Chapter 5

Wetlands

CHAPTER 5 WETLANDS

5.1 Introduction

5.1.1 Objectives

The objectives of this Chapter is: 1) to survey both natural and socio-economic situations of respective wetlands, 2) to identify natural and artificial factors that affect to wetlands, and 3) to evaluate environmental situation and values of respective wetlands. This Chapter has close relevance with 'Ecosystems' in Chapter 4 because noticeable fauna and flora in the study area are mostly those of wetlands. This Chapter is also related to hydrology-related Chapters because water balance is among most influential factors on wetland ecosystems.

5.1.2 Characteristics of the Study Area

Vegetation of Brazil is divided into eight types (**Fig. 5.1-1**) and the study area is classified as wet meadow. It is a different wetland type from Pantanal, and distribution of wet meadow vegetation is limited to the tropical Amazonian coast and lowland of the study area. Therefore, temperate vegetation will disappear from Brazil if the natural vegetation is lost from the study area. Lakes and wetlands in Brazil also have uneven distribution (**Fig. 5.1-2)** at remote places of Pantanal, Amazon River and huge reservoirs. The study area is unique in that wetlands distributes in agricultural areas and that they are susceptible to human economic activities.

5.1.3 Study Methods

(1) Definition of Wetlands in This Study

The Ramsar Convention defines wetlands broadly. The coverage extends to a wide variety of habitat types, including rivers and lakes, coastal lagoons, mangroves, peatlands, and even coral reefs. In addition there are human-made wetlands such as fish and shrimp ponds, farm ponds, irrigated agricultural land, salt pans, reservoirs, gravel pits, sewage farms, and canals. The wetland definition in this study is in line with the

above. In view of the study objectives marine water areas are omitted and wetland areas below 8 ha and small rivers/drainage channels without vegetation were not dealt as independent wetland.

(2) Types of Wetlands

The Ramsar Classification System for Wetland Type was used. Wetland types included in the study area are as follows:

Coastal wetlands: **E** (sand shores, dune systems; *e.g.* coast near Taim), **H** (brackish and freshwater marshes; e.g. Patos Lake estuaries) and **J** (brackish to saline lagoons with at least one relatively narrow connection to the sea; *e.g.* Lagoa do Peixe).

Inland wetlands: **L** (permanent inland deltas; *e.g.* Camaqua river mouth), **M** (permanent rivers/streams in many places), **O** (permanent freshwater lakes in many places), **Ts** (Seasonal freshwater marshes, seasonally flooded meadows in many places) and **Xf** (Seasonally flooded forests; *e.g.* riparian forest of Camaquã river).

Human-made wetlands: **3** (Irrigated rice fields in many places), **4** (Seasonally flooded wet meadow or pasture at many places), **6** (Water storage areas; *e.g.* barrages at west side of Patos Lake) and **9** (Canal de São Gonçalo).

In the case of large continued wetland areas, they were divided by sub-basins because water balance is among most influential factors to wetland ecosystems. For example, Caipira Wetland in the Camaqua State Park was separated from the latter as it belongs to another sub-basin. Patos and Mirim Lakes were also divided by sub-basins. In the case of rice paddy (that is a type of wetland), certain areas were arbitrary selected.

(3) Selection of wetlands

Due to diverse wetland types in the study area, survey of small number of wetlands turned out insufficient for evaluation of overall wetland status in the area. Thus, 48 wetland sites were selected for evaluation purpose (**Tables 5.1-1 and 5.1-2, Fig. 5.1-3**). In view of the study objectives, survey priority was placed on wetlands in the plains and those in the uplands of the study area were dealt as secondary importance. After all, there were few appropriate wetlands in the uplands except for unvegetated rivers and

reservoirs. There were no appropriate wetlands in sub-basins L30-1 and L30-2. In selecting wetlands, priority was placed for the following order:

1) Wetlands that include conservation areas (federal, state, municipal and private reserves)
2) Wetlands that include Nuclear areas zoned in the Mata Atlantica Biosphere Reserve Program.
3) Important areas identified in this study
4) Other areas (including lakes, vegetated rivers and rivers, marshes and rice paddy)

Information of respective sites was collected by the following methods (**Table 5.1-3)**.

(4) Questionnaire

Site-specific natural and socio-economic information on those areas was collected and it was arranged in the form of an information sheet (**WET-T-1 and WET-T-2**). To maintain worldwide data compatibility, items of the Information Sheet were designed in live with the data set used by the Ramsar Convention Secretariat for monitoring Ramsar sites in the world. Eventually, the Sheet could serve as a basis for wetland monitoring scheme in the Wetland Conservation Plan.

(5) Aerial and ground survey

To observe seasonal changes in inundation status of wetlands around Patos and Mirim lakes, aerial survey was made twice mainly along the shoreline of those lakes (Southern half of Mirim Lake was not covered). Wetland landscapes were photographed and video-filmed. The first flight was made on 22 February 1999 (Aircraft, Cenica low wing; Flight speed, 130-180 km/h; Altitude approximately at 100 m sometimes as low as 20 m). The second one was on 28 September 1999 for seven hours (Aircraft, Cessna 206 high wing; Flight speed, 100 km/h; Altitude at 50-100 m). In the second flight, wetlands along the eastern shore of Mirim Lake was added and north-eastern part of Patos Lake was omitted. Terrestrial visits were also made in different seasons.

(6) LANDSAT and aerial photo analysis

To identify wetland distribution in the study area, LANDSAT imagery (1:250,000) in 1998 and maps (1:250,000) of Geographical Service Bureau were used. For analysis of long term wetland transition, aerial photos (1:60,000) taken in 1964-1965 were compared with the above satellite imageries.

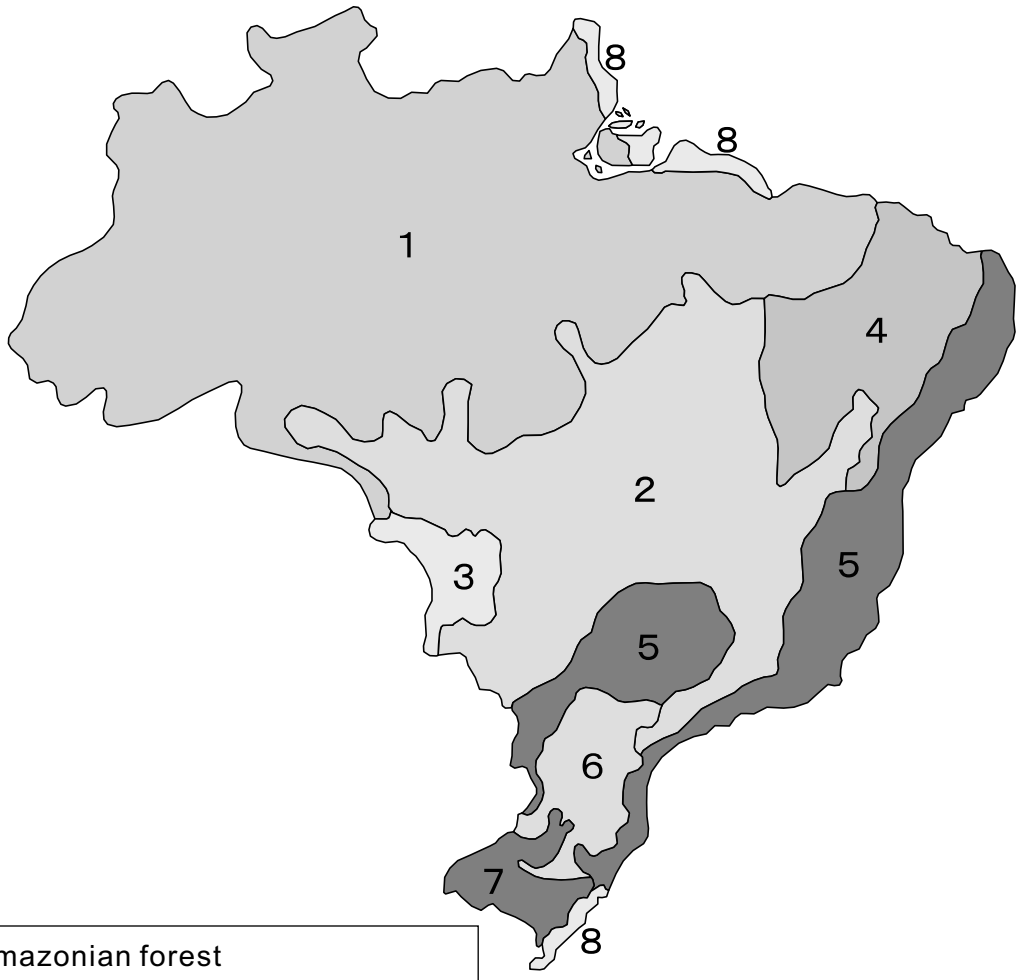
(7) Reference survey

Reference materials used in this Chapter mostly overlapped with those in Chapter 4.

(8) Interview

Personal information was obtained from counterpart organizations, NGOs and local people of respective sites.

(after "Conheça o Pantanal" by Nicia Wendel de Magalhaws, São Paulo, Terragraph, 1992.)



1. Amazonian forest
2. Savannah
3. Pantanal
4. Scrub savannah
5. Atlantic forest
6. Pine (*Araucaria angustifolia*) wood
7. Treeless savannah
8. Wet meadow

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Fig. 5.1-1

Natural Vegetation Type of Brazil

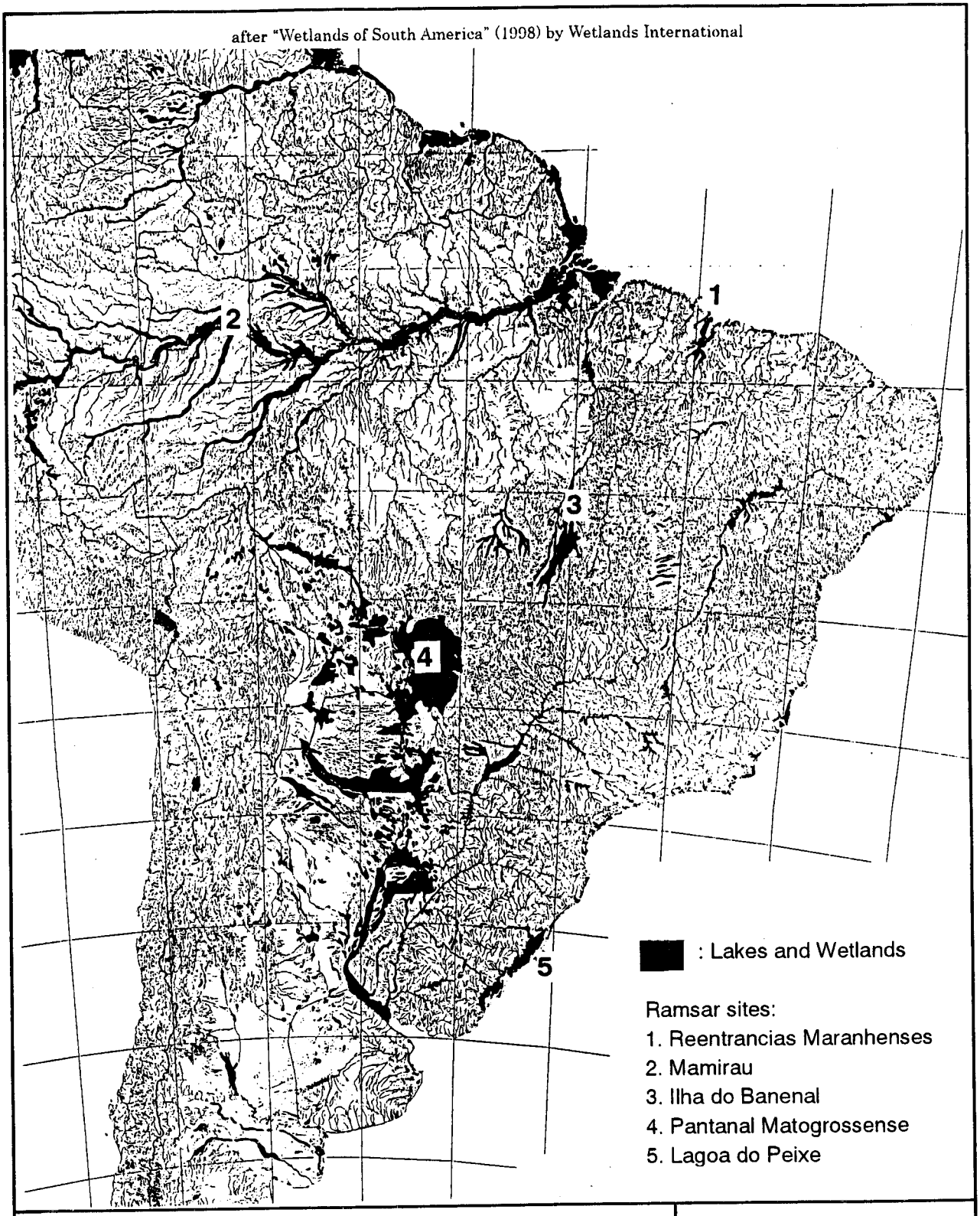

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Fig. 5.1-2

Wetlands and Ramsar Sites in Brazil

Table 5.1-1 List of selected wetlands at Patos Lake Basin

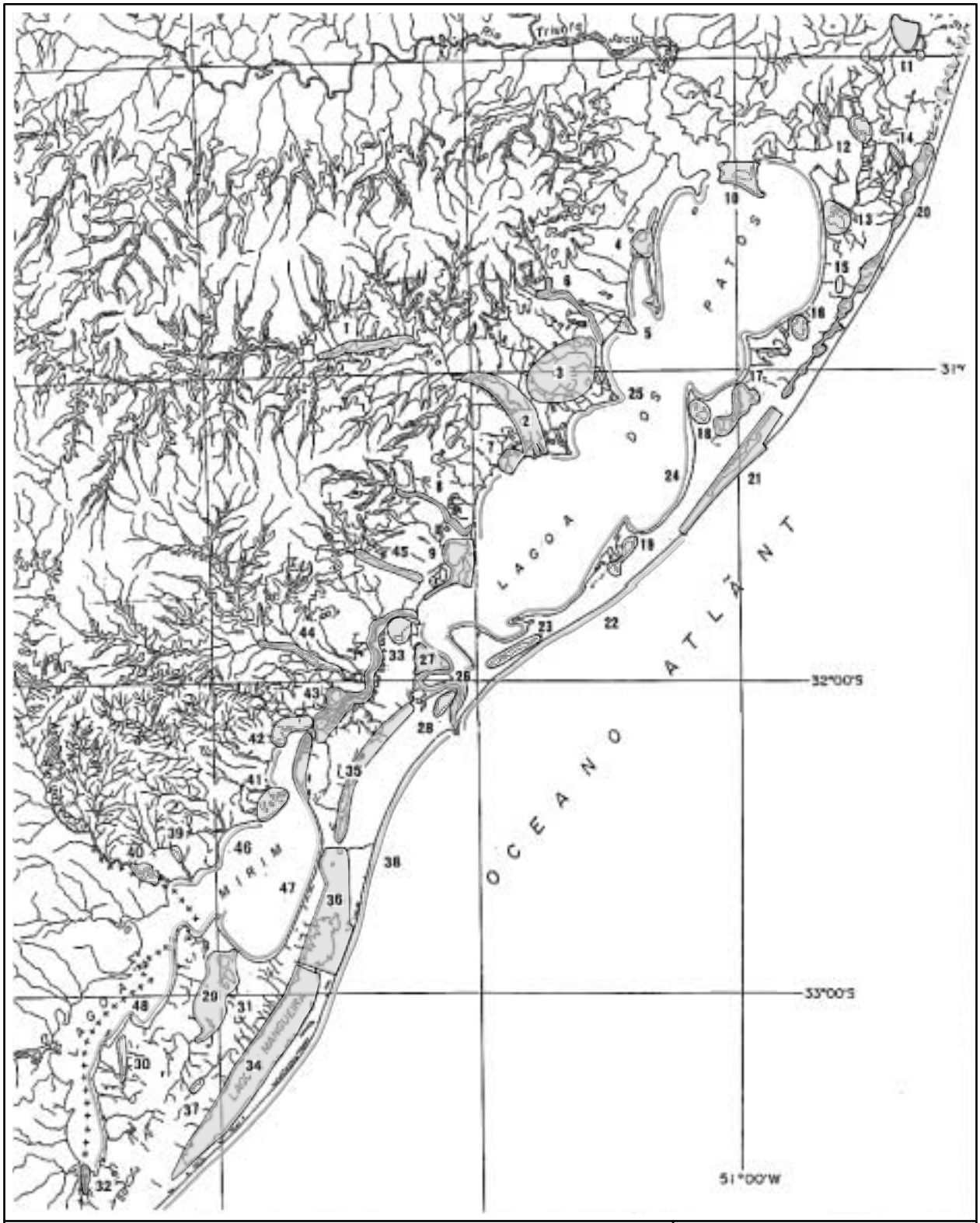
No.	Sub-basin	Wetland Areas	Reasons of Selection						Criteira for Identifying Range of Respective Sites	Coordinates (S/W)	Remarks
			Definition	Nacional	Estadual	Núcleo	RPPN	This Study			
1	L30-3	Rio Camaquã riverside	○						LANDSAT	30°54'/52°30'	Seasonally flooded riverside in upland area
2	L30-4	Parque Estadual do Camaquã	○		○	○		○	Parque area	31°08'/51°50'	Largest riparian forest in the study area
3	L30-5	Agricultural reservoirs near Arambaré	○			○			Arbitrary	31°00'/51°60'	Small reservoirs scatter in the farmland
4	L30-5	Wetland system near Lagoa do Cerro	○			○		○	Zona Núcleo	30°35'/51°23'	Attached lakes to Patos and neighboring marshes
5	L30-5	Lagoa Formosa (near Tapes)	○					○	Zona Núcleo	30°50'/51°24'	Attached lakes and marshes in the vicinity
6	L30-5	Arroio Velhaco	○			○			Zona Núcleo, LANDSAT	30°52'/51°31'	River with thin riparian forest
7	L30-6	Banhado do Caipira	○			○			Zona Núcleo	31°18'/51°51'	Marsh area conneced to Camaquã river mouth
8	L30-6	Arroio Grande in L30-6	○			○			Zona Núcleo, LANDSAT	31°27'/52°06'	River with thin riparian forest
9	L40-8	Lagoa Pequena	○			○		○	Zona Núcleo, LANDSAT	31°36'/52°04'	Brackish attached lake used for shrimp fishery
10	L20	Parque Estadual de Itapuã	○		○				Parque area	30°23'/51°00'	Park facilities being constructed under Pro-Guaiva
11	L20	Lagoa dos Barros	○						LANDSAT	29°55'/50°20'	Freshwater lake with little shore vegetation
12	L20	Lagoa Capivary	○					○	LANDSAT	30°14'/50°31'	Northern-most attached lake of Patos in farmland
13	L20	Lagoa dos Gateados	○					○	LANDSAT	30°32'/50°38'	Attached lake of Patos used for irrigation
14	L20	Banhado Grande in L20	○			○			Zona Núcleo, LANDSAT	30°21'/50°23'	Marshy area in farmland
15	L20	Banhado das Casimbas	○			○			Zona Núcleo, LANDSAT	30°43'/50°34'	Small marshy area in farmland
16	L20	Lagoa da Reserva	○					○	Zona Núcleo, LANDSAT	30°52'/31°47'	Attached lake of Patos used for irrigation
17	L20	Lagoa do Rincão	○			○			Zona Núcleo, LANDSAT	31°05'/51°09'	Lake system surrounded by rice paddy
18	L20	Lagoa do Sumidouro	○			○			Zona Núcleo, LANDSAT	31°08'/51°08'	Lake system surrounded by rice paddy
19	L20	Banhado Claudinho	○			○		○	Zona Núcleo, LANDSAT	31°36'/51°28'	Wetland in a poor road condition area
20	L20	Coastal lakes north of Peixe National Park	○						Lakes and coasts	30°40'/50°29'	Lake series with different salinity along sand dunes
21	L20	Lagoa do Peixe National Park	○	○					Parque area	31°20'/51°02'	Brackish Ramsar lake famous for migratory birds
22	L20	Coast between Peixe N.P. and Rio Grande	○			○			Zona Núcleo, Amortecimento, Transição	31°37'/51°20'	Coastal area visited by migratory birds
23	L40-2	Lagoa da Turnera	○			○			Zona Núcleo, Amortecimento, Transição	31°53'/51°50'	
24	L20	Lagoa dos Patos eastern (L20) side	○						Lake and lakeshore in P1	31°20'/51°10'	Lake water relatively deep at this side
25	L30-5,6	Lagoa dos Patos western (L30-5,L30-6) side	○						Lake and lakeshore in L30-5 and L40-8	30°56'/51°30'	Mainly beach-type shore with shallow water
26	L40-2	Lagoa dos Patos estuarine (L40-2) part	○			○			Lake and shore of L40-2 and part of L20	32°00'/52°06'	Brackish water area with varied aquatic species
27	L40-2	Ilha da Torotama	○					○	Torotama Island	31°54'/52°13'	Promontory largely occupied by marshes
28	L40-2	Saco do Mangueira	○						Open water and surrounding areas	32°04'/52°08'	Brackish lake in the urban area of Rio Grande

Note: Definition, Meet the definition of wetlands in this study; Nacional, National conservation areas; Estadual, State conservation areas; RPPN, Private Reserves of Natural Patrimony; Núcleo, Zonateted as nuclear area in Mata Atlântica Biosphere Reserve Program; This study, Selected in this study based on inputs from Fundação Zoobotânica-RS.

Table 5.1-2 List of selected wetlands at Mirim Lake Basin (incl. Canal de São Gonçalo)

No.	Sub-basin	Wetland Areas	Reasons of Selection						Criteira for Identifying Range of Respective Sites	Coordinates (S/W)	Remarks
			Definition	Nacional	Estadual	Núcleo	RPPN	This Study			
29	L40-1	Del Rei wetland system	○			○		○	Zona Núcleo, Amortecimento, Transiçâ	32°55'/53°00'	Largest wetland area maintaining natural features
30	L40-1	Banhado dos Afogados	○					○	Zona Núcleo, Amortecimento, Transiçâ	33°13'/53°22'	Small wetland barely remained in farmland
31	L40-1	Rice paddy I near BR-471	○				○		arbitrary	33°00'/52°57'	Lage rice field area proposed for RPPN
32	L40-1	Banahdo de São Miguel	○						LANDSAT	33°35'/53°32'	Riverside wetland expanding to Uruguay side
33	L40-1,2	Barra Falsa wetland system	○					○	LANDSAT	31°49'/52°08'	Seasonally waterlogged pasture near Pelotas
34	L40-3	Lagoa Mangueira	○						LANDSAT	33°15'/52°52'	Large lake in scarcely populated area
35	L40-2,3	Banhados between Taim and Quinta	○						LANDSAT	32°12'/52°20'	Wetlands in poor road condition area
36	L40-3	Estação Ecológica do Taim	○	○					Estação Ecológica area	32°42'/52°35'	Reserve established after failure of rice production
37	L40-3	Arroio Pastoreio	○			○			Zona Núcleo e Transiçâo	33°17'/53°06'	Conservation area established for native palm trees
38	L40-3	Coast between Rio Grande and Chuí	○			○			Zona Núcleo, Amortecimento, Transiçâ	33°15'/52°44'	Coastal area visited by migratory birds
39	L40-5	Arroio Juncal	○					○	LANDSAT	32°32'/53°10'	Small wetland surrounded by rice paddy,
40	L40-4	Rio Jaguarao	○						LANDSAT	32°35'/53°20'	River on the border of Brazil and Uruguay
41	L40-5	Banhado Mundo Novo	○			○		○	Zona Núcleo, Amortecimento, Transiçâ	32°23'/52°45'	Wetland at a promontory of Mirim Lake
42	L40-5	Banhado Mato Grande	○		○	○			Estadual reserve area, LANDSAT	32°09'/52°42'	Lake
43	L40-1,5,6,7	Canal de São Gonçalo and Lagoa Formosa	○			○		○	LANDSAT	42°03'/52°25'	Large channel surrounded by large marshy areas
44	L40-6	Rio Piratini	○			○		○	Zona Núcleo, LANDSAT	31°55'/52°38'	River with rich riparian forest
45	L40-7	Arroio Pelotas	○						LANDSAT	31°37'/52°20'	River with riparian forest
46	L40-5	Lagoa Mirim western (L40-5) side	○						Lake and lakeshore of M5	32°27'/52°50'	Shoreline changes largely according to water level
47	L40-1	Lagoa Mirim north-eastern (L40-1) side	○			○		○	M1 area north of Ponta dos Latinos	32°42'/52°40'	Monotonous shore leading to northern wetland
48	L40-1	Lagoa Mirim south-eastern (L40-1) side	○			○			M1 area south of Ponta dos Latinos	33°04'/53°20'	Lakeshore wetlands in spots

Note: Definition, Meet the definition of wetlands in this study; Nacional, National conservation areas; Estadual, State conservation areas; RPPN, Private Reserves of Natural Patrimony ; (proposed site included); Núcleo, Zonateted as nuclear area in Mata Atlântica Biosphere Reserve Program; This study, Selected in this study based on inputs from Fundação Zoobotânica-RS.



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JAPAN INTERNATIONAL COOPERATION AGENCY KOKUSAI KOGYO CO., LTD. / PACIFIC CONSULTANTS INTERNATIONAL	**Location of 48 Selected Wetlands**

Table 5.1-3 Information sources of respective wetlands

	No.	Sub-basin	Wetland Areas	Information Sources						
				Air survey in FEB *1	Air survey in SEP *2	Ground visit in FEB *3	Ground visit in SEP *4	Reference materials *5	Questionnaire *6	Personal *7
Patos Lake Basin	1	L30-3	Rio Camaquã riverside		○				○	
	2	L30-4	Parque Estadual do Camaquã	○	○	○	○	○	○	○
	3	L30-5	Agricultural reservoirs near Arambaré	○				○		
	4	L30-5	Wetland system near Lagoa do Cerro		○			○		
	5	L30-5	Lagoa Formosa (near Tapes)		○			○		
	6	L30-5	Arroio Velhaco	○						
	7	L30-6	Banhado do Caipira	○	○	○				○
	8	L30-6	Arroio Grande in L30-6			○	○		○	
	9	L40-8	Lagoa Pequena	○	○	○	○	○	○	○
	10	L20	Parque Estadual de Itapuã			○				○
	11	L20	Lagoa dos Barros			○				
	12	L20	Lagoa Capivary							○
	13	L20	Lagoa dos Gateados	○		○				○
	14	L20	Banhado Grande in L20							
	15	L20	Banhado das Casimbas							
	16	L20	Lagoa da Reserva	○						
	17	L20	Lagoa do Rincão	○	○					
	18	L20	Lagoa do Sumidouro		○					
	19	L20	Banhado Claudinho	○						
	20	L20	Coastal lakes north of Peixe National Park			○				○
	21	L20	Lagoa do Peixe National Park	○	○	○		○	○	○
	22	L20	Coast between Peixe N.P. and Rio Grande	○	○	○		○		○
	23	L40-2	Lagoa da Turnera	○					○	
	24	L20	Lagoa dos Patos eastern (L20) side	○	○					
	25	L30-5,6	Lagoa dos Patos western (L30-5,L30-6) side	○	○	○		○		○
	26	L40-2	Lagoa dos Patos estuarine (L40-2) part	○	○	○	○	○		○
	27	L40-2	Ilha da Torotama		○		○	○		○
	28	L40-2	Saco do Mangueira	○		○	○	○		○

	No.	Sub-basin	Wetland Areas	Information Sources						
				Air survey in FEB *1	Air survey in SEP *2	Ground visit in FEB *3	Ground visit in SEP *4	Reference materials *5	Questionnaire *6	Personal *7
Mirim Lake Basin	29	L40-1	Del Rei wetland system	○	○		○		○	○
	30	L40-1	Banhado dos Afogados		○					○
	31	L40-1	Rice paddy I near BR-471	○		○	○		○	○
	32	L40-1	Banahdo de São Miguel				○			○
	33	L40-1,2	Barra Falsa wetland system		○				○	○
	34	L40-3	Lagoa Mangueira	○			○	○		○
	35	L40-2,3	Banhados between Taim and Quinta	○		○				○
	36	L40-3	Estação Ecológica do Taim	○	○	○	○	○	○	○
	37	L40-3	Arroio Pastoreio	○		○	○			○
	38	L40-3	Coast between Rio Grande and Chuí			○		○		○
	39	L40-5	Arroio Juncal			○	○			
	40	L40-4	Rio Jaguarao						○	
	41	L40-5	Banhado Mundo Novo		○					
	42	L40-5	Banhado Mato Grande							
	43	L40-1,5,6,7	Canal de São Gonçalo and Lagoa Formosa	○	○	○	○	○	○	○
	44	L40-6	Rio Piratini	○	○				○	
	45	L40-7	Arroio Pelotas	○	○	○			○	
	46	L40-5	Lagoa Mirim western (L40-5) side	○	○					○
	47	L40-1	Lagoa Mirim north-eastern (L40-1) side	○	○					○
	48	L40-1	Lagoa Mirim south-eastern (L40-1) side			○	○			○

*1, Air survey in 1999; *2, Air survey in 1999; *3, Ground visits in 1999 and 2000; *4, Ground visits in 1999; *5, Faunal and floral information available from reference materials;
*6, Sufficiently filled questionnaire (Wetland Information Sheet) retrieved; *7, Information collected by interview to local people and relevant sectors.