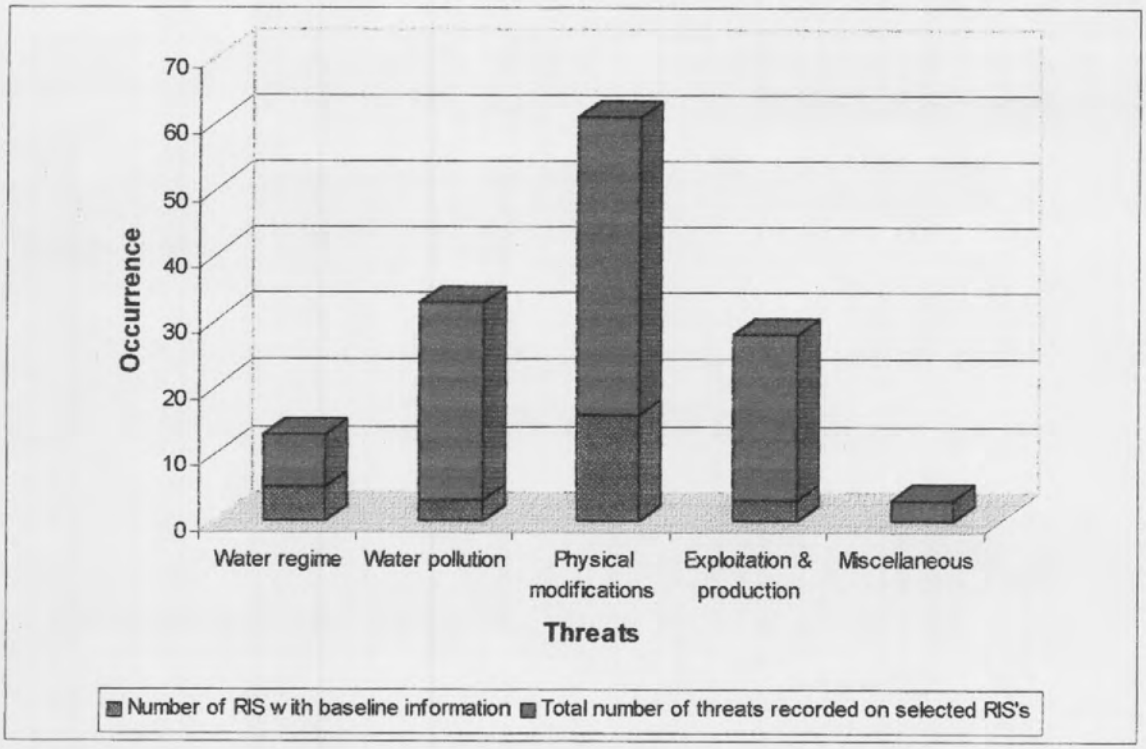


Figure 5 Summary of threats within each category scored from selected RIS's.

The results in Figure 5 show that in general all categories record a low occurrence of baseline information. Almost half of the occurrences of threats in the category of water regime are provided with baseline data. This includes a score of thirteen occurrences with five supplying baseline information. This was followed by the category of physical modifications, which scored sixty one occurrences of which sixteen provided baseline information.

3.3.3 Baseline information – values

It was sometimes necessary in the following presentation of results to shorten or abbreviate the names of the values and threats presented in Appendices six and seven. This ensures they are all represented in the figures below.

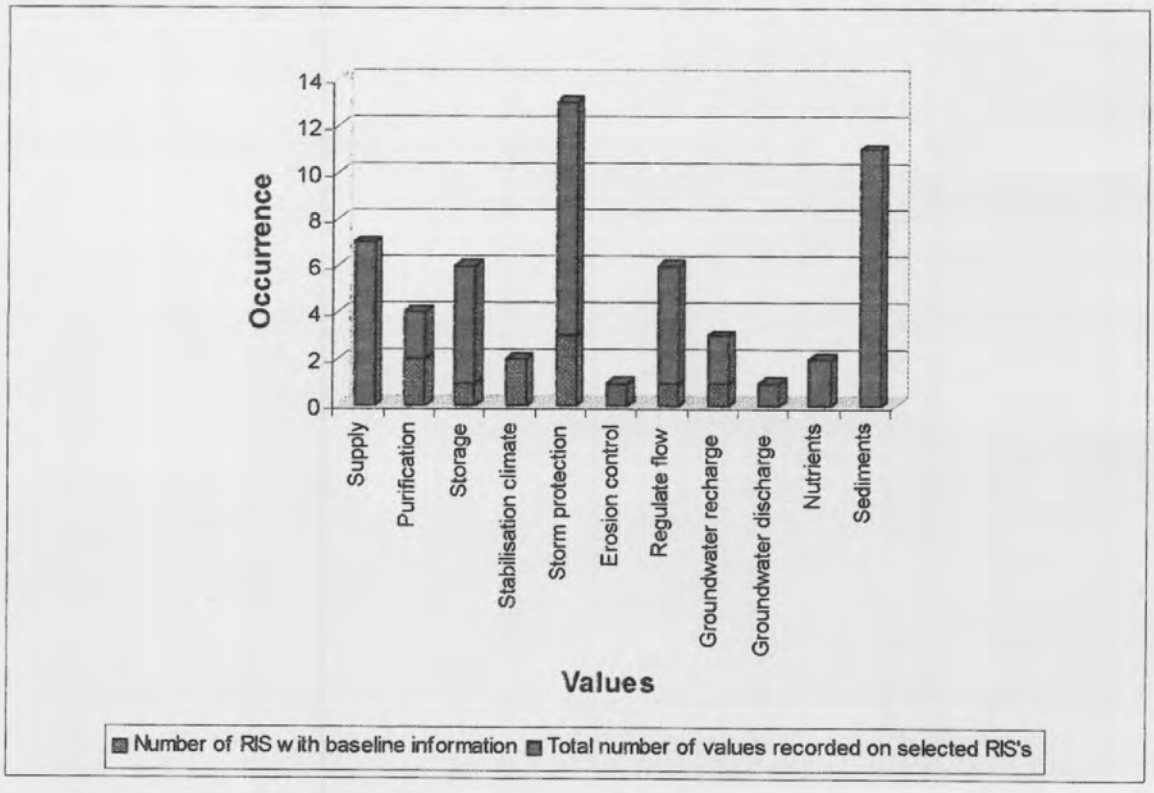


Figure 6 The number of values in the category of water regime recorded on selected RIS's.

As shown in Figure 6 the values in this category that scored for baseline information are water purification, storage, stabilization of local climatic conditions, storm water protection, regulation of flow, and groundwater recharge. Additionally, the value of storm protection recorded the highest number of occurrences totaling thirteen of which three provided baseline information. The analysis also revealed that sediment retention scored the second highest number of occurrences but did not score baseline information.

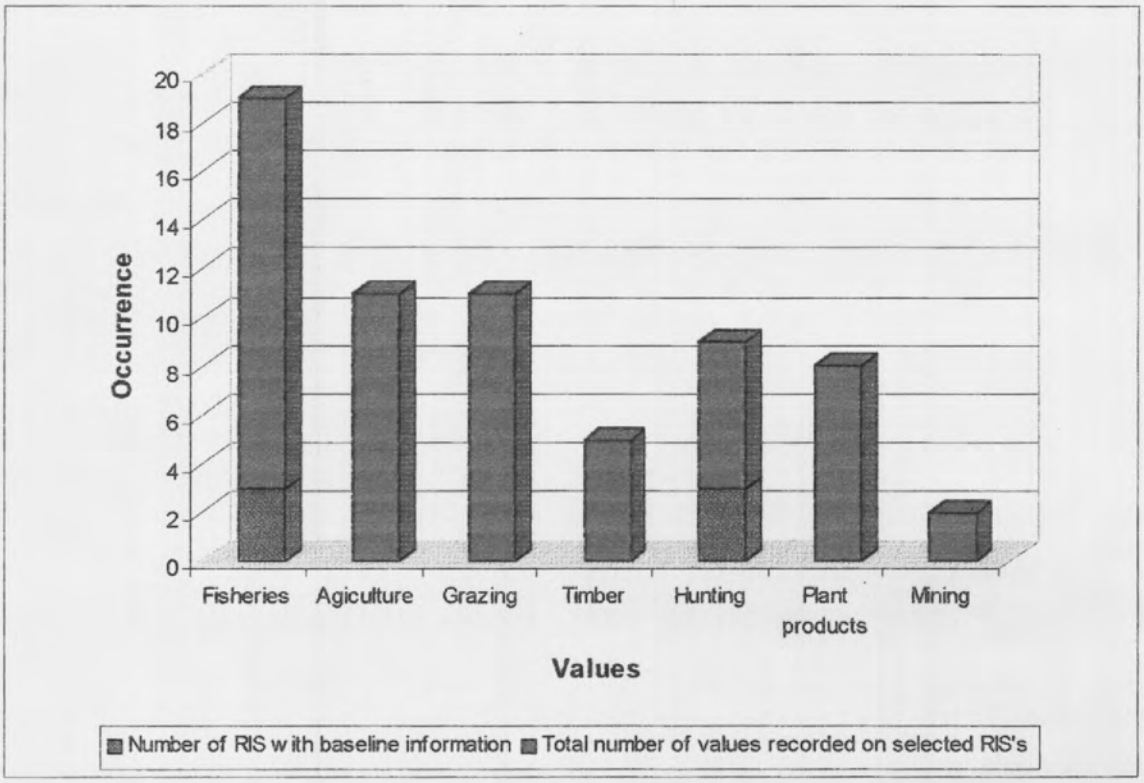


Figure 7 The number of values in the category of exploitation and production recorded on selected RIS's.

As shown in Figure 7, two out of the seven values that of fisheries and hunting in the category of exploitation and production recorded baseline information. The values of agriculture and grazing scored the second highest occurrence in this category with a score of eleven.

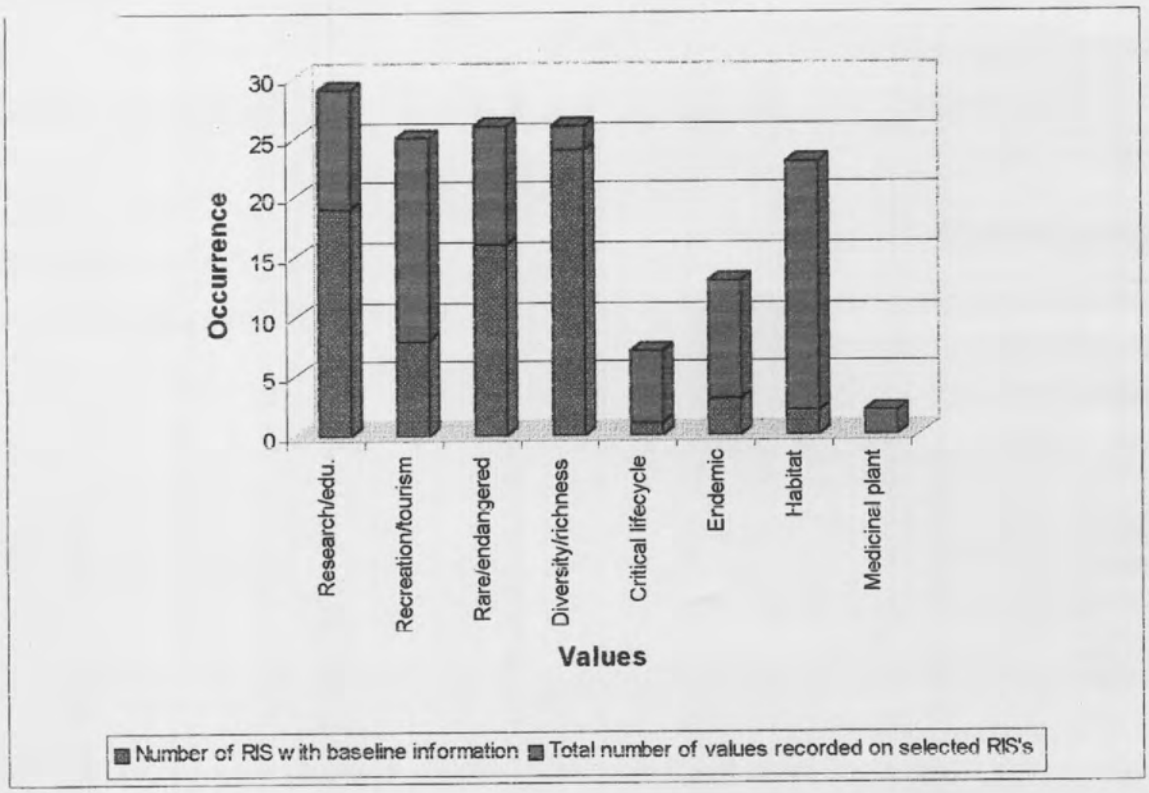


Figure 8 The number of values in the category of natural heritage recorded on selected RIS's.

The results in Figure 8 indicate that seven out of the eight values in this category record baseline information. The value of biological diversity and richness scored the highest number for baseline data being twenty four out of twenty six occurrences. The value of rare and endangered species also scored twenty six occurrences but only sixteen provided baseline information. The highest number of occurrences was for the value of scientific research and education with a score of twenty nine. Nineteen of these provided baseline information.

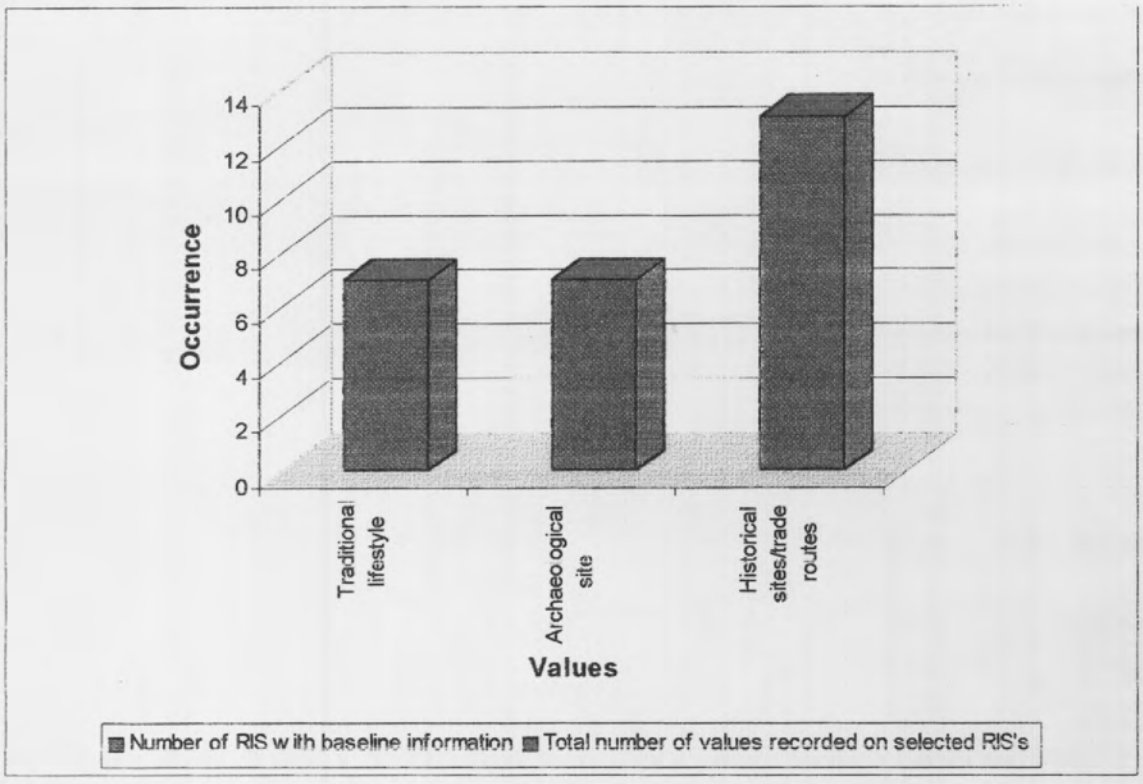


Figure 9 The number of values in the category of cultural heritage recorded on selected RIS's.

As shown in Figure 9 all of the values including traditional lifestyle, archacological sites, and historical sites/trade routes in the category of cultural heritage scored baseline information.

3.3.4 Baseline information - threats

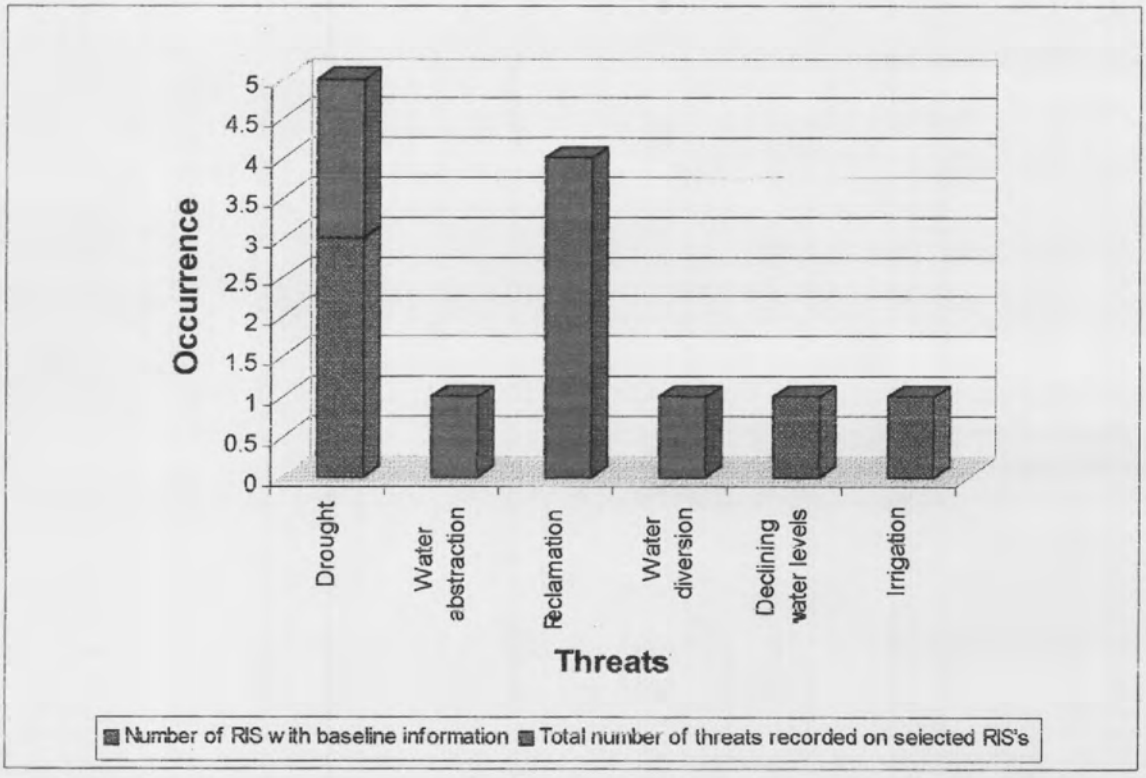


Figure 10 The number of threats in the category of water regime recorded on selected RIS's.

The results in Figure 10 indicate the three threats to score baseline information. The highest number of occurrence was that of drought with a score of five for which three were supplied with baseline data. The two other threats scoring baseline information were declining water levels, and irrigation both recording one occurrence. The threat of reclamation scored the second highest number of occurrences without recording any baseline information.

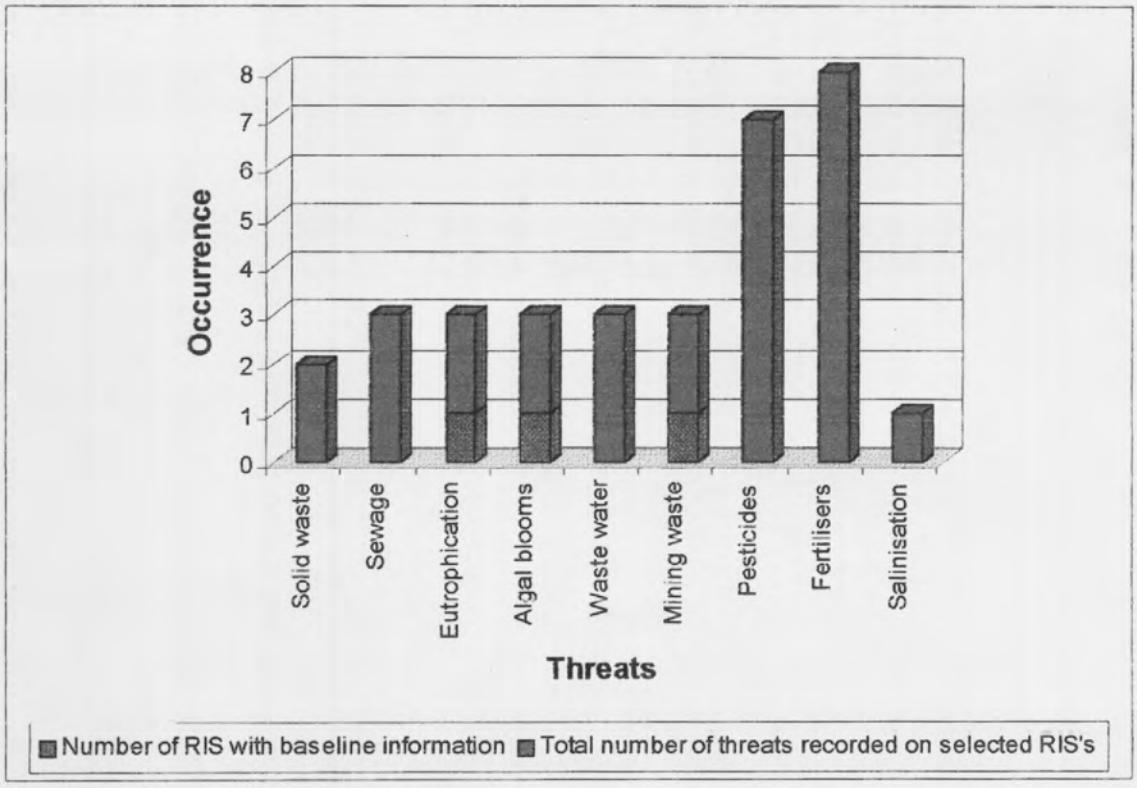


Figure 11 The number of threats in the category of water pollution recorded on selected RIS's.

As shown in Figure 11, six out of the nine threats in the category of water pollution did not score baseline information. The threats of eutrophication, algal blooms, and mining waste each scored an occurrence of three with a score of one for baseline information. The threats of pesticides and fertilizers recorded the highest number of occurrences with a score of seven and eight respectively.

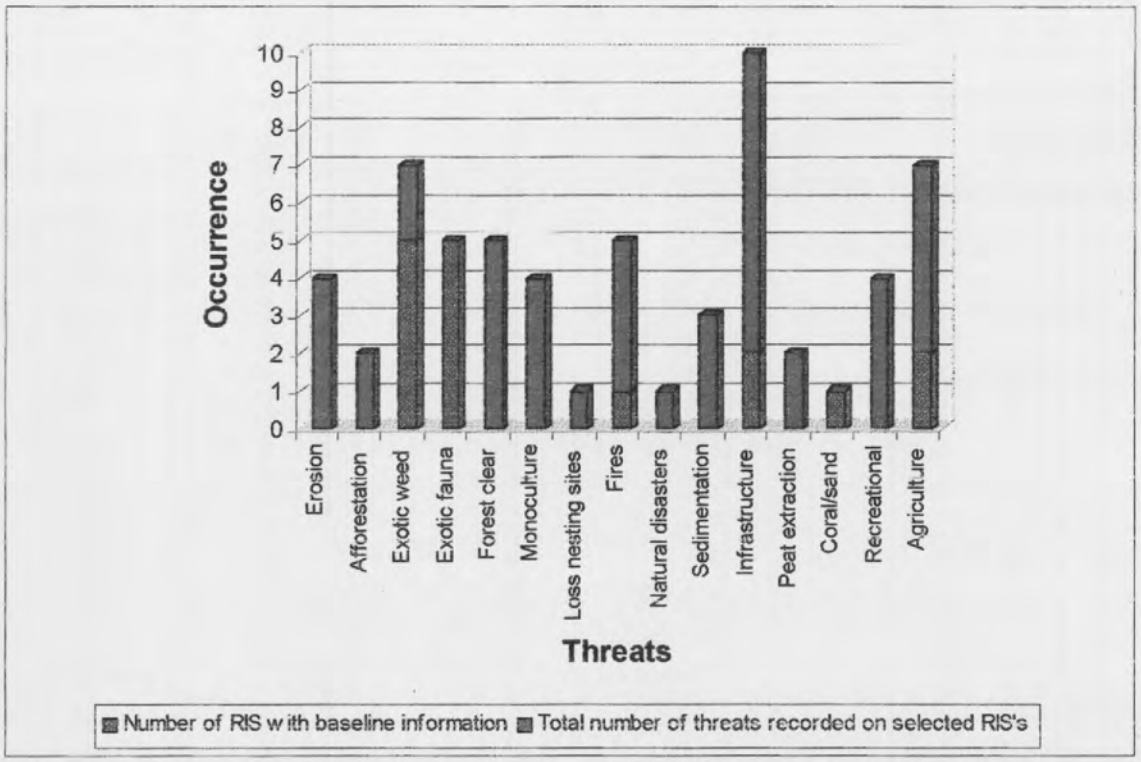


Figure 12 The number of threats in the category of physical modifications recorded on selected RIS's.

The results in Figure 12 show that six out of the fifteen threats in the category of physical modifications recorded baseline information. The threat of infrastructure scored the highest number of occurrences scoring ten of which two recorded baseline data. This was followed by agriculture and exotic weed intrusion with a score of seven and recording a score of two and five respectively for baseline information. Furthermore, the only two categories to score equal numbers for baseline information and the number of threats was exotic fauna with a score of five and coral/sand abstraction with a score of one.

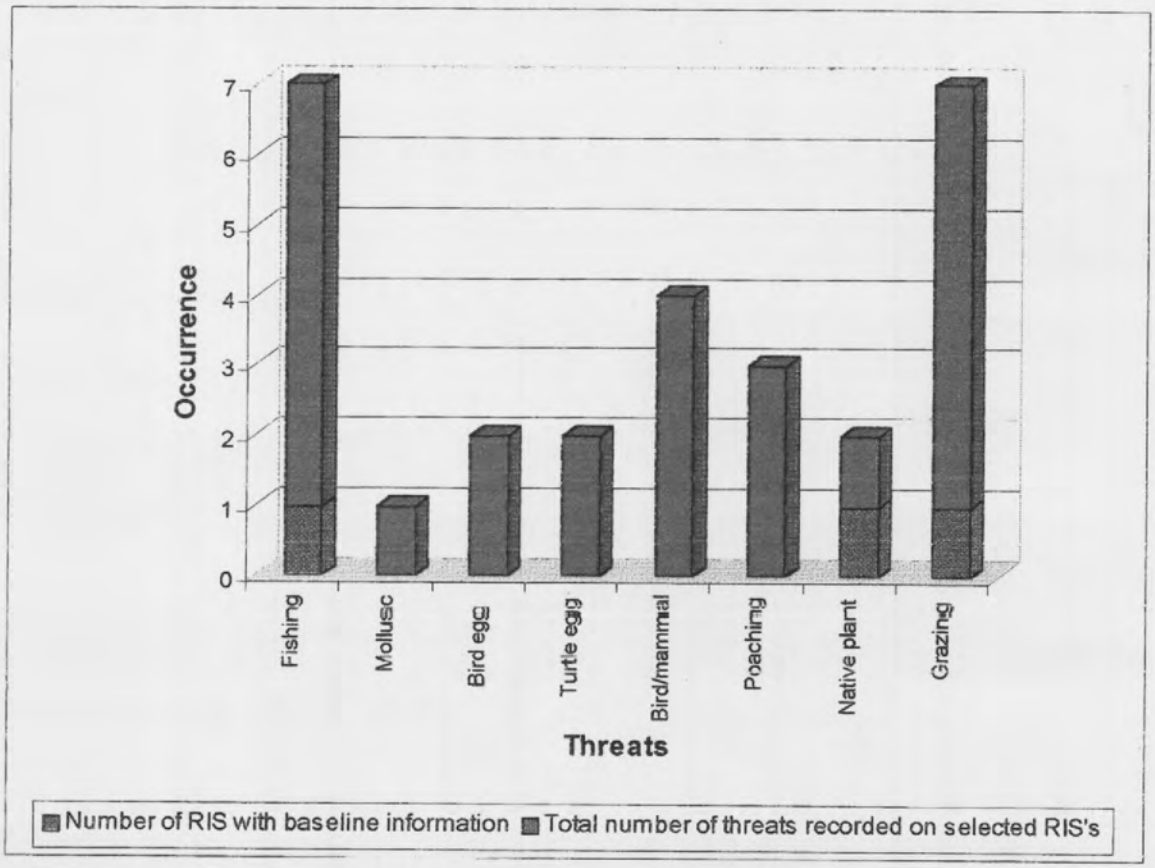


Figure 13 The number of threats in the category of exploitation and production recorded on selected RIS's.

The results in Figure 13 show only three out of the eight threats for this category recorded baseline information. The highest numbers of occurrences were recorded for fishing and grazing with a score of seven both of which scored one for baseline information. The threat of native plant extraction scored two occurrences with one providing baseline information. Poaching and bird/mammal hunting received scores of three and four respectively.

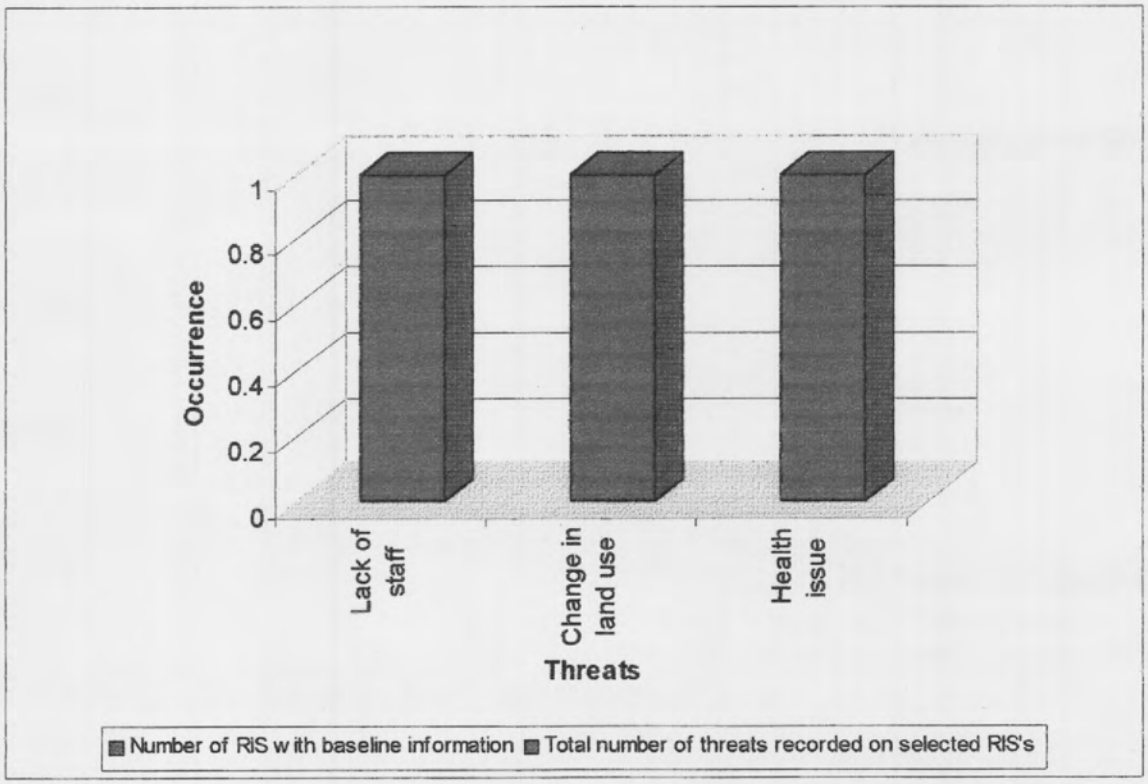


Figure 14 The number of threats in the category of miscellaneous recorded on selected RIS's.

As shown in Figure 14 all the threats for the category of 'miscellaneous' scored an occurrence of one without recording any information on baseline data.

3.3.5 *Monitoring information – values and threats*

Table 6 Details of monitoring being conducted at selected wetlands for values and threats.

NAME OF WETLAND	VALUE (V) OR THREAT (T)	MONITORING PROGRAM
Natal	Biodiversity & richness (V)	Abundance of large herbivores in Giant's Castle; Population sizes of large herbivores in Highmoor; Population sizes of large herbivores in Royal Natal; *Protea nubigena* monitoring at Royal Natal; Population and distribution of eland in the southern Drakensberg.
Hula	Recreation & tourism (V)	Daily and monthly visitor numbers.
	Biodiversity & richness (V)	Waterfowl transects (4 trials bi-weekly); Vegetation transects (4 trial twice a year).
	Pesticides (T)	Water quality at eight selected sites (bi-monthly).
	Fertilisers (T)	Water quality at eight selected sites (bi-monthly).
	Sewage (T)	Water quality at eight selected sites (bi-monthly).
	Drought (T)	Water levels (weekly).
Kushiro	Biodiversity & richness (V)	Change of mire vegetation (5 yearly).
Engure	Biodiversity & richness (V)	Waterbird populations.
Manchon	Biodiversity & richness (V)	Phenology of different plant associations.
	Pesticides (T)	Chemical analysis of water samples.
	Fertilisers (T)	Chemical analysis of water samples.
Biguglia	Biodiversity & richness (V)	Avifauna monitoring since 1985.

As shown in Table 6 only five of the twenty nine RIS's examined provided information on monitoring for the values and threats listed. The highest number of occurrences was for biodiversity and richness having been recorded on six occasions. This was followed by pesticides and fertilisers which both occurred twice.

3.4 Interpretation of Results

3.4.1 Values and threats

The reason for wetlands being protected through conventions such as Ramsar is primarily to conserve the values placed on them by society. That is providing benefits to the people who live in or adjacent to them, rather than directly concerning ecological processes. Wetlands have been described as one of the most productive environments in the word providing a large range of benefits to the plants, animals and people inhabiting them. The conservation of this ecotype is important if the ecological functions, values and attributes are to be maintained for future generations (Mitsch & Gosselink, 1986; Matthews, 1993; Davis, 1994).

Analysis indicated that on average twice as many values as threats were recorded on RIS's. This may be attributed to the RIS document being prepared to show the international importance of the selected wetland, with the majority of the categories being created to display the wetland's values and ecological character. Other reasons for values scoring highly include: the fact that they are seen as being a positive aspect of the wetland and are therefore easy to promote; information on threats may be more difficult to obtain especially with regard to indirect long term effects; and the compiler of the RIS may not have interpreted or listed all the relevant information.

The dominant category for values is that of natural heritage, which may be attributed to the initial purpose of the RIS that includes criteria by which a wetland is considered internationally important. The criteria broadly cover four main areas as follows:

1. Criteria for representative or unique wetlands;
2. General criteria based on plants or animals;
3. Specific criteria based on waterfowl; and
4. Specific criteria based on fish (Ramsar Convention Bureau, 1996a).

Six out of the eight values including biological diversity & richness, endemic species, and habitat for wildlife (especially waterfowl) in the category of natural heritage, fall into points two and three above. Therefore, this category scored highly as the RIS was initially designed to take these values into consideration. In addition,

this category provides information on 'values', and 'attributes' described in Table 1, which are considered to be important components in defining ecological character.

The second most dominant category was that of exploitation and production. The values for this category are extremely important to many societies as a source of food, shelter, income, and often also in maintaining their traditional lifestyle. An example of this is Titicaca, which lists six out of the seven values for this category. The RIS for this wetland indicates that the birds and fish of the lake are an important food supply for rural communities practicing indigenous fishing techniques and subsistence hunting, with some birds and fish also being sold at the local markets. In addition, totora plant is used for construction of houses, feed for livestock, substrate for plantations and in some cases the rhizomes of the totora are consumed as a food source. Furthermore, this category provides information on 'products' described in Table 1, which is considered to be an important component in defining ecological character.

The value and importance of a wetlands water regime have been well documented but often not fully understood and may account for this category's low dominance score. In general, this study found that the values that are not adequately addressed in Table 1 of the RIS document are those concerning 'processes' and 'functions'. The processes and functions of a wetland provide values such as flood control, storm protection, water purification, groundwater recharge/discharge, and retention of nutrients and sediments which are important in describing ecological character. Identifying and understanding these processes often requires more sophisticated equipment and trained personnel than values which come under the categories of natural heritage and exploitation and production.

Information on values such as rare and endangered species, endemic species, fishing, and plant products in the latter categories can often be determined through monitoring techniques that require simple observation, or flora and fauna surveys that do not necessarily require expensive equipment or technical expertise. The values in the water regime which include water purification, retention of nutrients/sediments and water supply may require monitoring of parameters such as pH, salinity, conductivity or ionic concentrations, and nitrogen and phosphorus concentrations to identify and better understand processes and functions taking place. The RIS for Manchon has indicated that there are no values in the category of water regime for this wetland. The document goes on to state however, that at present, the

hydrological value of the wetland has not been evaluated. Although, the RIS's for Engure and Koputai scored values for water regime, both acknowledge the hydrology of their wetland is poorly understood and insufficiently studied. In addition, complicated models are often utilized to give an understanding of the process and functioning of groundwater recharge and discharge, and the stabilization of local climatic conditions. These parameters or models often require specialized equipment and expertise that is not available or affordable to many countries, and thus may have contributed to the low score of values in this category.

The category for cultural heritage was the least dominant in the study, however, many of the RIS's including Moreton, Whangamarino, Champagne and the example, considered all the values in this category to be important. These RIS's mentioned traditional lifestyles, archaeological sites, historical buildings/sites and trading routes as important to the societies living in the area surrounding the wetland. These values are considered to be 'attributes' in Table 1 and are therefore, an important component in describing the ecological character of a wetland.

The difference in the number and type of values at each wetland may also be due to the amount of information that is currently available. The RIS's to score the greatest number of values includes Champagne, Whangamarino, Okavango, Kolkheti, and Kopuatai. These RIS's are generally well compiled with categories within the RIS following the requirements of the guidelines provided. It is also evident through information provided under 'current scientific research and facilities' and 'bibliography' that these wetlands have been subject to a number of studies relating to a wide variety of subjects including population ecology, the effects of fires, and surveys on rare and endangered species. In addition, they supply information on why each of the selected criteria applies to their particular wetland.

The RIS's to score the least number of values are Hula, Hortobagy (3HU008b), Hortobagy (3HU008d1), Hortobagy (3HU008d3). With the exception of Hula these RIS generally provide only the minimum amount of information required by the guidelines with very little information provided on 'current scientific research and facilities' with only one study mentioned for each RIS. In the 'bibliography' the reader is refered to the HNP directorate although a number of bibliographies appeared difficult to access. Furthermore, these RIS indicate further studies are required in the area of hydrology.

In order to manage wetlands to conserve the values placed on them by society, it is necessary to identify any threats or issues that are currently, or have the potential to, adversely affect the wetlands ecological character. The Ramsar Convention states that a change in ecological character at a wetland occurs when there is an, "impairment or imbalance in any of those processes and functions which maintain the wetland and its products, attributes and values " (Ramsar Convention Bureau 1996c, p2).

The number of threats in the analysis is on average only half of that compared with values. This may be attributed to the purpose of the RIS being to indicate why a wetland should be considered internationally important, rather than, displaying the adverse affects to the wetlands ecological character. A threat to a wetland can often be seen negatively, and may imply poor management of that resource, and therefore, could possibly be understated or not recorded. The RIS for the example in the Ramsar manual declares that there are, 'no perceived threats' to the wetland but then goes on to describe the invasive exotic weed Purple Loosestrife (*Lythrum salicaria*) and residential developments as having some impact on the resource values. The RIS for Whangamarino indicates that hunting waterfowl is a value not a threat. However, the RIS goes on to indicate the Brown Teal (*Anas aucklandica chlorotis*) has been recorded at the wetland and that it is one of New Zealand's rarest ducks and considered one of the five rarest ducks in the world. Although hunting permits are issued, unless the hunter is well trained at distinguishing different waterfowl species, this activity has the potential to impact directly on this rare species by shooting them and indirectly by disturbing nesting sites. Furthermore, information on threats may be more difficult to obtain especially if they are indirect and long term. Finally, the compiler of the RIS may not have interpreted or listed all the relevant information.

This analysis has shown that all the selected RIS's in this study record at least one or more threats to their wetlands. Although the number of threats recorded was on average less than that compared with values, each individual threat has the potential to adversely affect a number of wetland values. It is evident, with the exception of Hortobagy (3HU008a), that the RIS recording the lowest number of threats being Hortobagy (3HU008d2) and Hortobagy (3HU008d3) have the potential to effect more than one of their values. The only threat mentioned in the RIS's for these wetlands is that of drought, which has the potential to affect grazing, rare and

endangered species, biological richness and diversity, and habitat for wildlife, being values common to both wetlands.

The analysis also shows no correlation between the number of threats and values present in each RIS. However, if the ecology of the wetland is taken into consideration, there can often be direct and indirect correlations between values and threats, although this is rarely expressed explicitly within the RIS's analysed. The RIS for Titicaca establishes a direct negative link between the threat of drought leading to the exposure of the totora plant *(Scirpus californicus spp. tatora)*, one of the wetland values, which is subsequently burnt by farmers wanting to reclaim land for agriculture. This also serves to exacerbate the threat of bird hunting and indirectly effects many of the values at the wetland including grazing, agriculture, and biodiversity. Furthermore, water pollution at Titicaca is threatened by sewage, eutrophication, algal blooms, and industrial waste, which the RIS indicates will have a negative affect on the hydrobiological resources of the wetland including its fisheries. In general the 'processes' and 'functions' components utilized to describe ecological character in Table 1, are insufficiently addressed in all the RIS's selected for this analysis, however, previous literature indicates that links can be drawn from examining certain threats and values listed for each wetland. The RIS for Cicovske does not explicitly provide information on the processes occurring within this wetland. Nevertheless, it can be assumed that the threat of fertilizers has led to the threat of eutrophication which has in turn caused the threat of algal blooms resulting in a negative effect on the fisheries, being one of the values of this wetland.

The threats to each wetland will be different due to the variability of the socio-political processes and actions occurring around or within them. However, when grouping the different threats into categories, that of physical modification was shown to be dominant. This category has the potential to impair or destroy the 'values' and 'attributes' of a wetland, which are described in Table 1 and are important components of the ecological character. This may result from the effects of the threats in this category being easy to identify without the need for specialised equipment or trained staff. The RIS for Hula shows exotic weed and fauna intrusion, sedimentation, infrastructure, and recreational activities as being threats affecting this wetland all of which can be recognized by visual observations.

The next most important categories were that of exploitation and production, and water pollution. The category of exploitation and production provides

information on 'products' described in Table 1, which is considered to be an important component in defining ecological character. This category could be particularly threatening to the societies who utilize the wetland as sources of food, shelter, income, and also in maintaining their traditional lifestyle. For example, the RIS for Saloum has nearly all its threats in this category, which include mollusc, bird and marine turtle egg harvesting, fishing and grazing. It further states that these diverse activities on which the population depends for its survival may threaten the ecological equilibrium of the region.

The category of water pollution has the potential to impair the 'processes' and 'functions' found in Table 1 which are important in describing a wetlands ecological character. The process that appears to be occurring at Titicaca is that the sewage and industrial wastewater is leading to the eutrophication of the water supply and causing algal blooms. The effect of the algal blooms would be to reduce the light penetrating through the water resulting in a loss of primary production from aquatic plants. The algal bloom would also reduce the dissolved oxygen present in the water leading to changes in trophic levels. This would occur through the death of species unable to tolerate the reduced oxygen levels and an increase in other species, which have a high tolerance to low dissolved oxygen levels. The RIS for Manchon shows pesticides as a threat. These chemicals have the ability to disrupt food chains by killing or adversely affecting organisms such as macroinvertebrates, which are a food source for fish, the fish are then a food source for birds. In addition, these chemicals can produce long term indirect adverse effects from bioaccumulation and biomagnification time (Chambers & Davis (eds), 1995; Goldsmith (ed.), 1995; Spellerberg, 1994; Mitsch & Gosselink, 1986).

The next dominant category is water regime which once again has the potential to adversely affect the 'processes' and 'functions' found in Table 1 that help describe a wetlands ecological character. The processes and functions of a wetland provide it with many values such as storm protection, water purification, and groundwater recharge/discharged and are important in describing ecological character. Identifying and understanding these threats and how they affect the water regime often require sophisticated equipment and trained personnel. The threats in the water regime include drought, water abstraction, water diversion, declining water levels and irrigation. They may require regular monitoring of parameters which include: groundwater levels which require bores to be sunk; instillation of flow

meters; land surveys; and the monitoring of climatic conditions, this will assist in identifying and better understand processed and functions taking place. The RIS for Hula shows drought as a threat, it would be necessary to monitor information such as water level for both open and groundwater and record precipitation for a number of years in order to determine the extent of the drought. In addition, it would be beneficial to develop models which could indicate the likely affect drought or other threats will have on the wetland values under future hypothetical parameters. The equipment, technical expertise and financial support may not always be available to carry out this type of monitoring. Additionally, the RIS for Engure and Koputai both acknowledge the hydrology of their wetland is poorly understood and insufficiently studied.

To determine whether the ecological character at a wetland is changing it is necessary to establish baseline information, which can be utilized as a starting point for future analysis, and show that monitoring is taking place to determine change over time. The next analysis determines whether baseline information and monitoring is available within each RIS for the threats and values listed at individual wetlands.

3.4.2 Baseline information

This analysis investigated the availability of baseline information in selected RIS for each of the values and threats related to ecological character (as described in Table 1). The collection of baseline data for these values and threats is necessary to establish a reference base or starting point from which a change in ecological character can be assessed. As this study has already indicated, individual wetlands have different and specific values and threats that will require the collection of differing types of baseline information for change to be determined (Tomas Vives (ed), 1996; Finlayson, 1996a).

In general, insufficient baseline data has been recorded for both values and threats. Threats however, appear to have even less baseline information than values. This may result from the initial purpose of the RIS being to record information by which wetlands are considered internationally important, with the majority of the sections in the RIS providing information on values. Also, threats are perceived as negative, which may lead to baseline information being omitted or understated in

some way. Furthermore, the RIS were not initially designed to record baseline information for the assessment of ecological change.

The one category that contained baseline information for all its values was that of cultural heritage. This information is often an integral part of a community's identity, which either currently, or at one time influenced their way of life. The RIS for Whangamarino indicates that the wetland was important to early Maori inhabitants and used extensively by them as a source of food, plant materials and for transport. It provides information on the location of nine 'pa' (Maori fortress) sites around the wetland. The information recorded in this category may be part of an area's history. The Carlos RIS states that the San Luis de Alba, a small Hispanic fortress constructed during the Conquest has been restored. Furthermore, there is a section in the RIS titled 'social and cultural values' which specifically records information for values in this category. Therefore, it may be that the requirement for recording baseline information in this category is simply indicating the occurrence or absence of some aspect of cultural heritage for a particular wetland.

The categories with the most baseline information were that of natural heritage for values, and that of physical modifications for threats. This may be because the baseline information recorded for these categories utilizes unsophisticated technology that can be applied with relative ease. However, a closer examination of the baseline data provided in the selected RIS's indicates it is too superficial to produce useful information from which a change in ecological character can be determined.

This study found that the majority of the baseline information supplied in the selected RIS's was qualitative. The values and threats for which the most baseline information was available included: rare and endangered species, biological diversity and richness, and exotic weed and fauna intrusion, the majority of which were recorded as scientific species names that are easily acquired through simple observations. Additionally, the information supplied for the values of scientific research and education, and recreation/tourism involved simply listing the past and present research, and the different types of recreational activities currently conducted at the wetland.

In cases such as that at Whangamarino, where quantitative information is also supplied, it covers only a few selected species and even then the information has a degree of uncertainty to it. For example, the RIS speculates that there may be up to

two hundred and fifty Australasian Bittern (*Botaurus poiciloptilus*) inhabiting the wetland. This information has been derived from a census of the entire country. In other cases where quantitative data is supplied the information is unclear and often ambiguous. The RIS for Carlos provides a percentage breakdown of the different vegetation types which 'provides habitat for wildlife, especially waterfowl'. However, it does not indicate whether this information is related to the area covered or the number of species present. A map showing population densities and structures for the different vegetation types may provide more useful and appropriate information.

Analysis revealed that not enough parameters were utilized to provide baseline data for individual values and threats. The RIS for Titicaca indicates that nearly all the threats including sewage, eutrophication, algal blooms, industrial wastewater, and salinisation are problematic at this wetland. However, the only threats for which baseline information was given were that of eutrophication (covering an area of sixteen square kilometres), algal blooms (being up to three centimetres thick in places), and a salinity level of less than 1000mg/litre. Minimal information is provided and does not indicate the cumulative effects of a number of threats nor addresses the real issue of water quality. More detailed baseline information for the category of water pollution would incorporate measurement for a series of parameters to cover most aspects of the wetland's water quality. This may include recording standardised information for pH, conductivity, total dissolved solids, concentrations of nitrogen and phosphorus and chlorophyll *a*, turbidity and dissolved oxygen levels. Changes in ecological character can be more readily detected where standardised data has been collected over a specific period of time (Goldsmith (ed.), 1995; Spellerberg, 1994; Mitsch & Gosselink, 1986).

Another problem with information supplied in the RIS is that it often does not provide details on when the information was recorded (i.e. date, time, season), the location of the recorded information, what equipment was used, who recorded the information and for what purpose? If this information is not supplied it is difficult to determine the type and magnitude of the changes in ecological character that may be occurring. A well designed monitoring program would include an objective, a description of the methodology, and identification of variables needed to assess a change in ecological character (Ramsar Convention Bureau, 1996b & c; Finlayson, 1996a & b). The RIS for Titicaca shows that baseline data was recorded for the

threat of salinity. A salinity value of less than 1000 mg/l was considered to represent baseline level. Information on when and where the information was recorded, what equipment was utilized and the methodology are not given. It would therefore, be difficult to accurately replicate this information to assess what effect the parameter of salinity plays in, for example, a change in trophic levels within the water column over time.

The category of water regime provides information on the 'processes' and 'functions', which are integral components of all wetlands. The information supplied on the threats and values in these categories is often superficial and does not correlate information between the different categories, which is essential in describing the importance of energy flows or nutrient cycling within wetlands. The RIS for Xianghai supplies information on annual average temperature, precipitation, evaporation and frost-free days, which can be utilized as baseline data for the value of 'stabilization of local climate conditions'. There is however, no information relating directly to the process taking place at the wetland, which resulted in this value. This makes it difficult to know if other important parameters need to be recorded to accurately assess a change in ecological character. The process encompassing the stabilization of the local climate may involve the evaporation of water from the wetland surface. However, the percentage cover of different vegetation types may be important in the formation of clouds, which is also related to local climatic conditions. Therefore, baseline information for vegetation may also need to be recorded to provide accurate baseline information for assessing changes in ecological character at this wetland. In addition, the RIS for Hula indicates fertilizers and sewage as threats, which will have a direct effect on the wetlands ability to retain nutrients. It can also be assumed that if these threats are not controlled algal blooms will occur which will alter the trophic structure or cause food chains at the wetland to collapse. If the 'processes' and 'functions' at wetlands are not explicitly recorded in the RIS, parameters unique to a particular wetland and important in describing changes in ecological character, may not be recorded. Furthermore, the RIS's for both Engure and Kopuatai explicitly state that information on hydrology is poorly understood and insufficiently studied yet both have scored values in the category of water regime (Ramsar Convention Bureau, 1996b & c; Finlayson, 1996a).

Seasonal variation in values and threats was poorly addressed with little information provided on any RIS. The RIS that did mention seasonal variation often

provided inconsequential information, such as that recorded for Fuschertal on seasonal plant growth as being: winter – hibernation; spring – vegetation grows and blossoms; summer – vegetation blossoms and bears fruit; and autumn – fruits ripen. Another area important in the determination of change in ecological character is that of natural variation. The RIS did not supply any baseline information relating to natural variation for the threats and values listed. Both seasonal and natural variations are important to distinguish between changes to the wetlands ecological character which fall within its normal range and those incipient changes, which have the potential to cause damage if not rectified (Goldsmith (ed.), 1995; Spellerberg, 1994; Mitsch & Gosselink, 1986).

The occurrence of baseline information for values and threats in the category of exploitation and production is insufficient to adequately determine a change in ecological character. This may be related to many communities regarding the values and threats in this category as part of their traditional lifestyle from which they derive food, shelter, and incomes. It is therefore, important to record baseline information on them so that the values can be maintained for future generations. Difficulties arise when communities do not recognize the long term benefits of conservation over the short term increase in economic gain. Obtaining baseline information for this category is especially difficult if the threats involve illegal activities such as poaching or there are no legal controls such as hunting permits or bag limits from which baseline information can be recorded.

When assessing whether the RIS's are adequate for detecting changes in ecological character it is also important to bear in mind that they were not initially designed for this purpose. This has led to difficulties in finding information in the first place, as the entire document must be searched to ensure all relevant information on values and threats is recorded. In addition, the values and threats are not directly correlated to show that values are in danger of being impaired or altered by specific threats. Furthermore, the RIS guidelines do not request parameters with the values and threats in mind, which has resulted in only superficial information being recorded as baseline data. The RIS's are best suited to provide a general overview of the description of a particular wetland site.

3.4.3 Monitoring information

Determination of a 'change in ecological character' requires that data is collected over time, this can be accomplished through the use of a monitoring program. The Ramsar Convention has formulated a "framework for the design of a monitoring program" to assist Contracting Parties with this task. The framework sets out important components of a monitoring program which include an objective, a description of the methodology, and identification of the variables needed to assess a change in ecological character. The components are then followed by a brief description detailing the basic requirements for each (Ramsar Convention Bureau, 1996b & c; Finlayson, 1996a & b).

In general the analysis found that information on monitoring in the selected RIS's was poorly addressed. A small number of the RIS's recorded that monitoring programs were being conducted, however, many of these did not correspond to the values and threats listed at the wetland. Those monitoring programs that were mentioned did not provide any details on the specific components that encompass a framework for a monitoring design. It was therefore, difficult to associate monitoring programs mentioned in the RIS's with the values and threats listed. This is especially pertinent when the 'objective' is missing which ascertains the basis for the collection of the data (Ramsar Convention Bureau, 1996b & c; Finlayson, 1996a & b).

The most common value associated with a monitoring program was that of 'biological diversity and richness'. The main type of monitoring being conducted for this value involved population studies of fauna at Engure, Natal and Biguglia wetlands, and vegetation monitoring at Manchon and Kushiro wetlands. The RIS's for Hula and Manchon recorded monitoring programs for the most common threats which included 'pesticides', 'fertilizers' and 'sewage'. These threats received a score for monitoring if an analysis of water quality was mentioned. There is however, no mention of the type of variables being monitored or what values were recorded for them. The RIS was not initially designed to provide detailed information on monitoring programs and as the analysis indicates this type of information, if present, has only been superficially addressed.

3.5 Conclusions

The analysis of threats and values indicates that not all the components of ecological character have been addressed adequately in the RIS's examined. The 'values', 'products' and 'attributes' in Table 1 have usually been mentioned somewhere in the RIS for each wetland. The 'processes' and 'functions', however, are rarely explicitly expressed. Even when a process appears to be taking place by the type of threats that are occurring at a wetland the connections between them are not described. Therefore, it would be difficult to determine a change in a wetlands ecological character if all the components of its definition have not been fully addressed.

The analysis of baseline and monitoring information indicates that the RIS's are not adequate for detecting changes in ecological character. In general, information on baselines and monitoring for the values and threats were poorly addressed in the RIS's examined. The information provided was found to be superficial and best suited to providing a general site description.

The collection of baseline information is important in establishing a reference base or starting point from which a change in ecological character can be assessed. Analysis revealed that the majority of baseline information provided in the selected RIS's was qualitative. This included extensive lists of scientific species names relating to the category of 'natural heritage'. In some cases the RIS's also provided limited quantitative data on a few selected species. Issues important to adequately establish a meaningful baseline were either poorly addressed or not considered. These included:

- providing a sufficient number of parameters to describe baselines for individual values and threats;
- supplying important details on parameters including: when the information was recorded (i.e. date, time, season); the location of the recorded information; the equipment utilized; who recorded the information; and for what purpose;
- seasonal and natural variations, important in distinguishing between changes which fall within a wetlands normal ecological range and incipient changes which have the potential to cause negative impacts to the wetlands ecological character;
- providing information on 'processes' and 'functions', which are integral components of all wetlands; and

- correlating parameters for baseline information with the values and threats to ensure relevant information is recorded.

The collection of data over time, through the use of a monitoring program, is essential in the determination of 'change' in a wetlands ecological character. The analysis indicates that the small amount of monitoring information supplied in the RIS's examined, merely involved mentioning that a monitoring program was being conducted. The specific components that encompass the "framework for designing a wetland monitoring program" which include an objective, a description of the methodology, and identification of the variables, have not been recorded. This made it difficult to ascertain the basis for conducting the monitoring programs resulting in further difficulties in correlating them to the values and threats listed (Ramsar Convention Bureau, 1996b & c; Finlayson, 1996b).

In addition, the RIS was not initially designed to detect changes in ecological character, which has led to difficulties in finding the information. The entire document must be searched to ensure all relevant information is recorded. This is time consuming and does not readily or concisely show correlations between information necessary to determine changes in the ecological character of a wetland.

It may be unreasonable to shift the emphasis of the original purpose for the RIS to incorporate the complex issue of 'change in ecological character' by making limited modifications to the RIS guidelines as outlined in point 2.9.1 of Resolution C.6.1 (described in section 1.5). The additions to the existing guidelines will add to the already substantial amount of information required by some components of the RIS guidelines. The first analysis in section two has indicated that too many requirements in a particular component of the RIS leads to confusion on the type of information that is actually required. This resulted in a lower compliance to the requested information in the guidelines for particular components (Ramsar Convention Bureau, 1996b & c; Finlayson, 1996a).

The improvements to the guidelines also state that baselines can be established by describing the functions, products and attributes of a site that give it benefits and values of importance. Firstly, the analysis of values and threats in section three of this document has indicated that the 'process' and 'functions' components of ecological character (Table 1) were not sufficiently described. Secondly, the analysis on baseline and monitoring information indicates that simply

describing the components of ecological character and providing basic information on them does not necessarily establish baseline data or provide information on monitoring from which change can be assessed (Ramsar Convention Bureau, 1996b & c; Finlayson, 1996a).

The conclusion drawn from this analysis is that the RIS's provide superficial information which is best suited to providing a general description of the wetland site but is not adequate for detecting changes in ecological character.

4 Summary and Recommendations

The analysis described in section two indicates the RIS and guidelines are suitable for providing a standardised format that allows Contracting Parties to record information and provide criteria by which a wetland is considered internationally important.

The analysis described in section three examined the RIS's to determine whether they provided baseline and monitoring information which could be used to determine a 'change in ecological character' of a wetland. The components which describe 'ecological character' details of which are provided in Table 1, were found to be insufficient in the areas of 'processes' and 'functions' for the RIS's examined. In addition, the baseline and monitoring information supplied by the selected RIS's was in general poorly addressed. The information supplied was superficial and did not cover important issues to adequately establish a meaningful baseline or monitoring program.

Additionally, the design of the RIS did not allow for important correlations between values and threats with parameters for recording baseline data and associated monitoring programs to determine if changes were occurring. The RIS was not initially designed to detect changes in ecological character and appears best suited to providing a general description of the wetland site.

To accurately describe a 'change in ecological character' of a wetland the following recommendations are made:

- the RIS guidelines to incorporate definitions of 'ecological character' and 'change in ecological character' as described in Resolution C.6.1. This assists contracting parties in describing a full range of values and threats at a wetland;
- the design of the RIS to incorporate correlations between individual values and threats with the appropriate parameters for baseline data. This is essential if the relevant information is to be clearly requested and concisely recorded;
- utilize Finlayson (1996), "framework for designing a wetland monitoring program" to design a monitoring program which is directly related to the values and threats at a wetland. This will assist in recording information over time, which is an important component for detecting 'changes' in ecological character; and

- the RIS to be updated after a set period of time. This allows early detection and possible remediation of adverse effects to the ecological character of a wetland.

or

- an additional document could be specifically formulated which clearly and concisely provides information on all of the above points.

4.1 Limitations of the Report

Following the sixth Conference of Contracting Parties held in Brisbane 1996, modifications were made to RIS guidelines to provide additional information for assessing the ecological character of a wetland. This study was undertaken to assess the usefulness of the RIS's completed prior to this meeting. As a result it was anticipated the usefulness for detecting a 'change in ecological character' would be low. However, this study was undertaken to provide, more quantitative or formal support for the decision to modify the RIS's. In addition, insufficient RIS's have been compiled since the Brisbane Conference to permit assessment of the new guidelines.

This analysis incorporates a degree of subjectivity associated with the compilation of the matrices. In addition, some subjectivity was present in the initial compilation of each RIS.

Several of the RIS's needed to be translated into English, which may also have resulted in some loss of information.

4.2 Future Research

The analysis in this study clearly indicates that the original RIS's are not adequate with respect to detecting ecological change. This study could be repeated to assess the adequacy of new RIS's which have been compiled using the updated guidelines when they become available.

5. References

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Appendix 1

Prospective RIS Site Data for Testing Guidelines

Prospective {RIS cream} site data for testing monitoring guidelines (Printed: 21 July 97)

Record#	SITEREF	LEFT(COUNTRY,11)	LEFT(SITENAME,25)	FORMOFDATA
2	1AG002	ALGERIA	Lac Tonga	RIS
11	7AS001	AUSTRIA	Neusiedlersee, Seewinkel	RIS
12	7AS002	AUSTRIA	Donau-March-Auen	RIS
13	7AS003	AUSTRIA	Untere Lobau	RIS
14	7AS004	AUSTRIA	Stauseen am Unteren Inn	RIS
15	7AS005	AUSTRIA	Rheindelta Bodensee	RIS
16	7AS006	AUSTRIA	Pürgschachen Moor	RIS
17	7AS007	AUSTRIA	Sablatnigmoor	RIS
18	7AS008	AUSTRIA	Rotmoos im Fuschertal	RIS
19	7AS009	AUSTRIA	Hörfeld - Moor	RIS
20	1BW001	BOTSWANA	Okavango Wetland System	RIS
21	6BZ003	BRAZIL	Mamirauá	RIS
22	6BZ005	BRAZIL	Reentrancias Maranhenses	RIS
23	3BG001	BULGARIA	Srébarna	RIS
24	3BG003	BULGARIA	Atanassovo Lake	RIS
26	1CD001	CHAD	Lac Fitri	RIS
27	6CL001	CHILE	Carlos Anwandter Sanctuar	RIS
28	6CL002	CHILE	Salar de Surire	RIS
30	6CL004	CHILE	Salar de Tara	RIS
31	6CL005	CHILE	Sistema hidrológico de So	RIS
32	6CL006	CHILE	Complejo lacustre Laguna	RIS
33	6CL007	CHILE	El Yali	RIS
34	2CH007	CHINA (Hong	Mai Po Marshes and Inner	RIS
35	1ZR001	CONGO,DEMOC	Parc national des Virunga	RIS
36	1ZR002	CONGO,DEMOC	Parc national des Mangrov	RIS
37	6CS006	COSTA RICA	Humedal Caribe Noreste	RIS
38	1CI001	COTE D'IVOI	Parc national d'Azagny	RIS
39	7DK001	DENMARK	Fiil-So	RIS
40	7DK002	DENMARK	Ringkobing Fjord	RIS
41	7DK003	DENMARK	Stadil and Veststadil Fjo	RIS
47	7DK009	DENMARK	Nordre Ronner	RIS
49	7DK011	DENMARK	Randers and Mariager Fjor	RIS
50	7DK012	DENMARK	Anholt Island (waters nor	RIS
51	7DK013	DENMARK	Horsens Fjord & Endelave	RIS
52	7DK014	DENMARK	Stavns Fjord and adjacent	RIS
55	7DK017	DENMARK	South Funen Archipelago	RIS
56	7DK018	DENMARK	Sejero Bugt, Nekeselo Bug	RIS
58	7DK020	DENMARK	Karrebæk, Dybso and Avno	RIS

59	7DK021	DENMARK	Fejo and Femo Isles (wate	RIS
64	7DK026	DENMARK	Ertholmene Islands (east	RIS
66	6EC001	ECUADOR	Manglares Churute	RIS
68	1EG001	EGYPT	Lake Bardawil	RIS
69	1EG002	EGYPT	Lake Burullus	RIS
70	3EE002	ESTONIA	Alam-Pedja Nature Reserve	RIS
71	3EE003	ESTONIA	EmajΣe Suursoo Mire and P	RIS
72	3EE004	ESTONIA	Endla Nature Reserve	RIS
73	3EE005	ESTONIA	Hiiumaa Islets and KΣina	RIS
74	3EE006	ESTONIA	Muraka Nature Reserve	RIS
75	3EE007	ESTONIA	Nigula Nature Reserve	RIS
76	3EE008	ESTONIA	Puhto-Laelatu-Nehatu Wetl	RIS
77	3EE009	ESTONIA	Soomaa National Park	RIS
78	3EE010	ESTONIA	Vilsandi National Park	RIS
79	6FR009	FRANCE	Grand Cul-de-Sac Marin de	RIS
80	6FR010	FRANCE	Basse-Mana	RIS
81	7FR001	FRANCE	Camargue	RIS
82	7FR002	FRANCE	Etangs de la Champagne hu	RIS
83	7FR003	FRANCE	Etangs de la Petite Woëvr	RIS
84	7FR005	FRANCE	Golfe du Morbihan	RIS
85	7FR008	FRANCE	Etang de Biguglia	RIS
86	7FR012	FRANCE	Baie du Mont Saint-Michel	RIS
87	7FR013	FRANCE	Grande Briere	RIS
88	7FR014	FRANCE	Lac de Grand-Lieu	RIS
89	7FR015	FRANCE	Basses Vallees Angenvines	RIS
90	7FR016	FRANCE	Marais salants de Guérand	RIS
92	1GM001	GAMBIA	Baobolon Wetland Reserve	RIS
93	3GE001	GEORGIA	Central Kolkheti	RIS
95	7DE009	GERMANY	Rhein, Eltville - Bingen	RIS
96	7DE011	GERMANY	Donauauen & Donaumoos	RIS
97	7DE012	GERMANY	Lech - Donau - Winkel	RIS
99	7DE014	GERMANY	Ammersee	RIS
100	7DE015	GERMANY	Starnberger See	RIS
101	7DE016	GERMANY	Chiemsee	RIS
102	7DE017	GERMANY	Unterer Inn, Haiming - Ne	RIS
103	7DE018	GERMANY	Ostseeboddengäwasser West	RIS
104	7DE019	GERMANY	Krakower Obersee	RIS
105	7DE020	GERMANY	Ostufer Müritz	RIS
106	7DE021	GERMANY	Niederung der Untere Have	RIS
107	7DE024	GERMANY	Helmestausee Berga-Kelbra	RIS
108	7DE025	GERMANY	Galenbecker See	RIS
109	7DE026	GERMANY	Rieselfelder Münster	RIS
110	7DE027	GERMANY	Weserstaustufe Schlüsselb	RIS

111	7DE028	GERMANY	Unterer Niederrhein	RIS
112	7DE029	GERMANY	Hamburgisches Wattenmeer	RIS
114	7GR001	GREECE	Evros Delta	RIS
115	7GR002	GREECE	Lake Vistonis, Porto Lago	RIS
116	7GR004	GREECE	Nestos delta & adjoining	RIS
117	7GR005	GREECE	Lakes Volvi & Koronia	RIS
118	7GR006	GREECE	Artificial lake Kerkini	RIS
120	7GR008	GREECE	Lake Mikri Prespa	RIS
121	7GR009	GREECE	Amvrakikos gulf	RIS
122	7GR010	GREECE	Messolonghi lagoons	RIS
123	7GR011	GREECE	Kotychi lagoons	RIS
124	6GU001	GUATEMALA	Laguna del Tigre	RIS
125	6GU002	GUATEMALA	Manchón-Guamuchal	RIS
126	6GU003	GUATEMALA	Refugio de Vida Silvestre	RIS
127	1GI001	GUINEA.	Ile Alcatraz	RIS
128	1GI002	GUINEA.	Iles Tristao	RIS
129	1GI003	GUINEA.	Rio Kapatchez	RIS
130	1GI004	GUINEA.	Rio Pongo	RIS
131	1GI005	GUINEA.	Konkouré	RIS
132	1GI006	GUINEA.	Ile Blanche	RIS
134	3HU001	HUNGARY	Szaporca	RIS
135	3HU002	HUNGARY	Velence - Dinnyés	RIS
136	3HU003	HUNGARY	Kardoskút	RIS
137	3HU004	HUNGARY	Kis-Balaton	RIS
138	3HU005	HUNGARY	Mártély	RIS
139	3HU006	HUNGARY	Kiskunság	RIS
140	3HU007	HUNGARY	Pusztaszer	RIS
141	3HU008	HUNGARY	Hortobágy	RIS
142	3HU009	HUNGARY	Ocsa	RIS
143	3HU010	HUNGARY	Tata, Öreg-tó (Old Lake)	RIS
144	3HU011	HUNGARY	Lake Fertö	RIS
145	3HU012	HUNGARY	Lake Balaton	RIS
146	3HU013	HUNGARY	Bodrogzug	RIS
147	7IC003	ICELAND	Grunnafjördur	RIS
149	2IL001	ISRAEL	En Afeq	RIS
150	2IL002	ISRAEL	Hula	RIS
151	2JP001	JAPAN	Kushiro-shitsugen	RIS
152	2JP002	JAPAN	Izu-numa and Uchi-numa	RIS
153	2JP003	JAPAN	Kutcharo-ko	RIS
154	2JP004	JAPAN	Utonai-ko	RIS
155	2JP010	JAPAN	Sakata	RIS
156	2KR001	KOREA, REPU	Yongneup of Mt. Daeam, hi	RIS
157	3LV001	LATVIA	Lake Engure	RIS

158	3LV002	LATVIA	Lake Kanieris	RIS
159	3LV003	LATVIA	Teicu and Pelecares bogs	RIS
160	7MT001	MALTA	Ghadira	RIS
161	4ME001	MEXICO	Ría Lagartos	RIS
163	1MC002	MOROCCO	Merja Sidi Boughaba	RIS
164	1MC003	MOROCCO	Lac d'Afennourir	RIS
165	1MC004	MOROCCO	Baie de Khnifiss	RIS
167	1NA002	NAMIBIA	Sandwich Harbour	RIS
169	1NA004	NAMIBIA	Etosha Pan, Lake Oponono	RIS
170	2NE001	NEPAL	Koshi Tappu	RIS
171	7NT001	NETHERLANDS	Groote Peel	RIS
172	7NT002	NETHERLANDS	Weerribben	RIS
173	7NT003	NETHERLANDS	Naardermeer	RIS
174	7NT004	NETHERLANDS	Boschplaat	RIS
175	7NT005	NETHERLANDS	Griend	RIS
176	7NT006	NETHERLANDS	De Biesbosch (southern pa	RIS
177	7NT007	NETHERLANDS	Waddenzee (Wadden Sea)	RIS
178	7NT008	NETHERLANDS	Oosterschelde & Markiezaa	RIS
179	7NT009	NETHERLANDS	Zwanenwater	RIS
180	7NT010	NETHERLANDS	Oostvaardersplassen	RIS
181	7NT011	NETHERLANDS	Engbertsdijksvenen	RIS
182	1NG001	NIGER	Parc national du "W"	RIS
192	7NO015	NORWAY	Nordre Tyrifjord	RIS
208	2PA006	PAKISTAN	Kinjhar (Kalri) Lake	RIS
210	2PA008	PAKISTAN	Haleji Lake	RIS
211	6PY001	PARAGUAY	Lago Ypoá	RIS
212	6PY002	PARAGUAY	Río Negro	RIS
213	6PY003	PARAGUAY	Tifunque	RIS
214	6PY004	PARAGUAY	Estero Milagro	RIS
215	6PE004	PERU	Lago Titicaca	RIS
216	6PE005	PERU	Lake Junín	RIS
217	6PE006	PERU	Manglares de Tumbes	RIS
218	6PE007	PERU	Pantanos de Villa	RIS
219	2PH001	PHILIPPINES	Olango Island Wildlife Sa	RIS
221	7PT002	PORTUGAL	Ria Formosa	RIS
226	7PT007	PORTUGAL	Estuário do Sado	RIS
227	7PT008	PORTUGAL	Lagoa de Sto. André et La	RIS
228	7PT009	PORTUGAL	Ria de Alvor	RIS
229	7PT010	PORTUGAL	Sapais de Castro Marim	RIS
230	1SE001	SENEGAL	Djoudj	RIS
231	1SE002	SENEGAL	Bassin du Ndiaël	RIS
232	1SE003	SENEGAL	Delta du Saloum	RIS
233	1SE004	SENEGAL	Gueumbeul	RIS

234	3SV001	SLOVAK REPU	Súr	RIS
235	3SV002	SLOVAK REPU	Parízské mociare (Pariz m	RIS
236	3SV003	SLOVAK REPU	Cicovské mrtve rameno (Ci	RIS
237	3SV004	SLOVAK REPU	Senné-rybníky (Senné fish	RIS
239	3SV006	SLOVAK REPU	Dunajské luhy (Danube flo	RIS
242	1ZA013	SOUTH AFRIC	Natal Drakensberg Park	RIS
243	1ZA014	SOUTH AFRIC	Ndumo Game Reserve	RIS
244	1ZA015	SOUTH AFRIC	Seekoeivlei Nature Reserv	RIS
246	7SP002	SPAIN	Las Tablas de Daimiel	RIS
247	7SP008	SPAIN	S'Albufera de Mallorca	RIS
248	7SP009	SPAIN	Laguna de la Vega (o del	RIS
249	7SP010	SPAIN	Laguna de Villafáfila	RIS
250	7SP011	SPAIN	Complejo intermareal Umia	RIS
251	7SP012	SPAIN	Rias de Ortigueira y Ladr	RIS
252	7SP013	SPAIN	Albufera de Valencia	RIS
253	7SP014	SPAIN	Pantano de El Hondo	RIS
254	7SP015	SPAIN	Lagunas de la Mata y Torr	RIS
255	7SP016	SPAIN	Salinas de Santa Pola	RIS
256	7SP017	SPAIN	Prat de Cabanes - Torrebl	RIS
257	7SP020	SPAIN	Laguna de Manjavacas	RIS
258	7SP021	SPAIN	Lagunas de Alcázar de San	RIS
259	7SP022	SPAIN	Laguna del Prado	RIS
260	7SP023	SPAIN	Embalse de Orellana	RIS
261	7SP024	SPAIN	Complejo de Corrubedo	RIS
263	7SP036	SPAIN	Lagunas de Laguardia (Ala	RIS
264	2SR001	SRI LANKA	Bundala	RIS
265	6SM001	SURINAME	Coppenamemonding	RIS
268	7SW003	SWEDEN	Helgeån	RIS
304	1TU001	TUNISIA	Ichkeul	RIS
306	4US001	UNITED STAT	Ash Meadows	RIS
308	4US003	UNITED STAT	Izembek	RIS
309	4US004	UNITED STAT	Okefenokee	RIS
310	4US005	UNITED STAT	Everglades	RIS
313	4US008	UNITED STAT	Cache-Lower White Rivers	RIS
316	4US011	UNITED STAT	Delaware Bay	RIS
317	6UR001	URUGUAY	Bañados del Este y Franja	RIS
318	6VE001	VENEZUELA	Cuare	RIS
320	1ZM001	ZAMBIA	Kafue Flats: Lochinvar &	RIS
321	1ZM002	ZAMBIA	Bangweulu Swamps: Chikuni	RIS

Prospective (RIS cream) site data for testing monitoring guidelines (Printed: 21 July 97)

Record#	SITEREF	LEFT(COUNTRY,11)	LEFT(SITENAME,25)	FORMOFDATA
2	1AG002	ALGERIA	Lac Tonga	RIS
11	7AS001	AUSTRIA	Neusiedlersee, Seewinkel	RIS
12	7AS002	AUSTRIA	Donau-March-Auen	RIS
13	7AS003	AUSTRIA	Untere Lobau	RIS
14	7AS004	AUSTRIA	Stauseen am Unteren Inn	RIS
15	7AS005	AUSTRIA	Rheindelta Bodensee	RIS
16	7AS006	AUSTRIA	Pürgschachen Moor	RIS
17	7AS007	AUSTRIA	Sablatnigmoor	RIS
18	7AS008	AUSTRIA	Rotmoos im Fuschertal	RIS
19	7AS009	AUSTRIA	Hörfeld - Moor	RIS
20	1BW001	BOTSWANA	Okavango Wetland System	RIS
21	6BZ003	BRAZIL	Mamirauá	RIS
22	6BZ005	BRAZIL	Reentrancias Maranhenses	RIS
23	3BG001	BULGARIA	Srébarna	RIS
24	3BG003	BULGARIA	Atanassovo Lake	RIS
26	1CD001	CHAD	Lac Fitri	RIS
27	6CL001	CHILE	Carlos Anwandter Sanctuar	RIS
28	6CL002	CHILE	Salar de Surire	RIS
30	6CL004	CHILE	Salar de Tara	RIS
31	6CL005	CHILE	Sistema hidrológico de So	RIS
32	6CL006	CHILE	Complejo lacustre Laguna	RIS
33	6CL007	CHILE	El Yali	RIS
34	2CH007	CHINA (Hong	Mai Po Marshes and Inner	RIS
35	1ZR001	CONGO,DEMOC	Parc national des Virunga	RIS
36	1ZR002	CONGO,DEMOC	Parc national des Mangrov	RIS
37	6CS006	COSTA RICA	Humedal Caribe Noreste	RIS
38	1CI001	COTE D'IVOI	Parc national d'Azagny	RIS
39	7DK001	DENMARK	Fiil-So	RIS
40	7DK002	DENMARK	Ringkobing Fjord	RIS
41	7DK003	DENMARK	Stadil and Veststadil Fjo	RIS
47	7DK009	DENMARK	Nordre Ronner	RIS
49	7DK011	DENMARK	Randers and Mariager Fjor	RIS
50	7DK012	DENMARK	Anholt Island (waters nor	RIS
51	7DK013	DENMARK	Horsens Fjord & Endelave	RIS
52	7DK014	DENMARK	Stavns Fjord and adjacent	RIS
55	7DK017	DENMARK	South Funen Archipelago	RIS
56	7DK018	DENMARK	Sejero Bugt, Nekeselo Bug	RIS
58	7DK020	DENMARK	Karrebæk, Dybso and Avno	RIS

59	7DK021	DENMARK	Fejo and Femo Isles (wate	RIS
64	7DK026	DENMARK	Ertholmene Islands (east	RIS
66	6EC001	ECUADOR	Manglares Churute	RIS
68	1EG001	EGYPT	Lake Bardawil	RIS
69	1EG002	EGYPT	Lake Burullus	RIS
70	3EE002	ESTONIA	Alam-Pedja Nature Reserve	RIS
71	3EE003	ESTONIA	EmajΣe Suursoo Mire and P	RIS
72	3EE004	ESTONIA	Endla Nature Reserve	RIS
73	3EE005	ESTONIA	Hiiumaa Islets and KΣina	RIS
74	3EE006	ESTONIA	Muraka Nature Reserve	RIS
75	3EE007	ESTONIA	Nigula Nature Reserve	RIS
76	3EE008	ESTONIA	Puhto-Laelatu-Nehatu Wetl	RIS
77	3EE009	ESTONIA	Soomaa National Park	RIS
78	3EE010	ESTONIA	Vilsandi National Park	RIS
79	6FR009	FRANCE	Grand Cul-de-Sac Marin de	RIS
80	6FR010	FRANCE	Basse-Mana	RIS
81	7FR001	FRANCE	Camargue	RIS
82	7FR002	FRANCE	Etangs de la Champagne hu	RIS
83	7FR003	FRANCE	Etangs de la Petite Woëvr	RIS
84	7FR005	FRANCE	Golfe du Morbihan	RIS
85	7FR008	FRANCE	Etang de Biguglia	RIS
86	7FR012	FRANCE	Baie du Mont Saint-Michel	RIS
87	7FR013	FRANCE	Grande Briere	RIS
88	7FR014	FRANCE	Lac de Grand-Lieu	RIS
89	7FR015	FRANCE	Basses Vallees Angenvines	RIS
90	7FR016	FRANCE	Marais salants de Guérand	RIS
92	1GM001	GAMBIA	Baobolon Wetland Reserve	RIS
93	3GE001	GEORGIA	Central Kolkheti	RIS
95	7DE009	GERMANY	Rhein, Eltville - Bingen	RIS
96	7DE011	GERMANY	Donauauen & Donaumoos	RIS
97	7DE012	GERMANY	Lech - Donau - Winkel	RIS
99	7DE014	GERMANY	Ammersee	RIS
100	7DE015	GERMANY	Starnberger See	RIS
101	7DE016	GERMANY	Chiemsee	RIS
102	7DE017	GERMANY	Unterer Inn, Haiming - Ne	RIS
103	7DE018	GERMANY	Ostseeboddengäwasser West	RIS
104	7DE019	GERMANY	Krakower Obersee	RIS
105	7DE020	GERMANY	Ostufer Müritz	RIS
106	7DE021	GERMANY	Niederung der Untere Have	RIS
107	7DE024	GERMANY	Helmestausee Berga-Kelbra	RIS
108	7DE025	GERMANY	Galenbecker See	RIS
109	7DE026	GERMANY	Rieselfelder Münster	RIS
110	7DE027	GERMANY	Weserstaustufe Schlüsselb	RIS

111	7DE028	GERMANY	Unterer Niederrhein	RIS
112	7DE029	GERMANY	Hamburgisches Wattenmeer	RIS
114	7GR001	GREECE	Evros Delta	RIS
115	7GR002	GREECE	Lake Vistonis, Porto Lago	RIS
116	7GR004	GREECE	Nestos delta & adjoining	RIS
117	7GR005	GREECE	Lakes Volvi & Koronia	RIS
118	7GR006	GREECE	Artificial lake Kerkini	RIS
120	7GR008	GREECE	Lake Mikri Prespa	RIS
121	7GR009	GREECE	Amvrakikos gulf	RIS
122	7GR010	GREECE	Messolonghi lagoons	RIS
123	7GR011	GREECE	Kotychi lagoons	RIS
124	6GU001	GUATEMALA	Laguna del Tigre	RIS
125	6GU002	GUATEMALA	Manchón-Guamuchal	RIS
126	6GU003	GUATEMALA	Refugio de Vida Silvestre	RIS
127	1GI001	GUINEA.	Ile Alcatraz	RIS
128	1GI002	GUINEA.	Iles Tristao	RIS
129	1GI003	GUINEA.	Rio Kapatchez	RIS
130	1GI004	GUINEA.	Rio Pongo	RIS
131	1GI005	GUINEA.	Konkouré	RIS
132	1GI006	GUINEA.	Ile Blanche	RIS
134	3HU001	HUNGARY	Szaporca	RIS
135	3HU002	HUNGARY	Velence - Dinnyés	RIS
136	3HU003	HUNGARY	Kardoskút	RIS
137	3HU004	HUNGARY	Kis-Balaton	RIS
138	3HU005	HUNGARY	Mártély	RIS
139	3HU006	HUNGARY	Kiskunság	RIS
140	3HU007	HUNGARY	Pusztaszer	RIS
141	3HU008	HUNGARY	Hortobágy	RIS
142	3HU009	HUNGARY	Ocsa	RIS
143	3HU010	HUNGARY	Tata, Öreg-tó (Old Lake)	RIS
144	3HU011	HUNGARY	Lake Fertö	RIS
145	3HU012	HUNGARY	Lake Balaton	RIS
146	3HU013	HUNGARY	Bodrogzug	RIS
147	7IC003	ICELAND	Grunnafjördur	RIS
149	2IL001	ISRAEL	En Afeq	RIS
150	2IL002	ISRAEL	Hula	RIS
151	2JP001	JAPAN	Kushiro-shitsugen	RIS
152	2JP002	JAPAN	Izu-numa and Uchi-numa	RIS
153	2JP003	JAPAN	Kutcharo-ko	RIS
154	2JP004	JAPAN	Utonai-ko	RIS
155	2JP010	JAPAN	Sakata	RIS
156	2KR001	KOREA, REPU	Yongneup of Mt. Daeam, hi	RIS
157	3LV001	LATVIA	Lake Engure	RIS

234	3SV001	SLOVAK REPU	Súr	RIS
235	3SV002	SLOVAK REPU	Parízské mociare (Pariz m	RIS
236	3SV003	SLOVAK REPU	Cicovské mrtve rameno (Ci	RIS
237	3SV004	SLOVAK REPU	Senné-rybníky (Senné fish	RIS
239	3SV006	SLOVAK REPU	Dunajské luhy (Danube flo	RIS
242	1ZA013	SOUTH AFRIC	Natal Drakensberg Park	RIS
243	1ZA014	SOUTH AFRIC	Ndumo Game Reserve	RIS
244	1ZA015	SOUTH AFRIC	Seekoeivlei Nature Reserv	RIS
246	7SP002	SPAIN	Las Tablas de Daimiel	RIS
247	7SP008	SPAIN	S'Albufera de Mallorca	RIS
248	7SP009	SPAIN	Laguna de la Vega (o del	RIS
249	7SP010	SPAIN	Laguna de Villafáfila	RIS
250	7SP011	SPAIN	Complejo intermareal Umia	RIS
251	7SP012	SPAIN	Rias de Ortigueira y Ladr	RIS
252	7SP013	SPAIN	Albufera de Valencia	RIS
253	7SP014	SPAIN	Pantano de El Hondo	RIS
254	7SP015	SPAIN	Lagunas de la Mata y Torr	RIS
255	7SP016	SPAIN	Salinas de Santa Pola	RIS
256	7SP017	SPAIN	Prat de Cabanes - Torrebl	RIS
257	7SP020	SPAIN	Laguna de Manjavacas	RIS
258	7SP021	SPAIN	Lagunas de Alcázar de San	RIS
259	7SP022	SPAIN	Laguna del Prado	RIS
260	7SP023	SPAIN	Embalse de Orellana	RIS
261	7SP024	SPAIN	Complejo de Corrubedo	RIS
263	7SP036	SPAIN	Lagunas de Laguardia (Ala	RIS
264	2SR001	SRI LANKA	Bundala	RIS
265	6SM001	SURINAME	Coppenamemonding	RIS
268	7SW003	SWEDEN	Helgeån	RIS
304	1TU001	TUNISIA	Ichkeul	RIS
306	4US001	UNITED STAT	Ash Meadows	RIS
308	4US003	UNITED STAT	Izembek	RIS
309	4US004	UNITED STAT	Okefenokee	RIS
310	4US005	UNITED STAT	Everglades	RIS
313	4US008	UNITED STAT	Cache-Lower White Rivers	RIS
316	4US011	UNITED STAT	Delaware Bay	RIS
317	6UR001	URUGUAY	Bañados del Este y Franja	RIS
318	6VE001	VENEZUELA	Cuare	RIS
320	1ZM001	ZAMBIA	Kafue Flats: Lochinvar &	RIS
321	1ZM002	ZAMBIA	Bangweulu Swamps: Chikuni	RIS

Prospective (STD cream) site data for testing monitoring guidelines (Printed: 21 July 97)

Record#	SITEREF	LEFT(COUNTRY,11)	LEFT(SITENAME,25)	FORMOFDATA
1	6AR005	ARGENTINA	Laguna de Llancanelo	STD
2	5AU001	AUSTRALIA	Cobourg Peninsula	STD
3	5AU002	AUSTRALIA	Kakadu (Stage I and wetla	STD
4	5AU003	AUSTRALIA	Moulting Lagoon	STD
5	5AU004	AUSTRALIA	Logan Lagoon	STD
6	5AU005	AUSTRALIA	Sea Elephant Conservation	STD
7	5AU006	AUSTRALIA	Pittwater-Orielton Lagoon	STD
8	5AU007	AUSTRALIA	Apsley Marshes	STD
9	5AU008	AUSTRALIA	Cape Barren Island, east	STD
10	5AU009	AUSTRALIA	Lower Ringarooma River	STD
11	5AU010	AUSTRALIA	Jocks Lagoon	STD
12	5AU011	AUSTRALIA	Lake Crescent	STD
13	5AU012	AUSTRALIA	Little Waterhouse Lake	STD
14	5AU013	AUSTRALIA	Corner Inlet	STD
15	5AU014	AUSTRALIA	Barmah Forest	STD
17	5AU016	AUSTRALIA	Hattah-Kulkyne Lakes	STD
22	5AU021	AUSTRALIA	Gippsland Lakes	STD
23	5AU022	AUSTRALIA	Lake Albacutya	STD
24	5AU023	AUSTRALIA	Towra Point	STD
25	5AU024	AUSTRALIA	Kooragang	STD
26	5AU025	AUSTRALIA	The Coorong, Lake Alexand	STD
27	5AU026	AUSTRALIA	Bool and Hacks Lagoons	STD
28	5AU027	AUSTRALIA	Macquarie Marshes	STD
29	5AU028	AUSTRALIA	Coongie Lakes	STD
30	5AU029	AUSTRALIA	Riverland	STD
32	5AU031	AUSTRALIA	Ord River floodplain	STD
33	5AU032	AUSTRALIA	Lakes Argyle and Kununurr	STD
34	5AU033	AUSTRALIA	Roebuck Bay	STD
35	5AU034	AUSTRALIA	Eighty-mile Beach	STD
36	5AU035	AUSTRALIA	Forrestdale and Thomsons	STD
39	5AU038	AUSTRALIA	Vasse-Wonnerup system	STD
41	5AU041	AUSTRALIA	Moreton Bay	STD
42	5AU042	AUSTRALIA	Bowling Green Bay	STD
43	5AU040	AUSTRALIA (	Hosnie's Spring	STD
46	7BE002	BELGIUM	Schorren van de Beneden S	STD
48	7BE004	BELGIUM	De Ijzerbroeken te Diksmu	STD
49	7BE005	BELGIUM	Kalmthoutse Heide	STD
50	7BE006	BELGIUM	Marais d'Harchies	STD

OTHERS WHICH COULD HAVE BUT WERE NOT INCLUDED IN FIRST ROUND

127	3LT005	LITHUANIA	Nemunas Delta	STD
128	1MR002	MAURITANIA	Parc National du Diawling	STD
129	4ME002	MEXICO	Marismas Nacionales	STD
130	4ME003	MEXICO	Pantanos de Centla	STD
131	4ME004	MEXICO	Cuatrociénegas	STD
132	5NZ001	NEW ZEALAND	Waituna Lagoon	STD
133	5NZ002	NEW ZEALAND	Farewell Spit	STD
134	5NZ003	NEW ZEALAND	Whangamarino	STD
135	5NZ004	NEW ZEALAND	Kopuatai Peat Dome	STD
136	5NZ005	NEW ZEALAND	Firth of Thames	STD
140	6PN002	PANAMA	San San - Pond Sak	STD
141	6PN003	PANAMA	Punta Patiño	STD
142	6PE001	PERU	Paracas	STD
143	6PE002	PERU	Pacaya-Samiria	STD
144	6PE003	PERU	Lagunas de Mejía	STD
145	3PO001	POLAND	Jezioro Luknajno	STD
146	3PO002	POLAND	Slonsk Reserve	STD
148	3PO004	POLAND	Jezioro Karas	STD
149	3PO005	POLAND	Jezioro Siedmiu Wysp	STD
153	1ZA004	SOUTH AFRIC	Blesbokspruit	STD
157	1ZA010	SOUTH AFRIC	Orange River Mouth	STD
160	7SP019	SPAIN	Delta del Ebro	STD
161	7TR001	TURKEY	Göksu Deltasi	STD
162	7TR002	TURKEY	Burdur Gölü	STD
163	7TR003	TURKEY	Seyfe Gölü	STD
164	7TR004	TURKEY	Kus Gölü (Manyas)	STD
165	7TR005	TURKEY	Sultan Sazligi (Sultan Ma	STD
198	7UK033	UNITED KING	Upper Severn Estuary (par	STD
258	4US014	UNITED STAT	Connecticut River Estuary	STD
259	6VE002	VENEZUELA	Archipielago Los Roques	STD
260	6VE003	VENEZUELA	Laguna de la Restinga	STD
261	6VE004	VENEZUELA	Laguna de Tacarigua	STD
262	6VE005	VENEZUELA	Ciénaga de Los Olivitos	STD

Appendix 2

RIS Assessment for Testing Ecological Character

RIS ASSESSMENT FOR TESTING ECOLOGICAL CHARACTER

		CODE	SELECTION	LANGUAGE	
1. AFRICA					
BOTSWANA	Okavango Delta System	1BW001	(1 of) best	EN	selected
COTE D'IVOIRE	Parc national d'Azagny	1CI001	(1 of) best	FR	selected
GAMBIA	Baobolon Wetland Reserve	1GM001	Fair to Good	EN	
SENEGAL	Delta du Saloum	1SE003	Good	FR	selected
SOUTH AFRICA	Natal Drakensberg Park	1ZA013	(1 of) best	EN	selected
2. ASIA					
CHINA	Xianghai	2CH001	not evaluated	EN	selected
ISRAEL	En Afeq Nature Reserve	2IL001	(1 of) best	EN	
ISRAEL	Hula Nature Reserve	2IL002	(1 of) best	EN	selected
JAPAN	Kushiro-shitsugen	2JP001	Good	EN	selected
KOREA	The High Moor, Yongneup of Mt. Daeam	2KR001	Good	EN	
NEPAL	Koshi Tappu	2NE001	Fair to Good	EN	
PHILIPPINES	Olango Island Wildlife Sanctuary	2PH001	Fair to Good	EN	
SRI LANKA	Bundala	2SR001	(1 of) best	EN	
3. EASTERN EUROPE					
HUNGARY	Hortobagy	3HU008	not evaluated	EN	selected
GEORGIA	Wetlands of Central Kolkheti	3GE001	Fair to Good	EN	selected
LATVIA	Lake Engure	3LV001	(1 of) best	EN	selected
LATVIA	Lake Kanieris	3LV002	(1 of) best	EN	
SLOVAK REPUBLIC	Cicovské mrtve rameno	3SV003	(1 of) best	EN	selected
4. NORTH AMERICA					
CANADA	Cap Tourmente	4CN001	Fair to Good	EN	
CANADA	Whooping Crane Summer Range	4CN006	Fair to Good	EN	
CANADA	Minesing Swamp	4CN034	(1 of) best	EN	selected
CANADA	Matchedash Bay	4CN035	(1 of) best	EN	selected
MEXICO	Ria Lagartos	4ME001	Good	SP/EN*	selected
USA	Everglades	4US005	Fair [pre-hurricane]	EN	
USA	Delaware Bay	4US011	Fair	EN	
USA	Cache Lower White Rivers	4US008	Good in combination with other docs; otherwise unusable	EN	
5. OCEANIA					
AUSTRALIA	Moreton Bay	5AU041	not evaluated	EN	selected

AUSTRALIA	Kakadu (Stage I & comp. of Stage III)	5AU002	Good	EN	
AUSTRALIA	Corner Inlet	5AU013	Fair to Good	EN	
AUSTRALIA	Port Phillip Bay & Bellarine Peninsula	5AU018	Fair to Good	EN	
NEW ZEALAND	Farewell Spit	5NZ002	Good	EN	
NEW ZEALAND	Whangamarino	5NZ003	(1 of) best	EN	selected
NEW ZEALAND	Kopuatai Peat Dome	5NZ004	Very Good	EN	selected
6. NEOTROPICS					
BRAZIL	Reentrancias Maranhenses	6BZ003	(1 of) best	PO	
CHILE	Carlos Anwandter Sanctuary	6CL001	(1 of) best	EN	selected
CHILE	Sistema hidrológico de Soncor	6CL005	Good	EN	
COSTA RICA	Humedal Caribe Noreste	6CS006	(1 of) best	SP	selected
ECUADOR	Manglares Churute	6EC001	(1 of) best	SP/EN*	
FRANCE	Grand Cul-de-Sac Marin de la Guadeloupe	6FR009	(1 of) best	FR/EN*	
FRANCE	Basse-Mana	6FR010	Good	FR/EN*	
GUATEMALA	Manchón-Guamuchal	6GU002	Good	SP/EN*	selected
GUATEMALA	Ref. Vida Silv. Bocas del Polochic	6GU003	Good	SP	
PERU	Lago Titicaca (Peruvian sector)	6PE004	(1 of) best	SP	selected
PERU	Reserva Nacional de Junín	6PE005	Very Good	SP	
PERU	Santuario Nacional Los Manglares de Tumbes	6PE006	Very Good	SP	
PERU	Zona Reservada Los Pantanos de Villa	6PE007	Very Good	SP	
SURINAME	Coppenamemonding	6SM001	Good	EN	
7. WESTERN EUROPE					
AUSTRIA	Rotmoos im Fuschertal	7AS008	Good	EN	selected
AUSTRIA	Hörfeld Moor	7AS009	(1 of) best	EN	
FRANCE	Etangs de la Champagne humide	7FR002	Good	FR	selected
FRANCE	Golfe du Morbihan	7FR005	Good	FR/EN*	
FRANCE	Etang de Biguglia	7FR008	Good	FR/EN*	selected
GERMANY	Unterer Niederrhein	7DE028	Very Good	GE	
MALTA	Ghadira	7MT001	Fair to Good	EN	
PORTUGAL	Estuário do Sado	7PT007	Good	EN	
SPAIN	Lagunas de la Mata y Torrevieja	7SP013	Good	SP/EN*	
SPAIN	Salinas de Santa Pola	7SP016	(1 of) best	SP/EN*	

* Partial and/or unofficial translation.

Appendix 3

Semi – Quantitative Matrix Analysis

Semi – Quantitative Matrix Analysis

Abbreviated name	Example	Okavango 1BW001	Azagny 1CI001	Saloum 1SE003	Natal 1ZA013	Xianghai 2CH001	Hula 2IL002	Kushiro 2JP001	Hortobagy 3HU008a	Hortobagy 3HU008b	Hortobagy 3HU008c	Hortobagy 3HU008d1	Hortobagy 3HU008d2	Hortobagy 3HU008d3	Kolkheti 3GE001	Engure 3LV001
1 Country	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
2 Date (or update) of compilation	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
3 Reference number (for completion by Database Manager)	n/a	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
4 Name and address of the compiler	4	4	4	4	5	4	5	4	5	4	4	4	4	4	5	4
5 Name of wetland	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
6 Date of Ramsar designation	5	1	1	5	1	5	5	5	5	5	5	5	5	5	5	5
7 Geographical coordinates	5	5	2	5	2	5	5	5	5	5	5	5	5	5	5	5
8 General location	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4
9 Area (hectares)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
10 Wetland type	4	5	4	3	2	3	4	4	4	4	4	4	4	4	4	5
11 Altitude	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
12 Overview of site	5	5	4	5	4	3	3	5	5	4	5	4	4	4	5	5
13 Physical features	3	4	5	4	5	5	5	5	4	4	4	3	3	4	5	5
14 Ecological features	3	4	4	5	5	4	4	4	5	4	4	4	4	4	4	4
15 Land tenure/ownership of (a) site (b) surrounding area	5	5	4	5	5	5	5	4	5	5	5	5	5	5	5	5
16 Conservation measures taken	3	5	4	4	5	5	5	5	5	5	5	5	5	5	5	5
17 Conservation measures proposed but not yet implemented	3	5	5	5	3	3	4	5	5	3	5	5	3	3	5	5
18 Current land use (a) site (b) surroundings/catchment	5	5	5	3	5	5	4	5	5	5	5	5	5	5	5	5
19 Disturbances and threats	4	3	5	4	3	5	5	5	4	3	3	3	3	3	5	5
20 Hydrological and biophysical values	5	5	3	2	5	3	5	5	5	5	5	2	5	5	5	5
21 Social and cultural values	5	5	5	5	3	5	5	4	3	3	4	3	5	5	5	5
22 Noteworthy fauna	5	5	5	4	5	3	5	5	3	3	3	4	4	4	4	5
23 Noteworthy flora	5	5	5	3	5	4	3	5	3	3	3	3	3	4	5	5
24 Current scientific research and facilities	5	5	5	5	5	5	5	5	2	3	5	5	5	5	5	5
25 Current conservation education	5	5	5	5	5	5	5	5	4	4	5	5	5	5	5	5
26 Current recreation and tourism	4	4	4	5	4	4	5	5	5	5	5	5	5	5	4	5
27 Management authority	5	5	4	5	5	5	5	5	5	5	5	5	5	5	5	1
28 Jurisdiction	5	5	5	3	5	4	4	5	4	4	4	4	4	4	4	5
29 Bibliographical references	5	5	5	5	5	1	5	5	2	2	2	2	2	2	5	5
30 Justification of the criteria (reasons for inclusion)	5	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5
31 Map of site(to be appended)	5	3	2	2	4	1	3	4	3	3	3	3	3	3	5	4
Sum of all categories %	88.39	89.68	86.45	87.10	86.45	84.52	92.26	95.48	87.10	83.87	88.39	85.16	87.10	88.39	96.13	94.84

Key

5	Meets RIS guidelines
4	Most of the RIS guidelines are addressed
3	Some RIS guidelines are addressed
2	General statement provided
1	No information provided

Semi – Quantitative Matrix Analysis

Abbreviated name	Cicovske 3SV003	Minesing 4CN034	Matchedash 4CN035	Moreton 5AU041	Whangamarino 5NZ003	Kopuatai 5NZ004	Carlos 6CL001	Noreste 6CS006	Manchon 6GU002	Titicaca 6PE004	Lagartos 6ME001	Fuschertal 7AS008	Champagne 7FR002	Biguglia 7FR008	Sum of individual categories
1 Country	5	5	5	5	5	2	5		5	5	5	5	5	5	97 93
2 Date (or update) of compilation	5	5	5	5	5	5	5		5	5	1	5	5	5	97 24
3 Reference number (for completion by Database Manager)	5	5	5	5	5	5	5		5	5	5	5	5	5	96 55
4 Name and address of the compiler	4	4	3	4	4	4	4		4	5	3	4	4	3	81 38
5 Name of wetland	5	5	5	5	5	5	5		5	5	5	5	5	5	100 00
6 Date of Ramsar designation	1	5	5	1	5	5	5		1	1	5	1	1	1	72 41
7 Geographical coordinates	5	5	5	5	5	5	5		5	5	2	5	5	5	93 79
8 General location	4	4	4	4	4	4	3		4	5	4	4	4	4	79 31
9 Area (hectares)	5	5	5	5	5	5	5		5	5	5	5	5	5	100 00
10 Wetland type	4	4	4	4	5	5	4		5	5	4	4	4	5	82 07
11 Altitude	5	5	5	5	5	5	5		5	5	5	5	5	5	100 00
12 Overview of site	5	5	4	5	5	5	5		5	5	5	5	5	5	92 41
13 Physical features	4	3	3	5	5	5	5		4	5	5	5	5	5	87 59
14 Ecological features	5	4	4	3	5	5	5		5	4	4	5	4	4	84 83
15 Land tenure/ownership of (a) site (b) surrounding area	5	4	5	5	5	5	5		5	5	5	4	5	5	97 24
16 Conservation measures taken	5	5	5	5	5	5	5		5	5	5	5	5	5	97 24
17 Conservation measures proposed but not yet implemented	5	5	5	5	5	5	5		5	5	5	5	5	5	91 03
18 Current land use (a) site (b) surroundings/catchment	4	5	5	5	5	5	5		5	5	5	5	4	5	96 55
19 Disturbances and threats	3	5	3	4	4	4	4		5	5	5	4	5	5	82 07
20 Hydrological and biophysical values	3	5	2	5	5	4	5		2	2	5	4	5	5	84 14
21 Social and cultural values	4	5	5	5	5	5	5		3	5	5	4	5	5	90 34
22 Noteworthy fauna	4	5	5	5	5	5	5		3	5	5	5	4	3	86 90
23 Noteworthy flora	3	5	5	5	5	5	3		3	4	5	5	3	3	81 38
24 Current scientific research and facilities	5	5	5	5	5	5	5		5	5	5	5	5	5	96 55
25 Current conservation education	4	5	5	5	5	5	5		5	3	5	5	5	5	96 55
26 Current recreation and tourism	5	4	4	5	5	5	5		5	5	4	5	5	5	93 79
27 Management authority	5	5	5	5	5	5	5		5	5	5	5	5	5	96 55
28 Jurisdiction	5	4	4	5	5	5	4		5	5	5	5	5	5	90 34
29 Bibliographical references.	4	5	4	5	5	5	5		5	5	5	5	5	5	83 45
30 Justification of the criteria (reasons for inclusion).	1	2	2	5	5	5	5		5	5	5	5	5	5	91 03
31 Map of site(to be appended)	3	4	3	4	4	3	3		5	4	3	3	4	4	67 59
Sum of all categories %	83 87	91 61	86.45	92.90	97.42	94.19	93.55	0.00	89 68	92.26	90.32	91 61	91.61	91 61	

Appendix 4

Values Matrix

Values Matrix

Abbreviated name			Okavango 1BW001	Azagny 1CI001	Saloum 1SE003	Natal 1ZA013	Xianghai 2CH001	Huia 2IL002	Kushiro 2JP001	Hortobagy 3HU008a	Hortobagy 3HU008b	Hortobagy 3HU008c	Hortobagy 3HU008d1	Hortobagy 3HU008d2	Hortobagy 3HU008d3	Kolkheti 3GE001	Engure 3LV001	Cicovska 3SV003	Minesing 4CN034
Categories	**Values**	**Example**																	
Categories Total																			
Water regime	Water supply			x		x			x										
	Water purification								x					x				x	
	Water storage (catchments or basins)	x				x			x	x	x	x							
	Stabilisation of local climate conditions (rainfall & temperature)						x												
	Storm protection and flood mitigation	x		x				x		x	x	x				x		x	x
	Shoreline stabilisation and erosion control																		
	Regulation of river or streamflow patterns & water levels		x			x			x										x
	Groundwater recharge	x														x			x
	Groundwater discharge															x			
	Retention of nutrients							x											
	Retention of sediments	x	x					x				x					x		
Exploitation and production	Fisheries	x	x		x		x	x	x	x		x							
	Agriculture		x		x						x		x			x	x	x	
	Grazing				x		x									x			
	Timber production			x							x		x	x	x				
	mammals		x	x								x				x	x		
	Plant products (food, crafts, housing, industry)		x		x		x			x	x	x					x		
	Mining production (salt)																		
Natural heritage	Scientific research & education	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	Recreation and tourism opportunities	x	x	x	x	x	x	x	x	x		x				x	x	x	x
	Rare, vulnerable or endangered species	x	x	x		x	x	x	x	x	x		x	x	x	x	x	x	x
	Biological diversity & richness	x	x	x	x	x	x		x			x							
	Habitat is required for critical stage of plant or animals biological cycle					x	x									x			
	Endemic species		x	x		x	x		x				x	x	x	x	x	x	x
	Provides habitat for wildlife, especially waterfowl	x		x	x	x	x		x	x	x	x							
	Medicinal plant material		x																
Cultural heritage	Traditional lifestyles	x	x	x															
	Archaeological site	x				x													
	Historical buildings/ sites/trading routes	x	x													x			
	Total number of values identified at a site	13	14	11	8	11	11	7	11	8	7	10	7	9	7	14	10	8	8

Key

X Number of occurrences

Values Matrix

Abbreviated name		Matchedash	Moreton	Whangamarino	Kopuatai	Carlos	Noreste	Manchon	Titicaca	Lagartos	Fuschertal	Champagne	Biguglia	Total	
Categories	Values	4CN036	5AU041	6NZ003	6NZ004	6CL001	6CS006	6GU002	6PE004	6ME001	7AS008	7FR002	7FR008	number of values	Total of categories
Categories Total															
Water regime	Water supply								x	x		x		7	
	Water purification					x							x	4	
	Water storage (catchments or basins)													6	
	Stabilisation of local climate conditions (rainfall & temperature)								x					2	
	Storm protection and flood mitigation	x		x	x							x		13	
	Shoreline stabilisation and erosion control												x	1	
	Regulation of river or streamflow patterns & water levels	x										x		8	
	Groundwater recharge													3	
	Groundwater discharge													1	
	Retention of nutrients					x								2	
	Retention of sediments			x	x	x				x	x			11	56
Exploitation and production	Fisheries		x	x	x			x	x	x		x	x	19	
	Agriculture			x	x				x	x	x	x	x	11	
	Grazing				x	x		x	x	x		x		11	
	Timber production											x		5	
	mammals			x	x				x		x	x	x	9	
	Plant products (food, crafts, housing, industry)								x			x		8	
	Mining production (salt)							x		x				2	65
Natural heritage	Scientific research & education	x	x	x	x	x		x	x	x	x	x	x	29	
	Recreation and tourism opportunities	x	x	x	x	x		x	x	x	x	x	x	25	
	Rare, vulnerable or endangered species	x	x	x	x	x		x		x	x	x	x	26	
	Biological diversity & richness	x	x	x	x	x		x	x	x	x	x	x	26	
	Habitat is required for critical stage of plant or animals biological cycle		x	x	x			x						7	
	Endemic species			x	x				x					13	
	Provides habitat for wildlife, especially waterfowl		x	x		x		x	x	x		x	x	23	
	Medicinal plant material											x		2	151
Cultural heritage	Traditional lifestyles		x	x	x							x		7	
	Archaeological site		x	x						x		x		7	
	Historical buildings/ sites/trading routes	x	x	x	x	x				x	x	x		13	27
	Total number of values identified at a site	7	10	15	14	10		9	12	13	8	18	10		

Appendix 5

Threats Matrix

Threats Matrix

Abbreviated name			Okavango 1BW001	Azagny 1CI001	Saloum 1SE003	Natal 1ZA013	Xianghai 2CH001	Hula 2IL002	Kushiro 2JP001	Hortobagy 3HU008a	Hortobagy 3HU008b	Hortobagy 3HU008c	Hortobagy 3HU008d1	Hortobagy 3HU008d2	Hortobagy 3HU008d3	Kolkheti 3GE001	Engure 3LV001	Cicovske 3SV003	Minesing 4CN034
Category	Threats/issues	Example																	
Water Regime	Drought							1					1	1	1				
	Water abstraction		1																
	Reclamation (drainage)															1			
	Water diversion																		
	Declining water levels																		
	Irrigation							1											
Water Pollution	Solid waste-refuse																		
	Sewage-faecal							1										1	
	Eutrophication																		
	Algal blooms																	1	
	Industrial waste water																	1	
	Mining/mining wastes																		
	Pesticides (chemical)							1	1		1	1						1	
	Fertilisers (natural & man-made)							1	1		1	1						1	
	Salinisation																		
Physical Modifications	Erosion/erosion control					1			1										
	Afforestation (exotics)					1													
	Exotic weed intrusion	1				1		1											1
	Exotic fauna intrusion							1	1								1	1	
	Forest clearance			1					1							1	1		
	Monoculture development															1	1		
	Loss of nesting sites																1	1	
	Fires			1													1		
	Natural disasters																		
	Sedimentation							1										1	1
	Infrastructure/housing/ developments	1						1											1
	Peat extraction															1			
	Coral and sand extraction																		
	Recreational activities							1											1
	Agriculture/agricullural expansion	1		1	1	1	1												
Exploitation & Production	Fishing				1		1			1						1	1		
	Mollusc harvesting				1														
	Bird egg harvesting				1														
	Marine turtle egg harvesting				1														
	Bird/mammal hunting															1			
	Poaching			1															1
	Native plant extraction																		
	Grazing				1	1	1						1						
Miscellaneous	Lack of specialist staff																1		
	Changes in land use																		1
	Health issues																		
	Total number of threats identified at a site	3	1	4	6	5	3	10	5	1	2	2	2	1	1	5	6	8	6

Key

1 Number of occurrences

Threats Matrix

Abbreviated name		Matchedash	Moreton	Whangamarino	Kopuatai	Carlos	Noreste	Manchon	Titicaca	Lagartos	Puschertal	Champagne	Biguglia	Total number of threats	Total of categories
Category	Threats/Issues	4CN035	5AU041	5NZ003	5NZ004	6CL001	6CS006	6GU002	6PE004	6ME001	7AS008	7FR002	7FR008		
Water Regime	Drought								1					5	
	Water abstraction		1		1						1			1	
	Reclamation (drainage)													4	
	Water diversion			1				1						1	
	Declining water levels													1	
	Irrigation													1	13
Water Pollution	Solid waste-refuse										1			2	
	Sewage-faecal		1						1					3	
	Eutrophication		1						1					3	
	Algal blooms		1						1				1	3	
	Industrial waste water			1					1	1				3	
	Mining/mining wastes							1					1	3	
	Pesticides (chemical)							1			1		1	8	
	Fertilisers (natural & man-made)								1					1	33
	Salinisation				1	1								4	
Physical Modifications	Erosion/erosion control					1								2	
	Afforestation (exotics)			1	1	1								7	
	Exotic weed intrusion					1								5	
	Exotic fauna intrusion							1						5	
	Forest clearance								1			1		4	
	Monoculture development													1	
	Loss of nesting sites			1	1				1	1				5	
	Fires									1				1	
	Natural disasters													3	
	Sedimentation													10	
	Infrastructure/housing/ developments	1	1	1		1		1				1	1	2	
	Peat extraction				1									1	
	Coral and sand extraction		1											4	
	Recreational activities	1										1		7	61
	Agriculture/agricultural expansion							1		1				7	
Exploitation & Production	Fishing	1						1						1	
	Mollusc harvesting								1					2	
	Bird egg harvesting													2	
	Marine turtle egg harvesting							1						4	
	Bird/mammal hunting	1							1				1	3	
	Poaching							1						2	
	Native plant extraction							1	1					7	28
	Grazing			1							1	1		1	
Miscellaneous	Lack of specialist staff													1	
	Changes in land use													1	3
	Health issues												1		
	Total number of threats identified at a site	4	7	6	5	5	0	10	12	4	4	4	6		

Appendix 6

Monitoring and Baseline Matrix - Values

Monitoring and Baseline Matrix – Values

Abbreviated name			Okavango 1BW001	Azagny 1CI001	Saloum 1SE003	Natal 1ZA013	Xianghai 2CH001	Hula 2IL002	Kushiro 2JP001	Hortobagy 3HU008a	Hortobagy 3HU008b	Hortobagy 3HU008c	Hortobagy 3HU008d1	Hortobagy 3HU008d2	Hortobagy 3HU008d3	Kolkheti 3GE001	Engure 3LV001	Cicovske 3SV003	Mlnesing 4CH034
Categories	**Values**	**Example**																	
Water regime	Water supply			•		•			•										
	Water purification								•					•				•	
	Water storage (catchments or basins)	•				●			•	•	•	•							
	Stabilisation of local climate conditions (rainfall & temperature)						●												
	Storm protection and flood mitigation	•		•				•		•	•	•				•			●
	Shoreline stabilisation and erosion control																	•	
	Regulation of river or streamflow patterns & water levels		●																
	Groundwater recharge	•				•			•							●			•
	Groundwater discharge															•			•
	Retention of nutrients							•											
	Retention of sediments	•	•					•											
Exploitation and production	Fisheries	•	•		•		•	•	•	•		•		•			•		
	Agriculture		•		•											•	●	•	
	Grazing				•		•				•		•	•	•	•			
	Timber production			•						•						•			
	Hunting waterfowl & mammals		●	•								•				•	•		
	Plant products (food, crafts, housing, industry)		•		•		•										●		
	Mining production (salt)									•	•	•							
Natural heritage	Scientific research & education	●	●	•	●	●	●	●	●	•	•	•	•	•	•	•	●	●	●
	Recreation and tourism opportunities	•	•	•	●	●	•	● □	●	•		•							
	Rare, vulnerable or endangered species	•	●	●		●	•	●	●	•	•		•	•	•	•	•	•	•
	Biological diversity & richness	●	●	●	●	● □	●		● □	•	•	•	•	•	•	●	●	•	●
	Habitat is required for critical stage of plant or animals biological cycle					•	•										● □	●	●
	Endemic species		•	•		●	•		•							•			
	Provides habitat for wildlife, especially waterfowl	•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	
	Medicinal plant material		•																
Cultural heritage	Traditional lifestyles	●	●	●															
	Archaeological site	●																	
	Historical buildings/ sites/trading routes	●	●			●										●			●

Key

● Baseline information provided

□ Monitoring information is provided

• Value or threat is present, no baseline or monitoring information supplied

Monitoring and Baseline Matrix – Values

Abbreviated name		Matchedash 4CN036	Moreton 5AU041	Whangamarino 6NZ003	Kopuatai 6NZ004	Carlos 6CL001	Noreste 6CS006	Manchon 6GU002	Titicaca 6PE004	Lagartos 6ME001	Fuschertal 7AS008	Champagne 7FR002	Biguglia 7FR008
Categories	Values												
Water regime	Water supply												
	Water purification												
	Water storage (catchments or basins)												
	Stabilisation of local climate conditions (rainfall & temperature)												
	Storm protection and flood mitigation												
	Shoreline stabilisation and erosion control												
	Regulation of river or streamflow patterns & water levels												
	Groundwater recharge												
	Groundwater discharge												
	Retention of nutrients												
	Retention of sediments												
Exploitation and production	Fisheries												
	Agriculture												
	Grazing												
	Timber production												
	Hunting waterfowl & mammals												
	Plant products (food, crafts, housing, industry)												
	Mining production (salt)												
Natural heritage	Scientific research & education												
	Recreation and tourism opportunities												
	Rare, vulnerable or endangered species												
	Biological diversity & richness												
	Habitat is required for critical stage of plant or animals biological cycle												
	Endemic species												
	Provides habitat for wildlife, especially waterfowl												
	Medicinal plant material												
Cultural heritage	Traditional lifestyles												
	Archaeological site												
	Historical buildings/ sites/trading routes												

Appendix 7

Monitoring and Baseline Matrix - Threats

Monitoring and Baseline Matrix – Threats

Abbreviated name			Okavango 1BW001	Azaqny 1CI001	Saloum 1SE003	Natal 1ZA013	Xianghai 2CH001	Huia 2IL002	Kushiro 2JP001	Hortobagy 3HU008a	Hortobagy 3HU008b	Hortobagy 3HU008c	Hortobagy 3HU008d1	Hortobagy 3HU008d2	Hortobagy 3HU008d3	Kolkheti 3GE001	Engure 3LV001	Cicovske 3SV003	Minesing 4CN034	Matchedash 4CN035	Moreton 5AU041
Category	Threats/issues	Example																			
Water Regime	Drought							● □							●						
	Water abstraction		•																		
	Reclamation (drainage)																				
	Water diversion															•					•
	Declining water levels																				
	Irrigation							●													
Water Pollution	Solid waste-refuse																				
	Sewage-faecal							• □										•			
	Eutrophication																				•
	Algal blooms																	•			•
	Industrial waste water																	•			•
	Mining/mining wastes																				•
	Pesticides (chemical)							• □	•		•	•									
	Fertilisers (natural & man-made)							• □	•		•	•						•			
	Salinisation																	•			
Physical Modifications	Erosion/erosion control					•			•												
	Afforestation (exotics)					•															
	Exotic weed intrusion	●				•		●													
	Exotic fauna intrusion							●	●								●	●	●		
	Forest clearance			•					•							•	•				
	Monoculture development																				
	Loss of nesting sites																				
	Fires			●																	
	Natural disasters																				
	Sedimentation							•													
	Infrastructure/housing/ developments	●						•													
	Peat extraction																				
	Coral and sand extraction															•					
	Recreational activities							•													●
	Agriculture/agricultural expansion	●		•	•	●	•											•	•		
Exploitation & Production	Fishing				•		•			•											
	Mollusc harvesting				•											•	●			•	
	Bird egg harvesting				•																
	Marine turtle egg harvesting				•																
	Bird/mammal hunting																				
	Poaching			•												•				•	
	Native plant extraction																			•	
	Grazing				•	•	•								•						
Miscellaneous	Lack of specialist staff																				
	Changes in land use																●				
	Health issues																		•		

Key

● Baseline information provided
□ Monitoring information is provided
• Value or threat is present, no baseline or monitoring information supplied

Monitoring and Baseline Matrix – Threats

Abbreviated name		Whangamarino 5NZ003	Kopuatai 5NZ004	Carlos 8CL001	Noreste 8CS006	Manchon 8GU002	Titicaca 8PE004	Lagartos 8ME001	Fuschertal 7AS006	Champagne 7FR002	Bigugila 7FR008
Category	Threats/issues										
Water Regime	Drought						●				
	Water abstraction										
	Reclamation (drainage)		•						•		
	Water diversion					•					
	Declining water levels	●									
	Irrigation										
Water Pollution	Solid waste-refuse								•		
	Sewage-faecal						•				
	Eutrophication						●				
	Algal blooms						●				
	Industrial waste water						•				•
	Mining/mining wastes	●					•	•			
	Pesticides (chemical)					• □					•
	Fertilisers (natural & man-made)					• □			•		•
	Salinisation						●				
Physical Modifications	Erosion/erosion control		•	•							
	Afforestation (exotics)			•							
	Exotic weed intrusion	●	•	●							
	Exotic fauna intrusion			●							
	Forest clearance					•					
	Monoculture development						•			•	
	Loss of nesting sites										
	Fires	•	•				•	•			
	Natural disasters							•			
	Sedimentation										
	Infrastructure/housing/ developments	●		•		•					
	Peat extraction		•							•	•
	Coral and sand extraction										
	Recreational activities										
	Agriculture/agricultural expansion									•	
Exploitation & Production	Fishing					•		•			
	Mollusc harvesting										
	Bird egg harvesting						•				
	Marine turtle egg harvesting					•					
	Bird/mammal hunting						•				•
	Poaching					•					
	Native plant extraction					•	●				
	Grazing	●							•	•	
Miscellaneous	Lack of specialist staff										
	Changes in land use										
	Health issues										•