

# Bird Monitoring Programme Waiau River (Southland)

Report for Meridian Energy  
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By: Teri McClelland  
Environmental Resources



P O Box 603  
Invercargill  
Ph/Fax 03-231 3465  
Mobile 025 220 6654

Email [terim@southnet.co.nz](mailto:terim@southnet.co.nz)  
[www.EnvironmentalResources.co.nz](http://www.EnvironmentalResources.co.nz)

## SURVEY BACKGROUND

The aquatic birds of the mainstem Waiau River, Southland, have been monitored for absence/presence and relative abundance since November 1993 (Sagar 1994). During this time four reaches were surveyed (Figure 1) with surveys originally being undertaken during breeding and post-breeding (November and March) and latterly including the winter season as well (July). The results of these surveys have been written up and are available from Meridian Energy, or the Project Manager for the Waiau River Working Party.

At its May 2000 meeting the Waiau Working Party (which includes Meridian Energy, Department of Conservation, Iwi, Fish and Game Southland, and Environment Southland as members) reviewed the findings of previous monitoring and discussed recommendations from Teri McClelland, Environmental Resources, for changes to the monitoring regime. The Waiau Working Party agreed upon the recommendations and Meridian Energy then undertook formal notification and approval procedures with Environment Southland. A synopsis of the new monitoring programme for birds on the Waiau River is attached as Appendix 1.

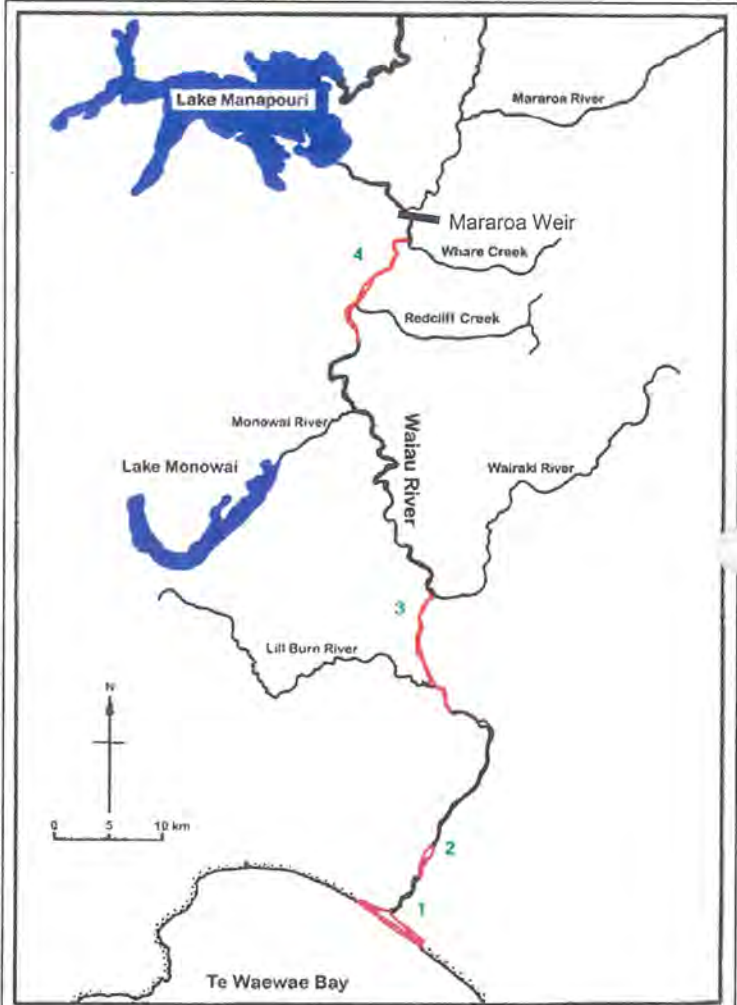
This is the second report since the establishment of the new monitoring programme.

## SPECIES MONITORED

The Waiau River bird monitoring programme is focused on the rarer and most likely affected species found on the river. These species were identified as:

- Black-fronted terns (*Sterna albobriata*) – a category B threatened species (Molloy and Davis 1992);
- Black-billed gulls (*Iarus bullerij*), which although not listed as a threatened species are of concern because of their decreasing numbers.

**Figure 1.** River Reaches Surveyed Prior to 2000: 1) Lagoon Reach; 2) Lower River Reach; 3) Clifden/Wairaki Reach; 4) Redcliffs Reach



Although there are other "rare" species which utilise the river, most notably black fronted Dotterel (*Charadrius melanops*) which breed on the river, a relevant monitoring programme for these species would be unjustifiably expensive as they are solitary nesters. For example the previous monitoring programme which covered in excess of 30km of river bed only ever recorded one pair of black-fronted dotterel, which were in the Lower River Reach (number 2 on Figure 1).

Two other species of concern were the red-billed gulls (*Larus novaehollandiae*) and white-fronted terns (*Sterna striata*), although not listed as rare, they are recognised as being significantly affected by river levels. Since both of these species are frequently found in the same areas as the 2 primary species, these species were included in the monitoring regime.

All the species selected for the new programme are colonial breeders which usually nest on gravel bars and islands and are therefore susceptible to large numbers of nests being wiped out by increased river levels during the breeding season. White-fronted terns and red-billed gulls are both predominantly coastal species and are widespread around the NZ coast, although they can at times be found well inland. These species are often found breeding in close vicinity to each other.

Black-fronted terns and black-billed gulls on the other hand are generally inland species, although the latter frequently breed on the coast e.g. Waiiau Bar, as well as on islands further upstream. These birds are both believed to be decreasing in numbers through out Southland. The Southland Branch of the OSNZ has been carrying out regional counts for black-billed gulls, largely using aerial photos. While there is some question over the accuracy of photo monitoring of colonies, i.e. how many birds per nest present, there is no doubt that this species has had a significant decline in past years (pers. comm. Lloyd Esler, Southland Branch, New Zealand Ornithological Society). Possible reasons for the decline in black-backed gulls include:

- Increased predation
- Nesting attempts being wiped out by high river flows
- Illegal killing
- Loss of habitat/food through competition/pollution and invasive weeds.

Black-fronted terns that feed both over land and water also appear to be declining. The reasons for which are unknown.

It has been an issue for many years that the breeding attempts of entire colonies, sometimes numbering several thousand can be wiped out by high river flows – particularly during September through November. High river flows occurring in the months of October and November are likely to have the greatest impact on these species. These are the initial nesting months and, although the birds will routinely re-nest if their first attempt is destroyed, having to re-nest increases the chances of the chicks not being recruited into the population, i.e. the chicks may fledge but not be prepared to survive the winter.



## TIMING

The surveys were all undertaken early in the months of October, November and December, to record as much of the breeding cycle as possible and note any disruptions to the breeding cycle (i.e. high water flows) as soon as possible during the period when the nests are most vulnerable. This timing also allows a safety margin in case surveys are delayed due to weather or river conditions. The time of day at which the surveys are carried out should have little effect as monitoring only records number of breeding attempts, rather than adult birds present. Timing of the surveys was generally based around the high tides at the lagoon for reasons of practicality.

**Figure 2.** River Reaches Surveyed 2001; 1) Upstream of Mararoa Weir; 2) Downstream of Wairaki River confluence; 3) Lillburn River confluence; 4) Orawea River confluence; 5) Waiau Lagoon Spit

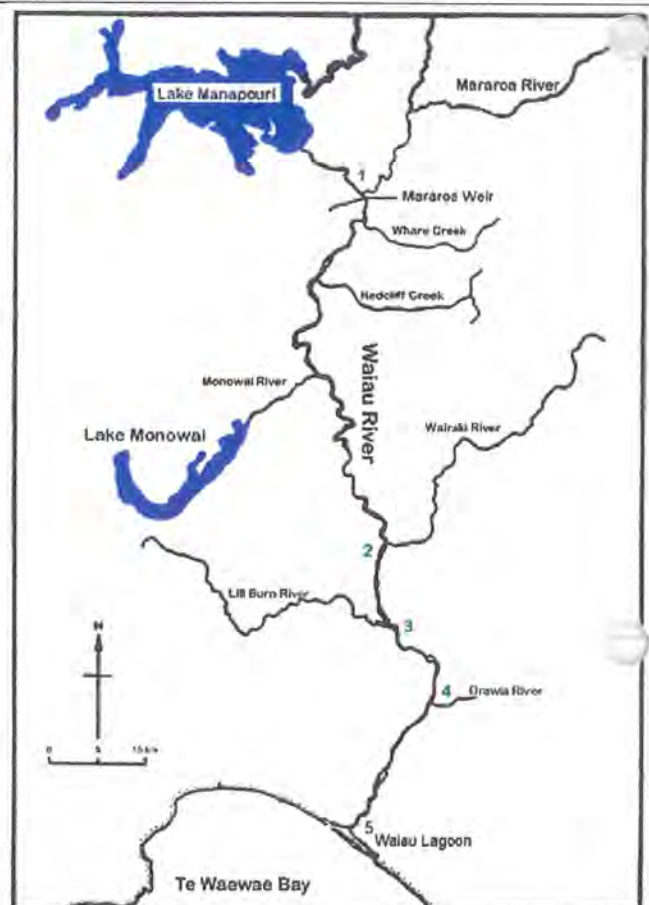
## SITE DESCRIPTIONS

An aerial survey of the Waiau River from the Lagoon to just upstream of the Mararoa Weir was undertaken on 3 October 2001. The purpose of the aerial survey was to determine the location of all black-billed gull and black-fronted tern colonies on the river. An additional colony was discovered during this aerial survey at the confluence of the Orawea and Waiau Rivers (Number 4 on Figure 2) and is included in this report.

### Mararoa Weir

This site is a triangular gravel spit at the confluence of the Mararoa and Waiau Rivers at NZMS 260 D44 961 974. It is approximately 500m upstream from the Manapouri Lake Control Structure (commonly known as the Mararoa Weir, Number 1 on Figure 2) which is operated by Meridian Energy to manage the water level in Lake Manapouri. The point of the spit rises up from the river in several gentle steps to the base that is approximately 3m above the river. This season, due to prolonged low river flows, an additional shingle bar at NZMS 260 D44 957 974 was exposed parallel to the Upper Waiau. This bar was utilised by a small breeding colony of black-billed gulls.

**Access** – this area is easily accessed through a locked gate, controlled by Meridian Energy. Access for the survey is co-ordinated through Colin Sinclair of Meridian Energy.



### **Downstream of Wairaki Confluence**

This site consists of an island in the mainstream of the Waiau River approximately 1 kilometre downstream of its confluence with the Wairaki River and a gravel beach on the true right bank of the Waiau River approximately 50 metres further downstream at NZMS 260 D45 967 601 (Number 2 on Figure 2). During the aerial survey of 3 October a colony of birds was observed at the gravel beach and further ground survey noted a few terns on the island, hence this site's inclusion in the 2001 survey.

*Access* – is via the Wairaki River public accessway to the Waiau River and then walking downstream. Crossing to the colony is hazardous in allbut low flows.

### **Lillburn Stream**

This site consists of several gravel islands in the Waiau River adjacent to the mouth of the Lillburn Stream at NZMS 260 D45 988 534 (Number 3 on Figure 2). None of these islands can be safely reached on foot, even at the current minimum flows, however through access from adjacent farmland; an overview of the islands can be had. The aerial survey of 3 October showed no evidence of nesting being attempted at this site.

*Access* – is via a farm track/gravel pit accessway and across paddocks owned by Mr Nick Robertson. There is unlikely to be any problem with ongoing access to this site.

### **Orawea Stream** (other spellings found for this stream are Orawia and Orauea)

This site consists of a small gravel beach on the true left bank of the Waiau River 300 metres upstream of the Orawea Stream at NZMS 260 D45 028 444 and a large gravel island in the mainstream of the Waiau River at its confluence with the Orawea Stream at NZMS 260 D45 013 429 (Number 4 on Figure 2). The majority of the birds were observed on the upstream end of the gravel island, with only a few nesting pairs on the gravel beach.

*Access* – to the main colony is by boat only, while the sub-colony could be accessed down the true right bank of the Orawea Stream. Both colonies can be observed with a spotting scope or binoculars from the farm property on the true right bank of the Waiau River directly opposite.

### **Lagoon**

The lagoon colony is situated towards the western end of the Waiau bar at NZMS 260 D46 930 330 (Number 5 on Figure 2). It is approximately 300m South west of the township of Papatotara on the seaward side of the lagoon. Between the November and December surveys the Waiau River mouth moved approximately 300m east.

*Access* - the current position of the river mouth means that the only practical access to this colony is by boat. The best site for launching is at the boat ramp on the eastern lagoon, which means that access is restricted to a couple of hours either side of high

tide in order to get safely through the channel. Alternatively a small boat can be launched at Papatotara.

## SURVEY RESULTS

### ▪ OCTOBER 2001

#### Mararoa Weir

It appeared that black-billed gull nesting at this site was delayed as compared to the 2000 survey as there were no chicks in the colony and the majority of the clutches were still in the process of being laid (in the 2000 survey, chicks were present at the October survey).

There were a large number of nest scrapes, which are indications of areas to be laid in the near future. Given the incubation period of 20 – 24 days, for this species, this means that eggs laid at this time would not hatch for another 4-5 weeks at least.

The main colony was observed on the lower level of the low gravel terrace on the Mararoa River side of the spit (Figure 3). This site was extremely vulnerable to high river flows as approximately 0.5m increase in river level would have flooded most of the nests present.

#### Findings: 3/10/01

##### Black-billed gulls

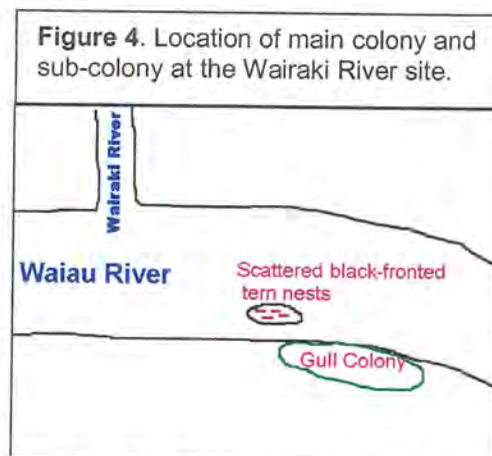
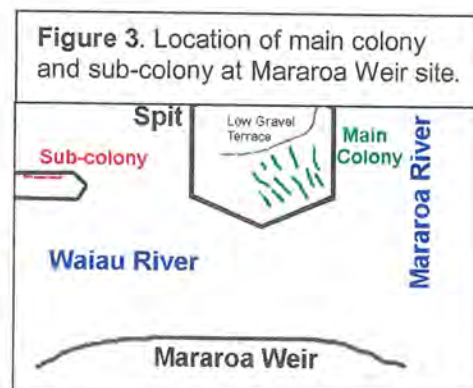
Number of eggs per nest	Number of nests
0	474
1	406
2	332
3	43

#### Totals:

Nest with Eggs	781
Nests scrapes without eggs	474
Total number of nests	1255

#### Wairaki

This is the first time this site has been recorded in the new monitoring regime, although presence of birds had been noted here during previous surveys. A colony of black-billed gulls was observed at the top of the gravel beach on the true right bank of the Waiau River (Figure 4). Additionally, scattered black-fronted tern nests were found on the upstream end of the black-backed gull colony and on a small gravel island in the Waiau River (Figure 4). This site was vulnerable to high river flows as approximately 1.0m increase in river level would have flooded most of the nests present.





**Findings: 3/10/01**

**Black-billed gulls**

Number of eggs per nest	Number of nests
0	41
1	109
2	16
3	1

**Totals:**

Nest with Eggs	126
Nests scrapes without eggs	<u>41</u>
Total number of nests	167

**Black-fronted Terns**

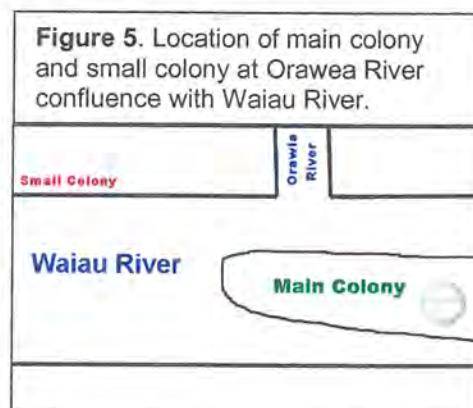
Approximately 12 nests total, spread between the black-billed gull colony and on the gravel island.

**Lillburn**

During the aerial survey no nesting was observed at this site. This is the second year in a row that this site has not been utilised and it may be possible that this site has been abandoned.

**Orawea**

During the aerial survey, a colony was observed on an island in the main Waiau River opposite the mouth of the Orawea River. There was no safe foot access to this site, so on 13 October 2002 a small boat was used to gain access. At this time an additional, small colony was discovered on the true left bank of the Waiau River approximately 300m upstream of the Orawea confluence (Figure 5).



**Findings: 13/10/01**

**Main Colony – Black-billed gulls**

In the main colony 1000+ nests were found with approximately 85% having 1 or 2 eggs (access difficulties encountered at the site did not enable more accurate counting to be carried out).

**Small Colony – Black-billed gulls**

Number of eggs per nests	Number of nests
0	2
1	4
2	7

Additionally, six black-fronted tern nests were found at the small colony of black-billed gulls.



## Lagoon

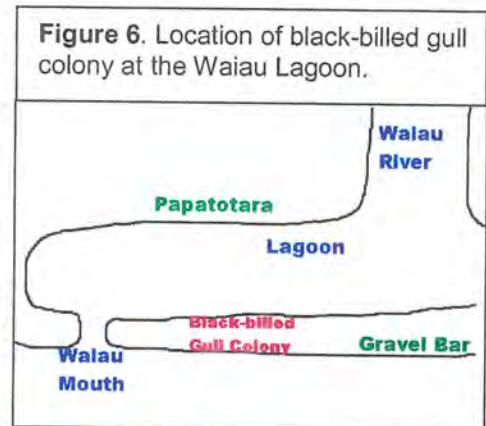
During this survey, the Waiau River mouth was at the very western end of the Lagoon (Figure 6). While a small number of white-fronted terns was observed at this time, no evidence of breeding was seen.

### Findings: 3/10/01 Black-billed gulls

Number of eggs per nests	Number of nests
0	175
1	147
2	171
3	34

#### Totals:

Nests with Eggs	352
Nests scrapes without eggs	<u>175</u>
Total number of nests	527



## ▪ NOVEMBER 2001

All the November surveys were carried out on 8 November 2001.

### **Mararoa Weir**

Less than 5% of the birds were still on eggs, with most chicks 2 to 3 weeks old. The water level was the same as during the October survey and the observers did not enter the colony due to the likely disturbance to the birds.

### **Wairaki**

Due to the hazard of crossing the river, this colony was counted from the true left bank of the Waiau River. There were approximately 136 nests with no chicks observed. The black-fronted tern chicks had hatched by this time and parents were observed feeding chicks.

### **Orawea**

The small colony was observed from river level and the main colony was observed from an elevated river terrace on the true right bank of the Waiau River. The small colony had 6 chicks approximately 2 to 3 weeks old and no black-fronted terns were observed. At the main colony approximately 50% of the birds were still on eggs, while the remainder had chicks up to 3 weeks old.

### **Lagoon**

The black-billed gull colony at the Lagoon had been washed out due to heavy seas which had rolled a substantial amount of gravel over the top of the bar. A white-fronted tern colony had established approximately 200 metres west of the previous gull colony. In the white-fronted tern colony, 516 nests were observed. Approximately 90% of these nests contained 1 egg and the remainder had 2 eggs.

## ▪ DECEMBER 2000

All December surveys were carried out on 5 December 2001.

### **Mararoa Weir**

The Waiau River level continued to be low with the main gravel nesting area not covered by water. Approximately 1,000 new nests were observed during the December survey in addition to several hundred fully feathered chicks observed at the edge of the colony and on the Weir. Eggs and chicks of all ages were present in the colony with many birds yet to commence laying. These could either be the original birds re-nesting after their first chicks had fledged or they could be birds from other colonies which had been flooded out. There were approximately 500 nests on an island 200 metres up the Waiau River. These appeared to be at the same stage as those of the main colony.

### **Wairaki**

No gulls were present at this site. It appeared that all nesting attempts had been washed out by high river levels. The fact that this colony was washed out coupled with the continued low river levels at the Mararoa Weir indicates that the high river level at this site was caused by high Wairaki River levels coming into the Waiau. One black-fronted tern was observed on a nest, but there was no sign of the chicks observed during the previous survey.

### **Orawea**

Both of these colonies had been flooded out, presumably by the same factors which caused the flooding of the Wairaki colony.

### **Lagoon**

The Waiau River Mouth had moved approximately 300 metres east, destroying the white-fronted tern colony which had been observed in November. No black-billed gulls or white-fronted terns were observed in the vicinity.

## **COMPARISON 2000 Survey and 2001 Survey**

During the 2000 survey the Lagoon site was the most important for black-billed gulls, with the Mararoa Weir site ranking a close second. The Mararoa Weir site continued to be important to black-billed gulls in the 2001 with over 2000 nesting attempts observed over the entire survey period. Due to heavy seas at the Lagoon site in 2001, the black billed nesting attempts were destroyed and no further blackbilled nesting attempts were recorded in this area. However, a substantial colony of white-fronted terns was observed nesting in this vicinity (an area where they have a past history of nesting). Unfortunately this colony was destroyed due to movements in the Waiau River mouth between the November and December surveys.

The newly recorded black-billed gull nesting sites at the Wairaki and Orawea River confluences with the Waiau River are of importance. The Wairaki site is probably of less importance given it had fewer than 150 nests. However, the main colony at the Orawea site was a substantial one with over 1000 nests. Unfortunately, flooding caused this site to be washed out between the November and December surveys.

In contrast to the total lack of black-fronted tern nesting attempts observed at any of the survey sites in 2000, during this survey black-fronted terns were found nesting at both the Wairaki and Orawea sites. Unfortunately, the chicks noted during the November survey were not observed in December (after the flooding event mentioned above), although one adult on a nest was observed at the Wairaki site in December.



## **OBSERVATIONS**

The weed management regime put in place by Meridian Energy at the Mararoa Weir site appears to have been beneficial to the blackbilled gulls nesting at this site. The removal of vegetation from the site, removes cover for predators and increases the amount of available nesting habitat for the birds. Additionally, by timing the work outside the breeding season, the potential for disturbing nesting birds and reducing nesting success is minimised.

The low flows at the start of the season allowed the Mararoa Weir colony to establish on the lower levels of the spit, which created a real potential for the colony to be flooded out at any stage during the season. However, the consistent, low flows at the Mararoa Weir enabled nesting to extend throughout the entire survey period. Notably, there were nearly as many new nesting attempts recorded in December as there were in the beginning of the season in October. These new attempts may have been the result of birds moving to the Mararoa Weir site after being flooded out from other sites.

The loss of the colonies at the Wairaki and Orawea sites did not appear to be due to flow releases from the Mararoa Weir. The flooding of these colonies coincided with extremely high flows in the Wairaki and adjacent catchments flowing into the Waiau River.

The loss of all nests at the Lagoon site in November and December was due to natural events that were unrelated to flows originating at the Mararoa Weir.

The aerial survey prior to the ground monitoring was instrumental in locating colonies. Without the aerial survey the newly recorded colonies at the Wairaki and Orawea sites could well have been missed. These sites are especially important given that they were the only ones with black-fronted terns present.

## **RECOMMENDATIONS**

Based on the 2001 survey, the following recommendations are made:

- River flow information from the Mararoa Weir and river levels from all recording sites on the Lower Waiau River would be of benefit when trying to determine whether river flows attribute to nesting attempt losses.
- A cross-sectional survey of the river at the colony sites be carried out and this information be related to the river level at standard river flows in order to determine the river flows and levels which would place the colonies at risk.
- That an aerial survey be carried out for the length of the Waiau River to identify the breeding colonies early on in the season, i.e., Sept/Oct. This was particularly useful in locating previously unrecorded colonies, including blackfronted tern breeding sites in the 2001 survey.

- To carry out additional checks on the colonies in:
  - September to check colony locations to see if colonies are lost due to high river levels etc, early in the season and monitor where these birds may re-nest.
  - January to check the final status of late breeding birds, e.g., the lagoon colony this year.
- That all spraying at the weir continue to be carried out before September and then again after December to avoid disturbing nesting birds.
- That the colonies, especially the weir colony, not be entered when chicks are present as they will frequently go into the river and may be lost downstream.
- That the site of the weir colony continues to be subject to an intensive weed control programme – removing all vegetation on the gravel spit so as to remove cover for predators.
- That the feasibility of a trapping programme at the weir colony to reduce losses to predators/monitor the potential impact of predators be investigated.

#### **ACKNOWLEDGEMENTS:**

Thanks to Colin Sinclair, Meridian Energy, for access to Mararoa Weir survey site and for his information and comments regarding the weir colony, and to P Rowley for access to the Orawea site, and to the survey team of Pete McClelland and Gary Morgan.

#### **REFERENCES:**

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Molloy and Davis. 1992. Ranking of New Zealand's Threatened Wildlife. *Department of Conservation.*

Sagar, P.M. 1994. Aquatic Birds of the Waiau River November 1993 and March 1994. Southland Regional Council. *NIWA Christchurch Miscellaneous Report No. 168.* 16p.

## APPENDIX 1

### Synopsis of the New Monitoring Programme for Birds on the Waiau River

1. Surveys to be held during October, November, December- to cover the time when birds are most vulnerable to changes in waterflow (i.e. breeding)- the post breeding (March) and winter (July) surveys to be discontinued, as the data usefulness is limited to relative presence/absence of species (and there is ample data on this now from previous surveys) and does not incorporate impacts of changes in waterflow (given birds are very mobile at these times).
2. Surveys to focus on high-priority species (in terms of national/regional significance and potential for impact upon breeding success due to changes in waterflow) such as black-billed gulls; white-fronted terns; dotterels (both banded and black-capped); black-fronted terns, rather than low-priority species such as feral geese; paradise shelduck; black-backed gull; etc.
3. Survey sites to be the known nesting sites at: Te Waewae Lagoon (both eastern and western ends); Clifden/Wairaki Reach; and the gravel areas above the Mararoa Weir, as these are the predominant breeding sites for high-priority species.
4. October survey to focus on nesting attempts (e.g. location, density, and number of nests); November survey to focus on nesting pairs (e.g. how many nests being utilised); December survey to focus on nesting success (e.g. presence of chicks).

This refinement will provide Meridian Energy and the Waiau Working Party with more specific, relevant information as to the possible impacts of activities (both natural, such as flooding; and man-induced, such as flow releases, shingle extraction, and weed encroachment and removal) on specific, high-priority avian species.

**Waiau River Aquatic Birds  
Survey Summary  
May 1999**

**T J McClelland**

**prepared for Meridian Energy**

Teri McClelland  
Environmental Resources  
P O Box 603  
Invercargill



## EXECUTIVE SUMMARY

This report compiles the data collected during bird surveys in the Waiau River from (and including) November 1993 to March 1999. During this period climatic events in the Region have influenced the Waiau River causing prolonged periods of very high levels. This natural event has played a significant role in the birds' ability to use the River environment. Emerging trends are discussed and recommendations made for the future review of the monitoring regime.

## INTRODUCTION

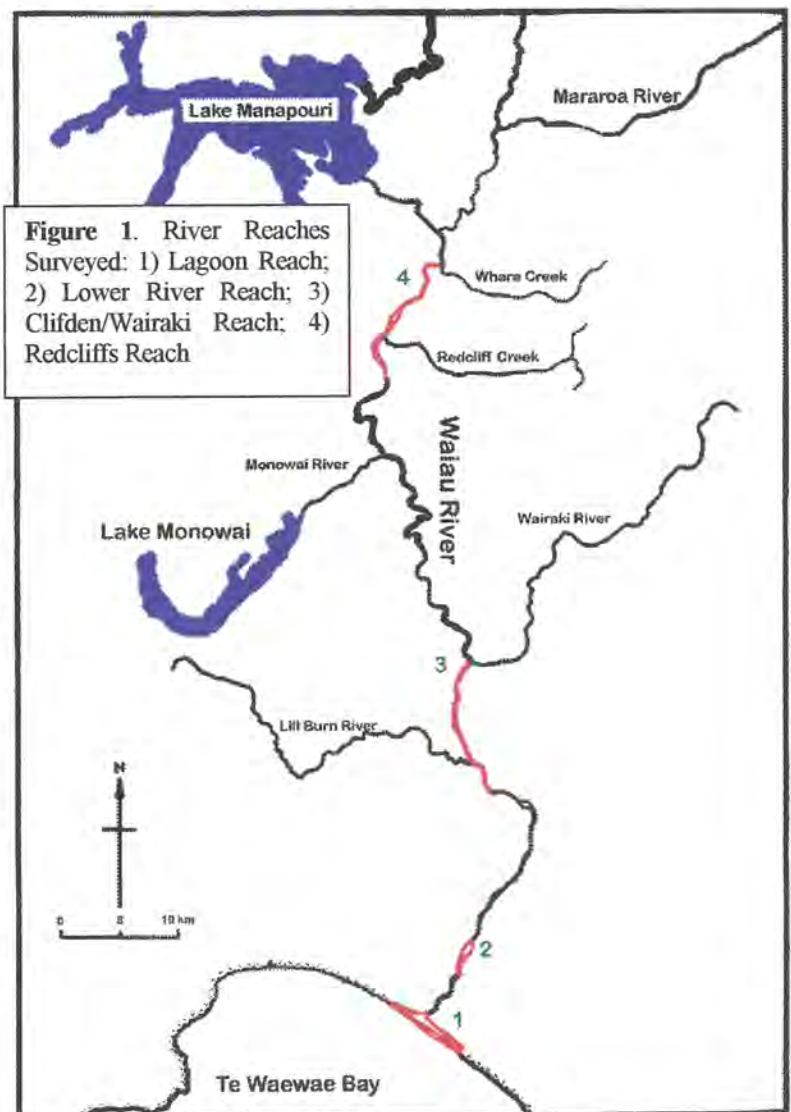
Surveys have been undertaken of the breeding, post-breeding and winter aquatic bird populations of the Waiau River for several years as part of the requirements of ECNZ's resource consent for use of water for the Manapouri hydro-scheme. This report compiles the findings of all surveys from November 1993 (Sagar 1994) through to March 1999. All surveys have utilised similar methodology and have been carried out during comparative seasons (breeding surveys in November, winter surveys in July and post-breeding surveys in March).

The objective of these surveys is to assist in the development of a long-term monitoring plan and determine the effect of the new hydrology regime on the aquatic bird population of the Lower Waiau River through the development of yearly indices of relative abundance.

## METHOD

In order to obtain comparable data, the methodology used in this survey was the same as that first used by Sagar 1994. Figure 1 shows the reaches that are surveyed. Since the advent of the new flow regime for the Waiau River,  $\frac{1}{2}$  km at the southern end of the Redcliffs Reach is now inaccessible (as compared to when this reach was surveyed by Sagar 1994) and has had to be removed from the survey. In response to this, an additional  $\frac{1}{2}$  km was added to the northern end of this reach (in order to keep the survey distance equal).

The totals given in Tables 1 to 3 should be considered as indices of relative abundance rather than absolute counts.



## RESULTS

Tables 1 to 3 give the total numbers of each species recorded in each of the reaches during the breeding, post-breeding and winter surveys. This information is presented graphically in Figures 1 to 3. Figures 4 to 6 graph the counts of each individual survey which has been carried out during the breeding, post-breeding and winter time periods. Figures 7 to 9 graph the total counts for each reach for each of the survey periods.

**TABLE 1.** Numbers of aquatic birds recorded on the Lagoon and Lower River reaches of the Waiau River, during breeding, post-breeding and winter surveys.

Species	Lagoon Breeding	Lower River Breeding	Lagoon Post-Breeding	Lower River Post-Breeding	Lagoon Winter	Lower River Winter
Black Shag	25	-	14	5	-	2
Pied Shag	26	-	1	-	-	-
Little Shag	37	3	26	1	8	-
Spotted Shag	1458	-	1650	-	-	-
White-faced Heron	19	2	10	4	-	-
Black Swan	8	-	7	-	20	-
Canada Goose	-	-	75	-	-	-
Feral Goose	-	-	13	1	-	-
Paradise Shelduck	23	-	42	93	4	2
Mallard	404	8	1094	174	353	200
Grey Duck	-	-	-	-	-	-
Grey Teal	13	-	50	90	-	-
Shoveler	14	-	14	20	-	-
Scaup	4	-	12	4	-	-
Pukeko	1	-	-	4	-	-
Pied Oystercatcher	56	2	-	-	3	3
Variable Oystercatcher	4	-	8	-	-	-
Pied Stilt	25	2	59	12	-	4
Banded Dotterel	19	-	-	-	-	-
Black-fronted Dotterel	2	-	2	2	-	-
Spur-winged Plover	467	14	211	213	36	8
Bar-tailed Godwit	12	-	-	-	-	-
Black-backed Gull	1743	61	279	14	192	110
Red-billed Gull	34	-	37	5	-	6
Black-billed Gull	6031	3	63	82	567	600
Black-fronted Tern	140	-	4	80	4	4
Caspian Tern	2	-	-	-	1	-
White-fronted Tern	1276	-	349	-	2	-

**TABLE 2.** Numbers of aquatic birds recorded on the Clifden/Wairaki reach of the Waiau River, during breeding, post-breeding and winter surveys.

Species	Clifden/Wairaki Breeding	Clifden/Wairaki Post-Breeding	Clifden/Wairaki Winter
Black Shag	13	43	2
Pied Shag	-	-	-
Little Shag	-	1	-
Spotted Shag	-	-	-
White-faced Heron	2	2	-
Black Swan	-	2	6
Canada Goose	5	211	-
Feral Goose	-	-	-
Paradise Shelduck	550	258	32
Mallard	84	692	167
Grey Duck	-	-	-
Grey Teal	9	1	-
Shoveler	4	-	-
Scaup	-	-	-
Pukeko	-	-	-
Pied Oystercatcher	73	-	14
Variable Oystercatcher	-	-	-
Pied Stilt	25	5	-
Banded Dotterel	54	-	17
Black-fronted Dotterel	-	-	-
Spur-winged Plover	234	88	144
Bar-tailed Godwit	-	-	-
Black-backed Gull	147	29	22
Red-billed Gull	-	-	-
Black-billed Gull	5957	-	695
Black-fronted Tern	51	1	25
Caspian Tern	-	2	-
White-fronted Tern	-	-	-

**TABLE 3.** Numbers of aquatic birds recorded on the Redcliffs reach of the Waiau River, during breeding, post-breeding and winter surveys.

Species	Redcliffs Breeding	Redcliffs Post-Breeding	Redcliffs Winter
Black Shag	21	41	34
Pied Shag	-	-	-
Little Shag	3	4	1
Spotted Shag	-	-	-
White-faced Heron	2	4	-
Black Swan	-	-	-
Canada Goose	9	175	10
Feral Goose	-	36	21
Paradise Shelduck	266	117	61
Mallard	95	189	212
Grey Duck	5	10	4
Grey Teal	5	-	-
Shoveler	-	-	-
Scaup	6	-	5
Pukeko	-	-	-
Pied Oystercatcher	17	-	4
Variable Oystercatcher	-	-	-
Pied Stilt	6	-	-
Banded Dotterel	-	-	-
Black-fronted Dotterel	-	-	-
Spur-winged Plover	11	6	10
Bar-tailed Godwit	-	-	-
Black-backed Gull	77	13	112
Red-billed Gull	51	-	-
Black-billed Gull	660	-	4
Black-fronted Tern	9	-	11
Caspian Tern	-	-	-
White-fronted Tern	-	-	-



Figure 1. Total sum of birds recorded in all reaches during Breeding Surveys

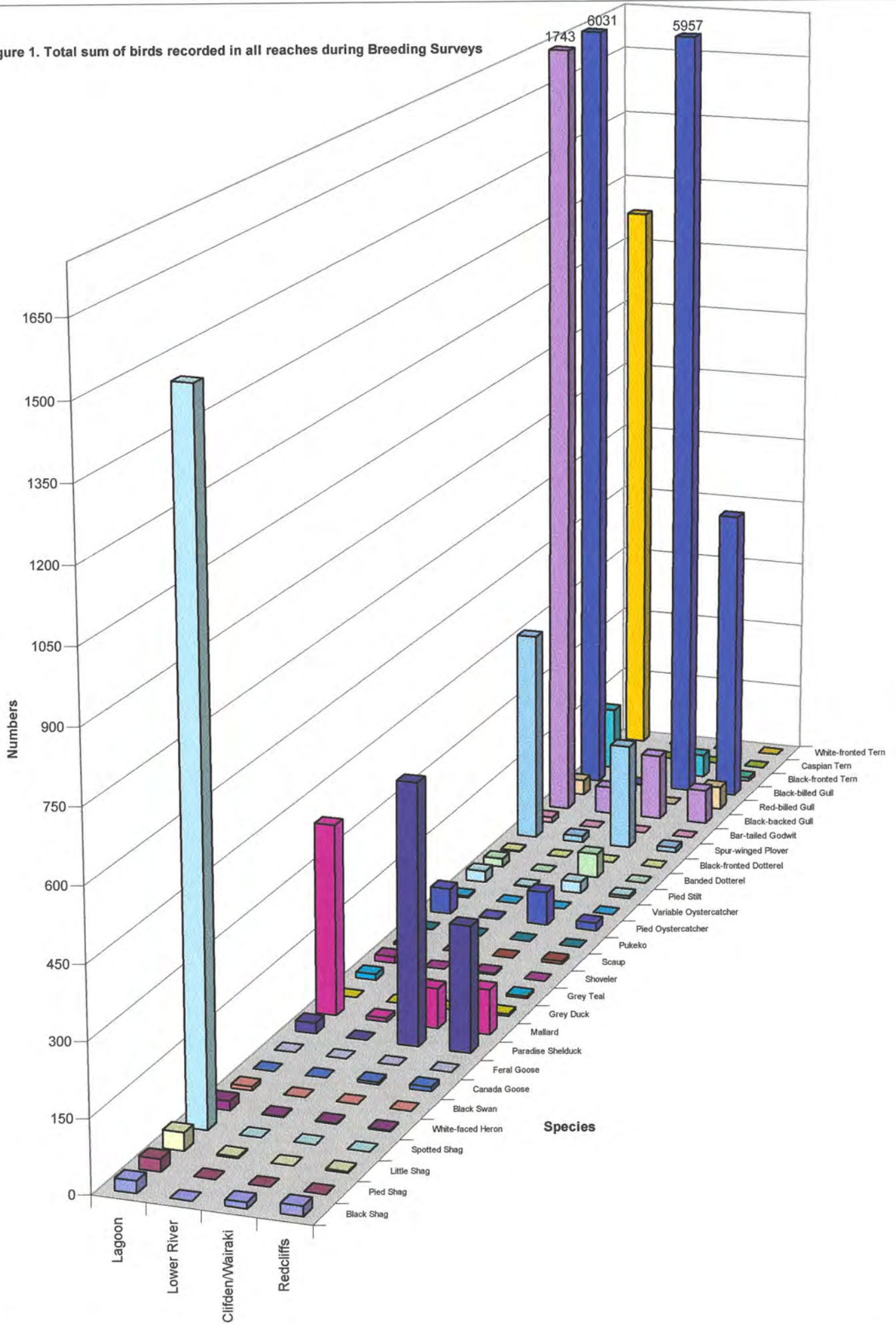


Figure 2. Total sum of birds recorded in all reaches during Post-Breeding Surveys

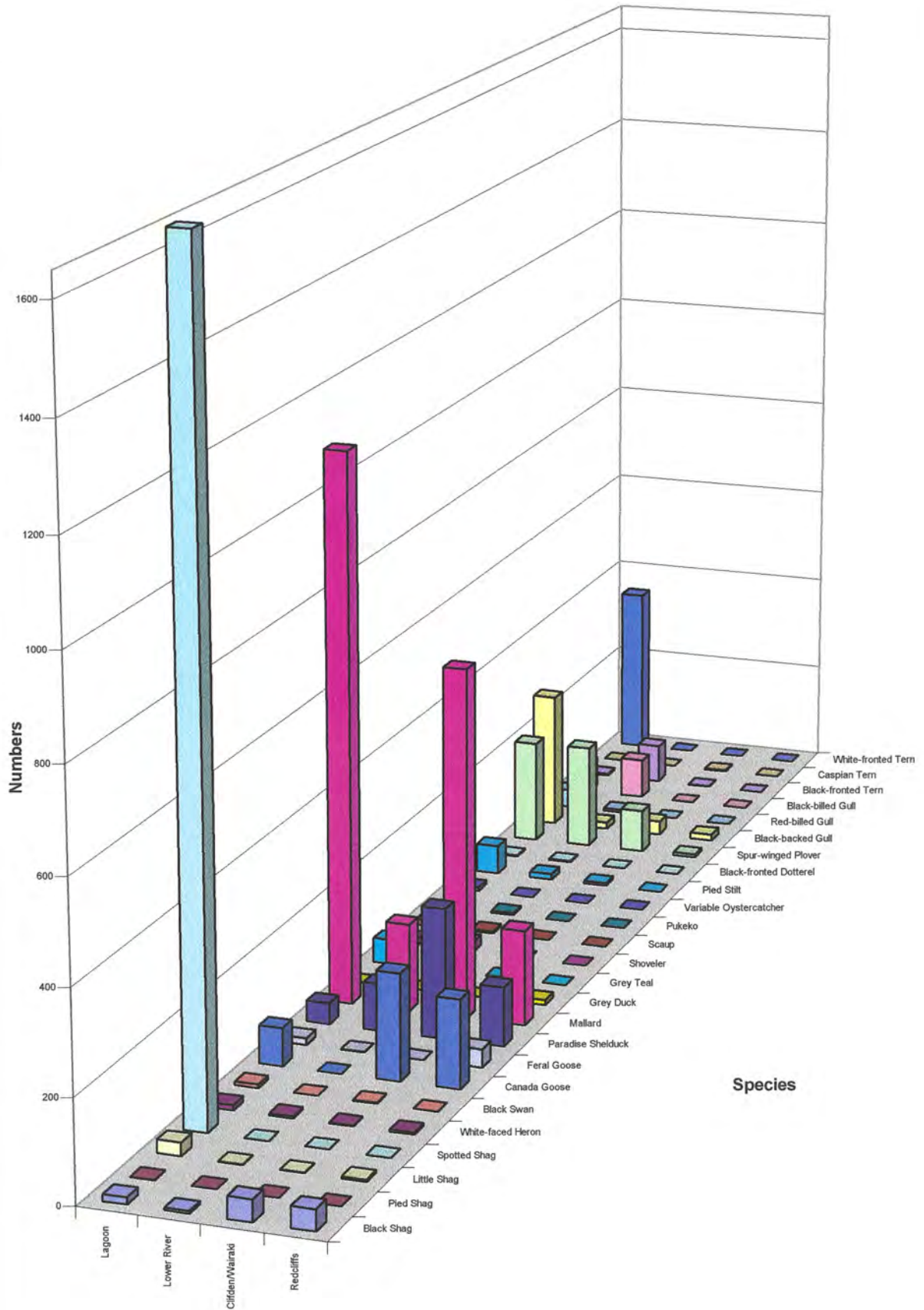






Figure 4. Counts at all reaches during Breeding Surveys

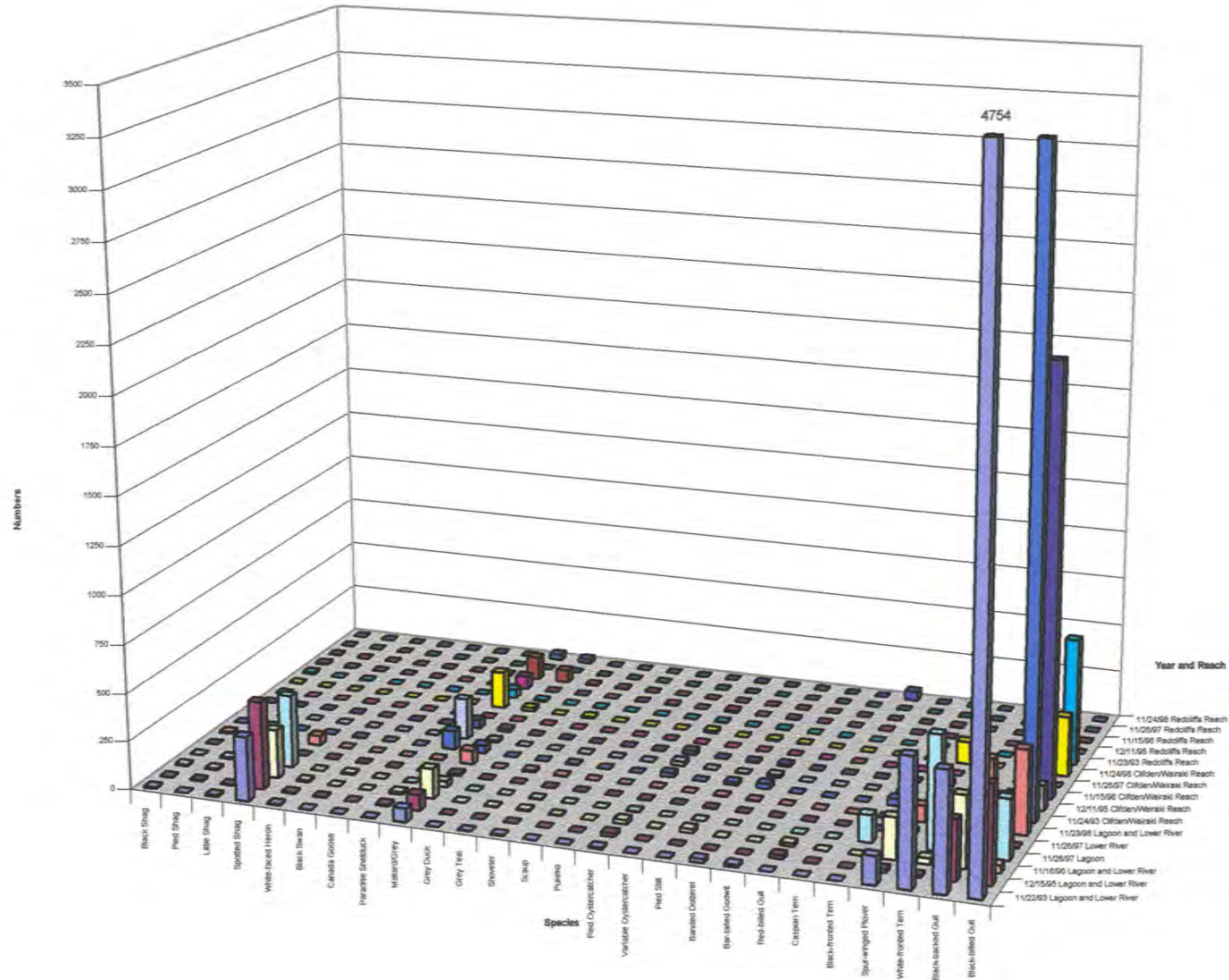






Figure 6. Counts at all reaches during Winter Surveys

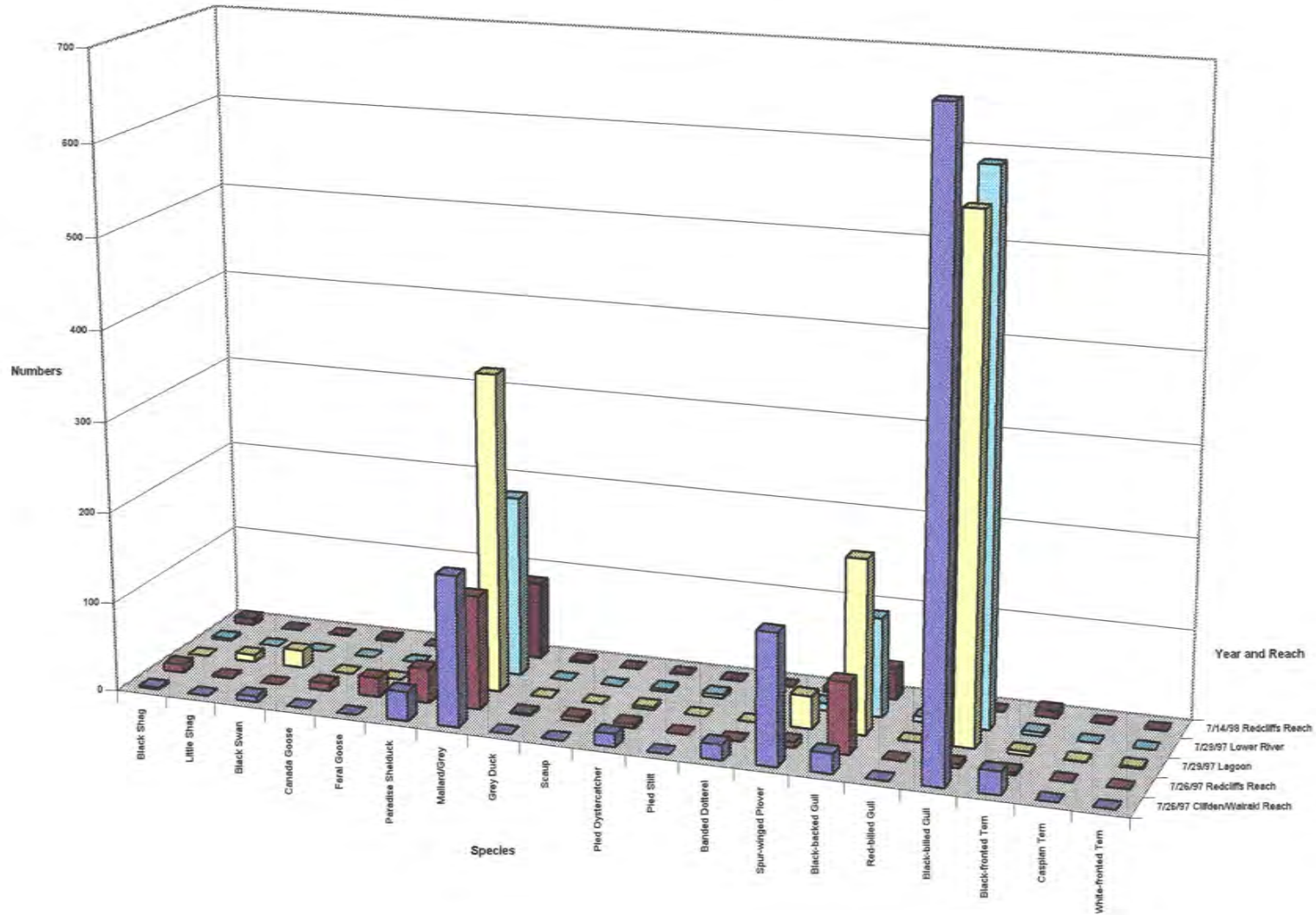


Figure 7. Total counts of each species for each reach during Breeding Surveys

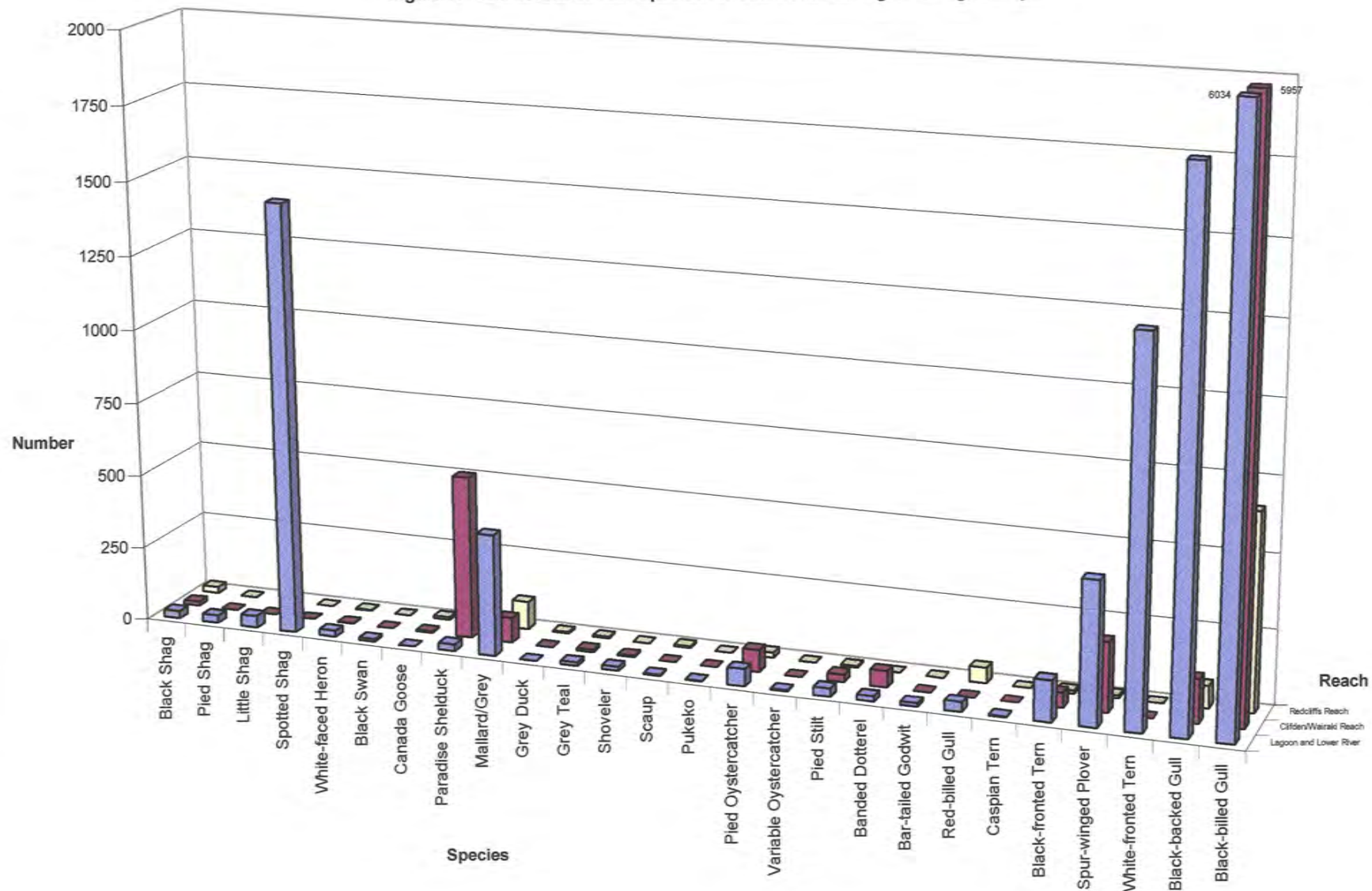




Figure 8. Total counts of each species for each reach during Post-Breeding Surveys

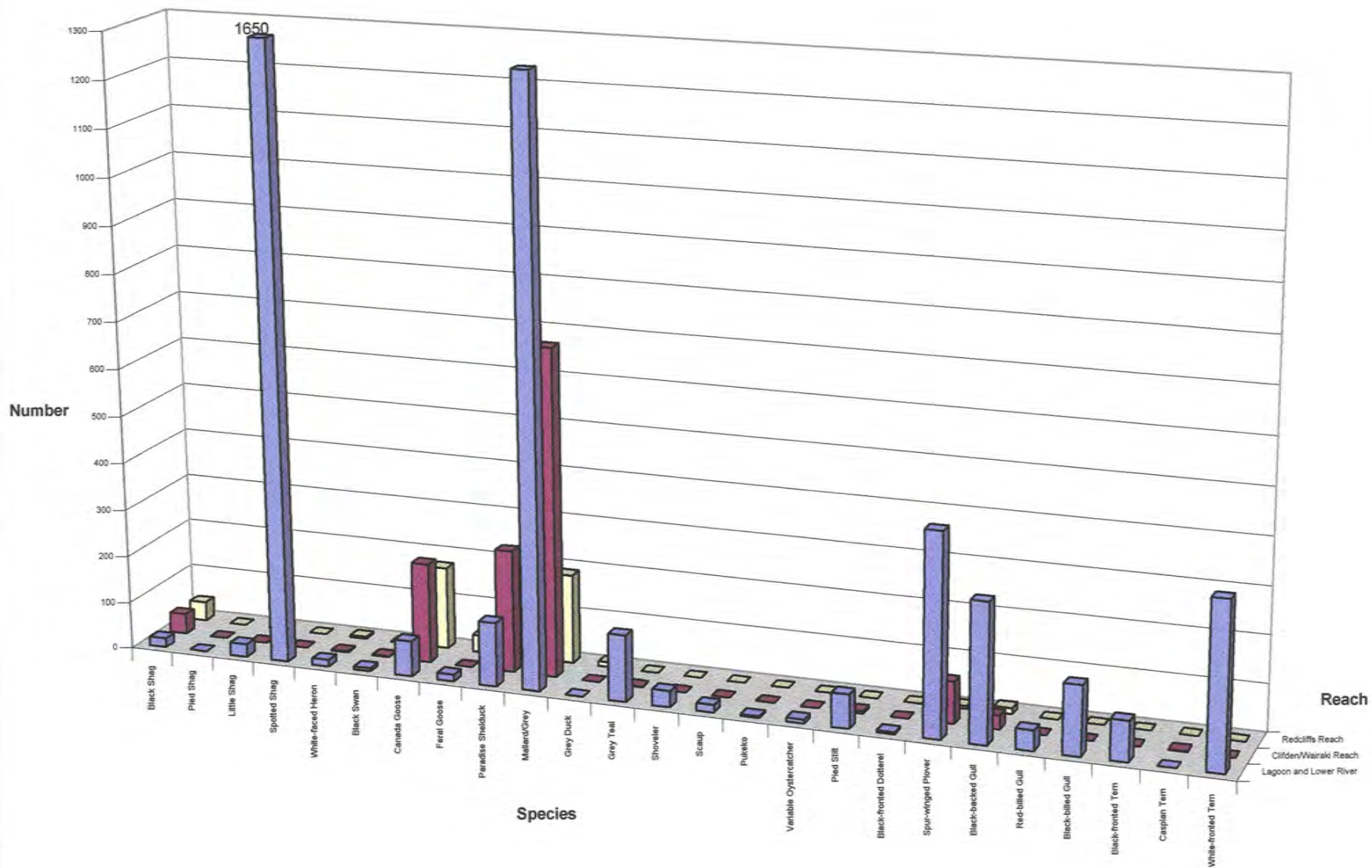
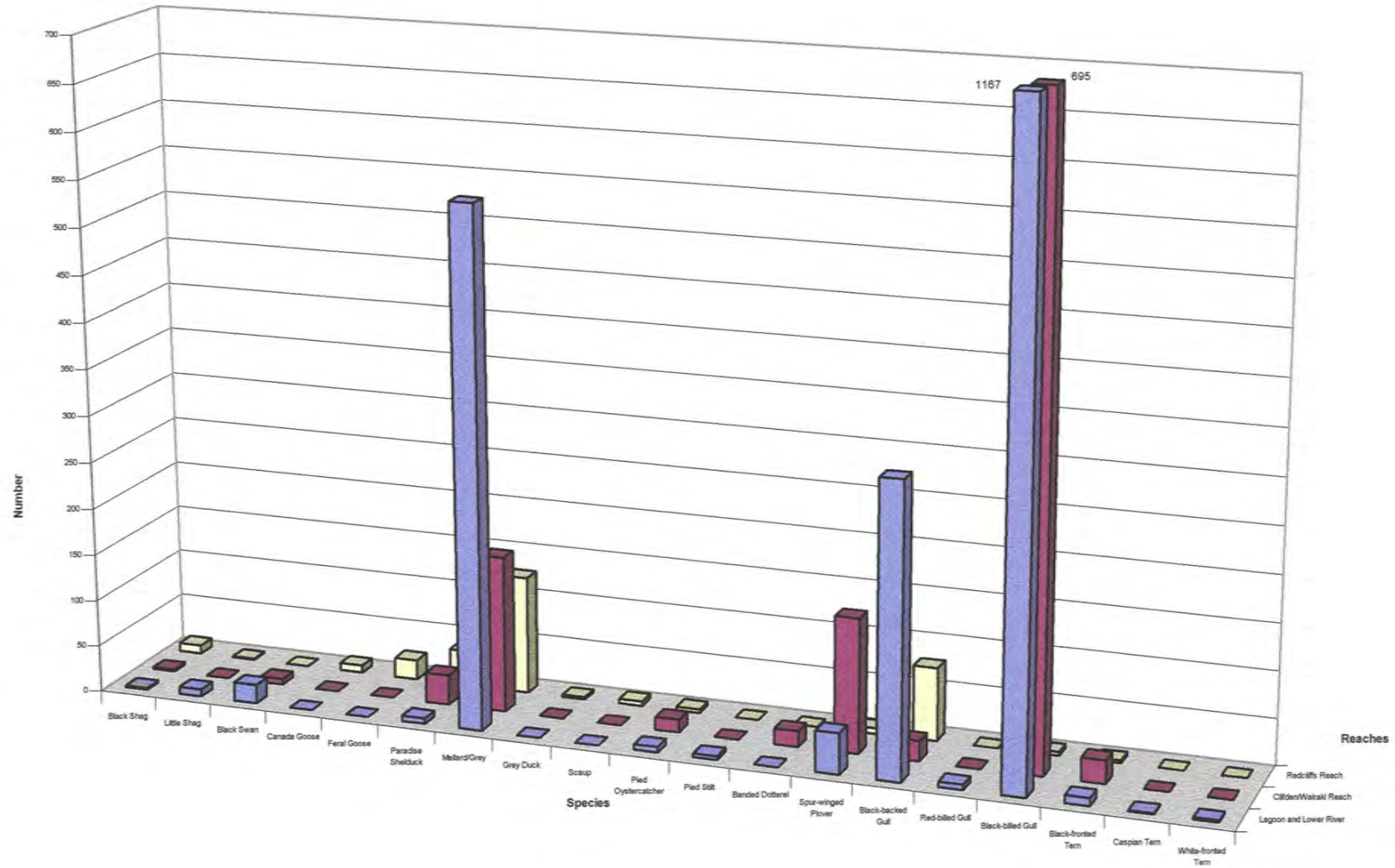


Figure 9. Total counts of each species for each reach during Winter Surveys





## DISCUSSION

During the past two years bird numbers have been difficult to record due to higher than average flows. This was a result of high rainfalls throughout the Catchment, and was experienced in all catchments in the Region. The best evidence of the effect on bird numbers and species diversity can be seen in Figure 4. In all reaches both species diversity and total counts decrease from the earlier surveys as compared to the 1997/98 surveys. Numbers and diversity were reduced due to breeding areas (mainly gravel shorelines and islands) being underwater during the pre-nesting and nesting periods. This effect was not due to power generation in the river, but was the outcome of a natural event and experienced throughout the Region.

During the March 1999 post-breeding survey, the most significant effect on birds was the introduction of stock (predominately cattle) onto gravel shorelines and islands in the Clifden/Wairaki Reach. Due to the drought experienced throughout Southland between January and March 1999, pasture growth was minimal and farmers had to find feed elsewhere. When stock, particularly cattle, are in these areas, birds will usually avoid them. The only species which exhibited any measurable increase in relative abundance in the Clifden/Wairaki Reach in the 1999 Post-Breeding Survey was the Feral Goose (Figure 5), all other species (excepting the Black-backed Gull which remained stable) declined in relative abundance as compared to previous years. Again, this effect is not a result of use of the river for power generation, but a combination of natural events (drought) and human response (putting stock in river margins/islands).

Some trends are starting to become visible in the data collected to date. For example, the Lagoon and Lower River Reaches can be identified as having the most diversity of species and largest relative indices of abundance (Figures 1 to 6).

Also, important reaches for certain species during specific times are starting to show up as trends. For example the Lagoon and Lower River and Clifden/Wairaki Reaches are important for priority species such as Black-billed Gulls and White-fronted Terns during the breeding and winter seasons. In comparison, the Lagoon and Lower River Reaches are important to the Black-fronted Tern during the breeding season and the single winter survey indicates that the Clifden/Wairaki Reach is more used by this species at that time (Figures 7 to 9).

## ACKNOWLEDGMENTS

Thanks to the survey team of Pete McClelland and Gary Morgan and to Jericho Farm Manager, C Till, and Tuatapere farmer Ray Horrell for access to survey sites.

## REFERENCE

Sagar, P.M. 1994. Aquatic Birds of the Waiiau River November 1993 and March 1994. Southland Regional Council. *NIWA Christchurch Miscellaneous Report No. 168*. 16 p.

**Waiau River Aquatic Birds  
Post-Breeding Survey  
March 2000**

**T J McClelland**

**prepared for Meridian Energy**

Teri McClelland  
Environmental Resources  
P O Box 603  
Invercargill

May 2000

## EXECUTIVE SUMMARY

This report compiles the data collected during the post-breeding bird surveys in the Waiau River during March 2000.

## INTRODUCTION

Surveys have been undertaken of the breeding, post-breeding and winter aquatic bird populations of the Waiau River for several years as part of the requirements of Meridian Energy's (formerly ECNZ) resource consent for use of water for the Manapouri hydro-scheme. This report is complimentary to previous monitoring reports and supplements the information collated in the 1999 Summary report and the January 2000 report. All surveys have utilised similar methodology and have been carried out during comparative seasons (breeding surveys in November, winter surveys in July and post-breeding surveys in March).

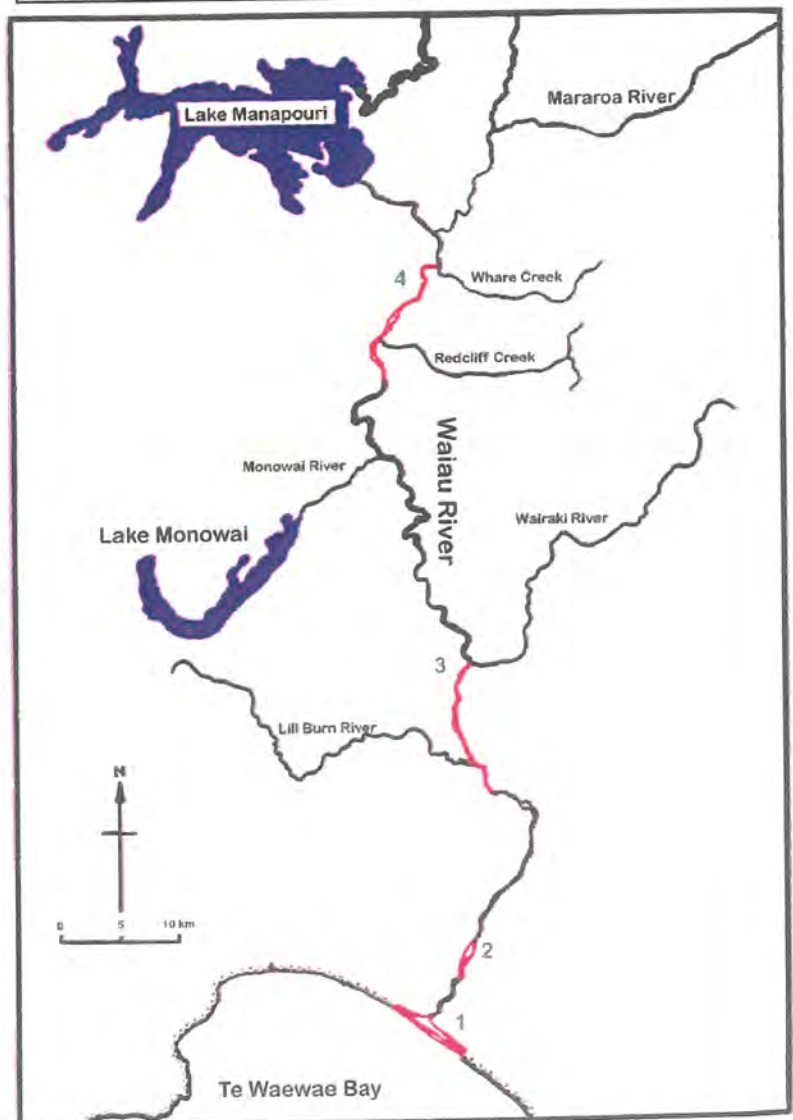
The objective of these surveys is to assist in the development of a long-term monitoring plan and determine the effect of the new hydrology regime on the aquatic bird population of the Lower Waiau River through the development of yearly indices of relative abundance.

## METHOD

In order to obtain comparable data, the methodology used in this survey was the same as that first used by Sagar 1994. Figure 1 shows the reaches that are surveyed. Since the advent of the new flow regime for the Waiau River, ½ km at the southern end of the Redcliffs Reach is now inaccessible (as compared to when this reach was surveyed by Sagar 1994) and has had to be removed from the survey. In response to this, an additional ½ km was added to the northern end of this reach (in order to keep the survey distance equal).

The totals given in Tables 1 to 3 should be considered as indices of relative abundance rather than absolute counts.

**Figure 1.** River Reaches Surveyed: 1) Lagoon Reach; 2) Lower River Reach; 3) Clifden/Wairaki Reach; 4) Redcliffs Reach

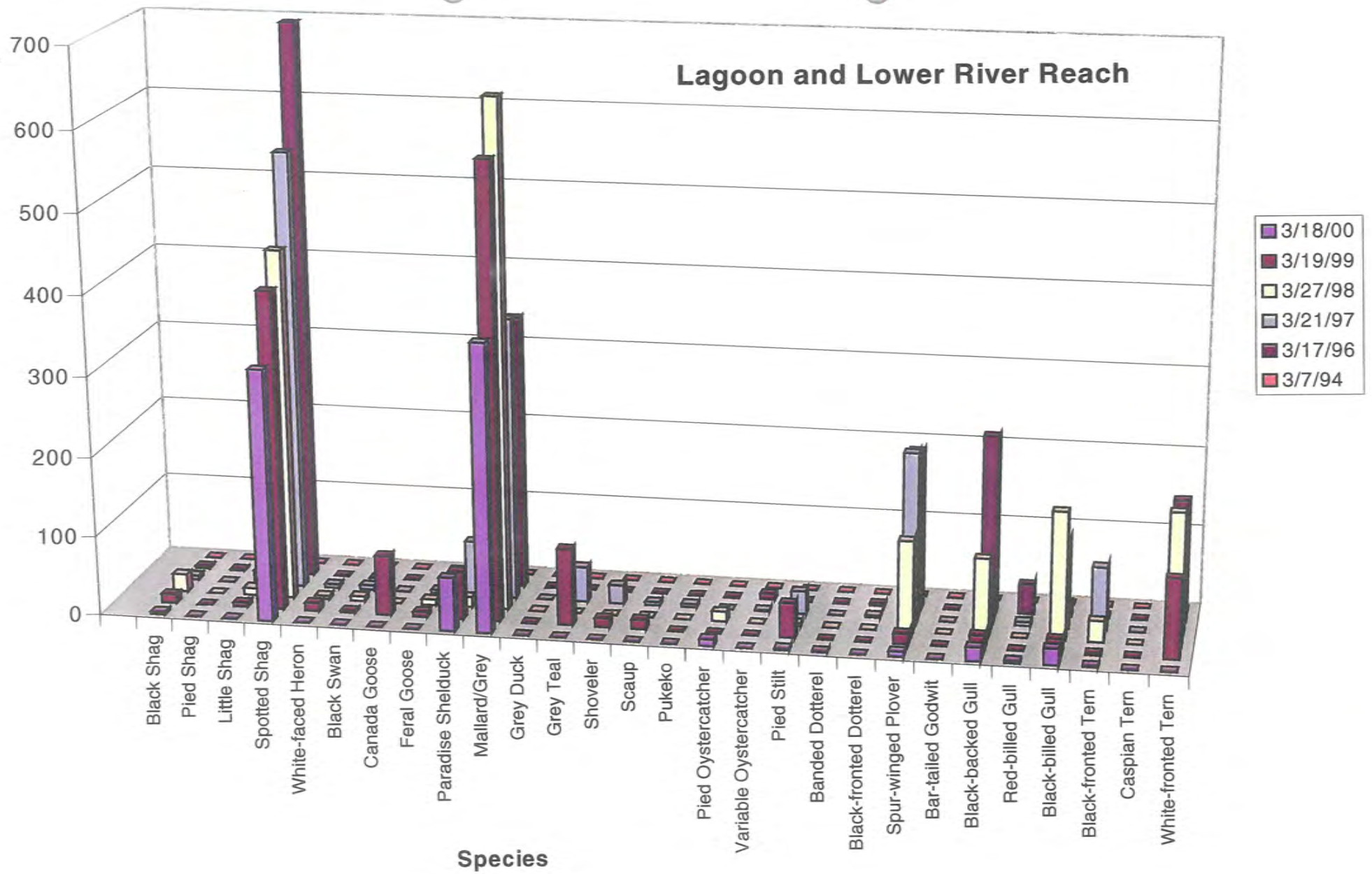


## RESULTS

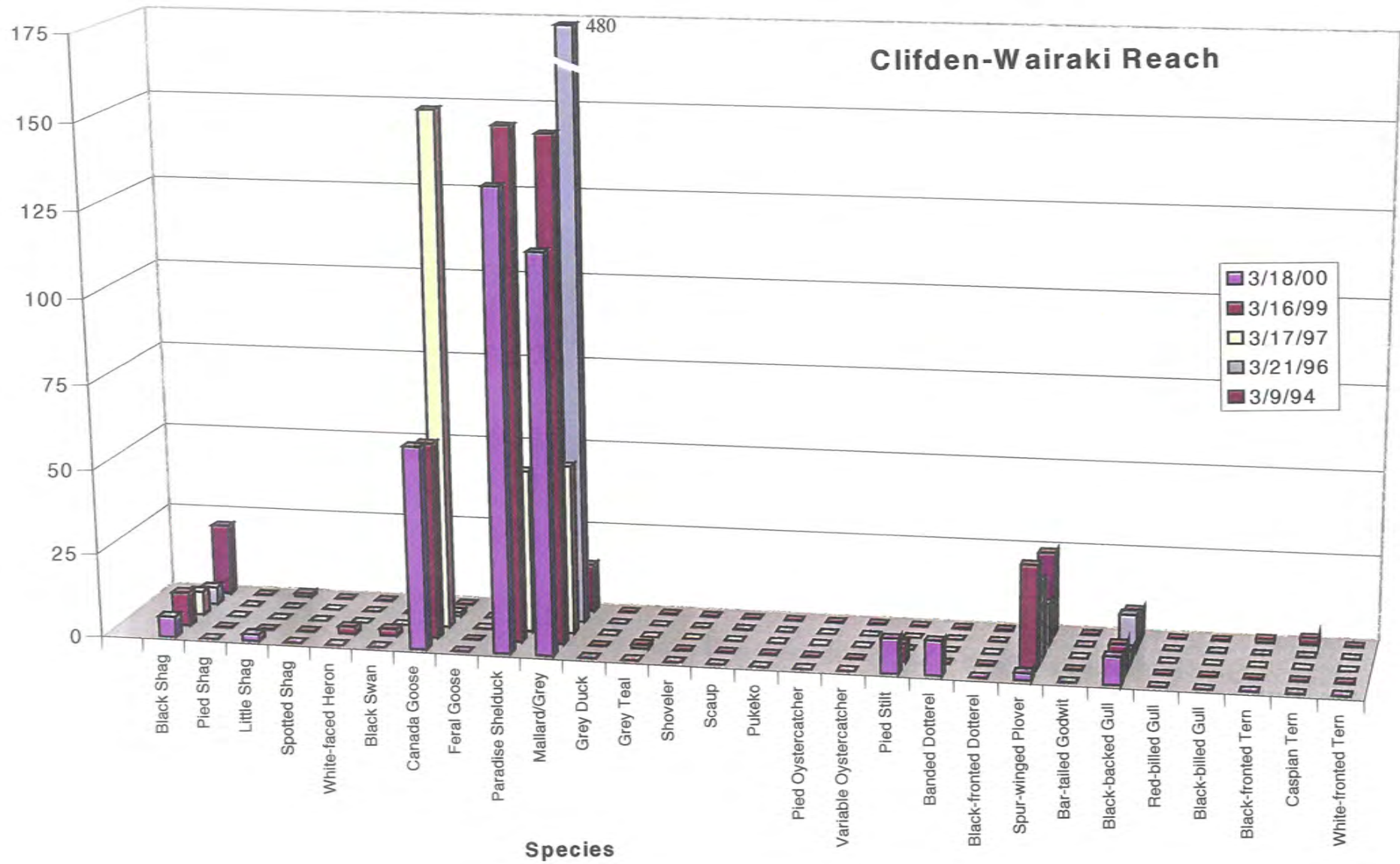
Tables 1 to 3 give the total numbers of each species recorded in each of the reaches during the March 2000 post-breeding surveys. This information has been collated with all previous post-breeding surveys and is presented graphically in Figures 1 to 3.

**TABLE 1.** Numbers of aquatic birds recorded on the Waiau River reaches during the March 2000 post-breeding surveys.

Species	Lagoon and Lower River	Clifden-Wairaki	Redcliffs
Black Shag	3	6	11
Pied Shag	-	-	-
Little Shag	-	2	1
Spotted Shag	315	-	-
White-faced Heron	-	-	-
Black Swan	-	-	-
Canada Goose	-	60	1
Feral Goose	-	-	5
Paradise Shelduck	67	135	23
Mallard	360	117	20
Grey Duck	-	-	-
Grey Teal	-	-	-
Shoveler	-	-	-
Scaup	-	-	-
Pukeko	-	-	-
Pied Oystercatcher	8	-	-
Variable Oystercatcher	-	-	-
Pied Stilt	2	10	-
Banded Dotterel	1	10	-
Black-fronted Dotterel	-	-	-
Spur-winged Plover	6	2	-
Bar-tailed Godwit	-	-	-
Black-backed Gull	17	8	1
Red-billed Gull	3	-	-
Black-billed Gull	21	-	-
Black-fronted Tern	2	-	-
Caspian Tern	-	-	-
White-fronted Tern	-	-	-

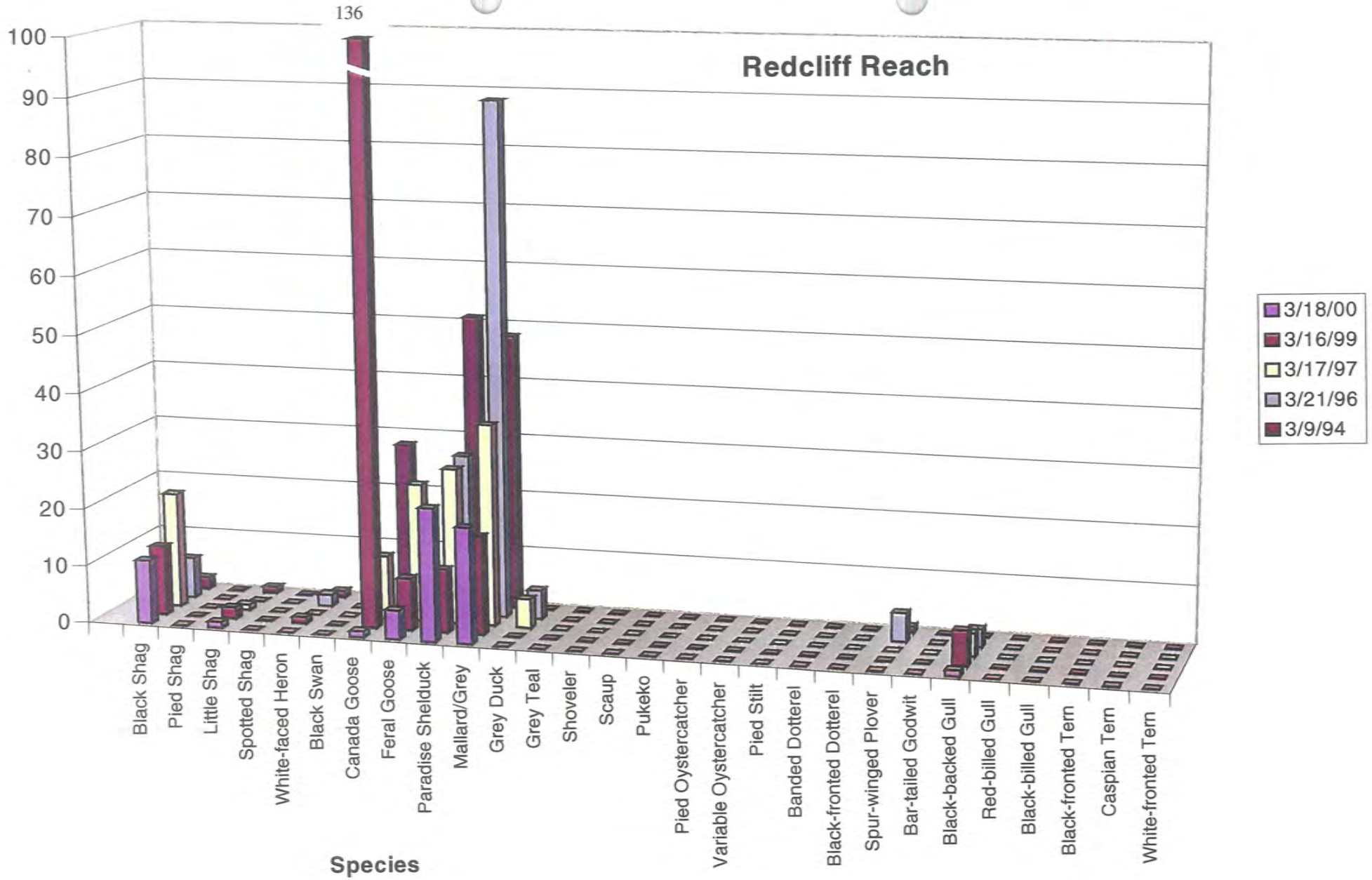








# Redcliff Reach



## **DISCUSSION**

In general terms numbers were down during this year's post-breeding survey. This is probably related to the November 1999 floods that interrupted breeding activity.

Overall numbers of species of particular concern (such as the black-billed gull) are still well down and while this may be attributable to the high flow events that have occurred during the past 3 breeding seasons, it is still of concern. One suggestion is that monitoring work in the future is more targeted to these species.

Otherwise, this post-breeding survey was similar to others in its findings. A verbal report on this survey, including recommendations for future monitoring will be made at the May 2000 Waiiau Working Party meeting.

## **ACKNOWLEDGMENTS**

Thanks to the survey team of Pete McClelland and Gary Morgan and to Jericho Farm Manager, C Till, and Tuatapere farmer Ray Horrell for access to survey sites.

## **REFERENCE**

Sagar, P.M. 1994. Aquatic Birds of the Waiiau River November 1993 and March 1994. Southland Regional Council. *NIWA Christchurch Miscellaneous Report No. 168*. 16 p.

# Bird Monitoring Programme Waiau River (Southland)

Report for Meridian Energy  
January 2001

By: Teri McClelland  
Environmental Resources



P O Box 603  
Invercargill  
Ph/Fax 03-231 3465  
Mobile 025 220 6654

Email [terim@southnet.co.nz](mailto:terim@southnet.co.nz)  
[www.EnvironmentalResources.co.nz](http://www.EnvironmentalResources.co.nz)

## SURVEY BACKGROUND

The aquatic birds of the mainstem Waiau River, Southland, have been monitored for absence/presence and relative abundance since November 1993 (Sagar 1994). During this time four reaches were surveyed (Figure 1) with surveys originally being undertaken during breeding and post-breeding (November and March) and latterly including the winter season as well (July). The results of these surveys have been written up and are available from Meridian Energy, or the Project Manager for the Waiau River Working Party.

At its May 2000 meeting the Waiau Working Party (which includes Meridian Energy, Department of Conservation, Iwi, Fish and Game Southland, and Environment Southland as members) reviewed the findings of previous monitoring and discussed recommendations from Teri McClelland, Environmental Resources, for changes to the monitoring regime. The Waiau Working Party agreed upon the

recommendations and Meridian Energy then undertook formal notification and approval procedures with Environment Southland. A synopsis of the new monitoring programme for birds on the Waiau River is attached as Appendix 1.

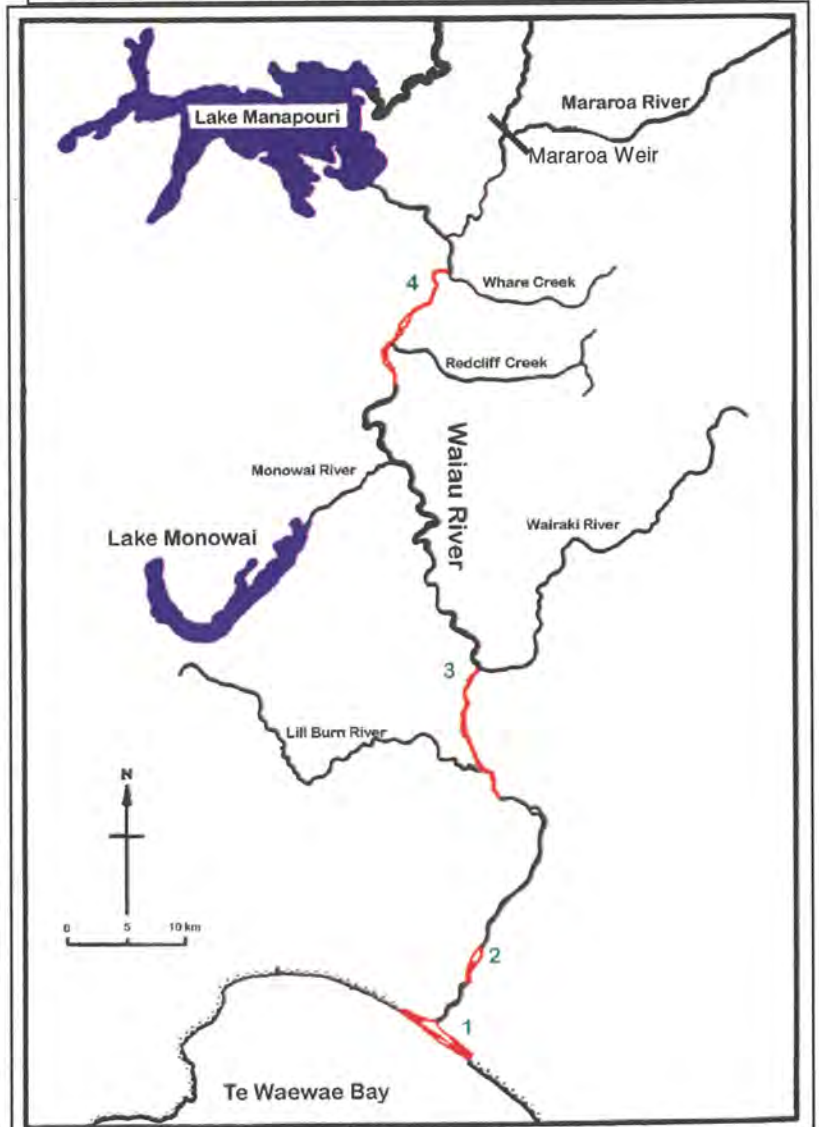
## SPECIES MONITORED

It was decided to focus the Waiau River bird monitoring programme on the rarer and most likely affected species found on the river. These species were identified as:

- Black-fronted terns (*Sterna albostrata*) – a category B threatened species (Molloy and Davis 1992);
- Black-billed gulls (*Larus bullerii*), which although not listed as a threatened species are of concern because of their decreasing numbers.

Although there are other “rare” species which utilise the river,

**Figure 1.** River Reaches Surveyed: 1) Lagoon Reach; 2) Lower River Reach; 3) Clifden/Wairaki Reach; 4) Redcliffs



most notably black-fronted Dotterel (*Charadrius melanops*) which breed on the river, a relevant monitoring programme for these species would be unjustifiably expensive as they are solitary nesters, e.g. the previous monitoring programme which covered in excess of 30km of river bed only ever included one pair of black-fronted dotterel at the Lower River Reach (number 2 on Figure 1).

Two other species of concern were the red-billed gulls (*Larus novaehollandiae*) and white-fronted terns (*Sterna striata*), although not listed as rare, they are recognised as being significantly affected by river levels. Since both of these species are frequently found in the same areas as the 2 primary species it was decided to include them in the monitoring regime.

All the species selected for the new programme are colonial breeders which usually nest on gravel bars and islands and are therefore susceptible to large numbers of nests being wiped out by increased river levels during the breeding season. White-fronted terns and red-billed gulls are both predominantly coastal species and are widespread around the NZ coast, although they can at times be found well inland. These species are often found breeding in close vicinity to each other.

Black-fronted terns and black-billed gulls on the other hand are generally inland species, although the latter frequently breed on the coast e.g. Waiau Bar, as well as on islands further upstream. These birds are both believed to be decreasing in numbers through out Southland. The Southland Branch of the OSNZ has been carrying out regional counts for black-billed gulls, largely using aerial photos. While there is some question over the accuracy of photo monitoring of colonies, i.e. how many birds per nest present, there is no doubt that this species has had a significant decline in past years. Of particular concern was the high number of black-backed gulls that were hit on Southland roads where they were finding some respite from the big freeze that saw most of Southland covered in snow for up to 10 days in July 1996. Other possible reasons for the decline in black-backed gulls include:

- Increased predation
- Nesting attempts being wiped out by high river flows
- Illegal killing
- Loss of habitat/food through competition/pollution and invasive weeds.

Black-fronted terns that feed both over land and water also appear to be declining. The reasons for which are unknown.

It has been an issue for many years that the breeding attempts of entire colonies, sometimes numbering several thousand can be wiped out by high river flows – particularly during September through November. High river flows occurring in the months of October and November are likely to have the greatest impact on these species. These are the initial nesting months and, although the birds will routinely re-nest if their first attempt is destroyed, having to re-nest increases the chances of the chicks not being recruited into the population, i.e. the chicks may fledge but not be prepared to survive the winter.

## **TIMING**

It is planned to carry out the surveys in the middle of each month programmed, as this allows a safety margin in case surveys are delayed due to weather or river conditions. Unlike the previous survey technique, the time of day at which this survey is carried out should have little effect, unless there is to be an attempt to monitor the total number of birds present. Timing of the surveys will generally, for reasons of practicality, be based around the high tides at the lagoon.

## **SITE DESCRIPTIONS**

### **Mararoa Weir**

This site is a triangular gravel spit at the confluence of the Mararoa and Waiau Rivers at NZMS 260 D44 955976. It is approximately 500m upstream from the Manapouri Lake Control Structure (commonly known as the Mararoa Weir, Figure 1) which is operated by Meridian Energy to manage the water level in Lake Manapouri. The point of the spit rises up from the river in several gentle steps to the base that is approximately 3m above the river.

*Access* – this area is easily accessed through a locked gate, controlled by Meridian Energy. Access for the survey is co-ordinated through Colin Sinclair of Meridian Energy.

### **Lillburn**

This site consists of several gravel islands in the Waiau River adjacent to the mouth of the Lillburn Stream at NZMS 260 D45 988534 (Figure 1). None of these islands can be safely reached on foot, even at the current minimum flows, however through access from adjacent farmland; an overview of the islands can be had. Therefore, this site was checked through the use of a spotting scope. If a colony had been observed on the islands, an attempt to access the island by boat would have been made. Black-billed gulls have regularly been recorded congregating/breeding at this site although there are no current exact counts known.

*Access* – is via a farm track/gravel pit accessway and across paddocks owned by Mr Nick Robertson. There is unlikely to be any problem with ongoing access to this site.

### **Lagoon**

The lagoon colony is situated towards the western end of the Waiau bar at NZMS 260 D46 930330 (Figure 1 – Western end of Reach 1). It is approximately 300m South west of the township of Papatotara on the seaward side of the lagoon.

*Access* - the current position of the river mouth, west of the colony, means that the only practical access to this colony is by boat. The best site for launching is at the boat ramp



on the eastern lagoon, which means that access is restricted to a couple of hours either side of high tide in order to get safely through the channel.

## SURVEY RESULTS

### ▪ OCTOBER 2000

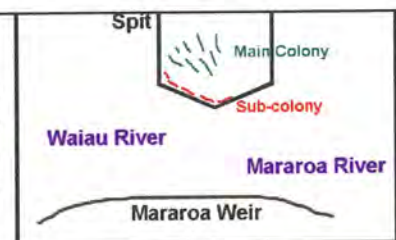
#### Mararoa Weir

It was apparent that black-billed gull nesting at this site is spread over several months as one nest had small chicks present and the eggs in many other nests (<5%) had starred or pipped (chick starting to break out of the shell). While, at the same time, there were a large number of nest scrapes, which are indications of areas to be laid in the near future. Given the incubation period of 20 – 24 days, for this species, this means that eggs laid at this time will not hatch for another 4-5 weeks at least.

There were large numbers of birds roosting around the periphery of the colony – possibly non-nesters or off duty birds.

Earliest nesting attempts were at the lower site nearer to the weir (sub-colony in Figure 2), however later nesting attempts were higher up the spit, above the water level. The location of the main colony in this area is attributed to a rise in lake/river levels early in the nesting season (Colin Sinclair, pers comm).

**Figure 2.** Location of main colony and sub-colony at Mararoa Weir site.



#### Findings:

Number of eggs per nest	Number of nests
0	254
1	409
2	663
3	108
Chicks	1

#### Totals:

Nest with Eggs	1180
Nests with chicks	<u>1</u>
Operational nests	1181

Nests scrapes without eggs	<u>254</u>
Total number of nests	1435

## Lillburn

During this count, no gulls were seen in this area and although five black-fronted terns were seen feeding on one of the smaller branches, there was no evidence of them breeding.

As this colony is the most vulnerable to high river flows, there may be merit in undertaking an earlier survey (i.e. in September) to monitor whether birds have attempted to breed at this site, in order to gauge the effect of any temporary increase in water flows. Given that this site frequently contains a breeding colony, it is possible that nesting attempts were foiled due to high river levels and that birds moved to other sites. On 6 November a visit was paid to a large (>2000 birds) black-billed gull colony on the Whitestone River. Nesting in this colony was obviously spread over a long time and was considerably later than at either of the Waiau colonies with some small chicks present but many birds were still laying. It is possible that at least some of these birds were from a washed out colony at the Lillburn site on the Waiau.

## Lagoon

Like the Mararoa Weir colony, this colony had many more birds present than nests. These "extra birds" are likely to be a mix of non-sitting birds of a breeding pair, pairs of birds that have not laid and non-breeders. There was also a significant group – 100+ of white-fronted terns, but there was no sign of this species breeding at this location at this time. The December survey in previous years had recorded significant numbers of this species breeding near the black-billed gull colony.

Prior to this season, the mouth of the river has been east of the colony, however following very high flows in November 1999, the river burst out at the very western end of the lagoon and has remained there ever since. This does not appear to have had any obvious effect on the colony.

### Findings:

Number of eggs per nests	Number of nests
0	175
1	349
2	1363
3	599
4	3
Chicks 1	3
Chicks 2	11
Chicks 3	1

### Totals:

Nests with Eggs	2314
Nests with chicks	15
Operational nests	2329
Nests scrapes without eggs	175
Total number of nests	2504

## ▪ NOVEMBER 2000

### **Mararoa Weir**

The nests in the weir colony were at a wide range of stages in the breeding cycle. A large number of well-feathered chicks were present in the colony with an estimated 15-20% of birds still on eggs.

### **Lillburn**

As with the October count, the only birds present in this vicinity were approximately six black-fronted terns feeding on a small reach on the true left of the river.

### **Lagoon**

It was not possible to count the number of chicks or birds still on nests due to the detrimental effect that people walking through the black-billed gull colony could have. When disturbed at this stage of the breeding cycle, i.e. with chicks present, the chicks frequently run into the water and can be swept downstream, at the very least risking a lengthy separation from their parents and at worst being swept out to sea.

In order to minimise disturbance, the colony was observed from a boat and from the bar to the west of the colony. This enabled the colony to be observed with only minimal effect, i.e. at times the adults nearest the observers took off briefly but they quickly settled down again with no noticeable effect on the chicks.

While it was not possible to do a count of the chicks/nests, it is estimated that 5-10% of adult birds present were still on nests – presumably still with eggs or small chicks. The chicks in the colony ranged from a couple of days old to a few that had started to feather-out.

A group of 12 red-billed gull nests had been built in the middle of the black-billed gull colony. These appeared to all be on eggs and were the only red-billed gulls in the vicinity.

During this survey a large number of white-fronted terns were found on nests (an accurate count was not possible at this time given the effect on the adjoining gull colony and the indistinctive nests of the terns, making locating a nest without an adult present very difficult). The breeding terns were divided approximately in half on either side of the gulls. A count of the terns was carried out during the December survey, when the impact on breeding gulls was significantly reduced.

## ▪ **AERIAL SURVEY of WAIAU RIVER**

On 13 November an aerial survey of the Waiau was carried out from the lagoon to the weir to check for any additional gull and tern colonies. No additional colonies were located confirming that if there had been a colony at the Lillburn early in the season which had been washed out, the birds had joined other existing colonies either on the Waiau or nearby. This exercise proved invaluable for both confirming the choice of the survey sites and ensuring no at-risk colonies were omitted.

## ▪ **DECEMBER 2000**

### **Mararoa Weir**

The majority of the nests had fledged their chicks and those that remained had congregated towards the head of the spit (close to the weir) close to the river. There were only four nests still active and as they all still had eggs, it is likely that they are re-nesting attempts. There were quite a few dead chicks present in the colony but not sufficient to raise undue alarm when compared with the number of live chicks.

### **Lillburn**

Once again there was no sign of any gull or tern colonies at the Lillburn. As noted above, it appears that, if there was a colony this breeding season, it was washed out early on (e.g. September) and all the birds then moved to other colonies either on the Waiau or nearby rivers.

### **Lagoon**

Black-billed gull nesting at the lagoon appears to spread out over a much greater time than at the other sites. During this survey there were chicks present, ranging from < one week old to fully feathered, along with approximately 1200 nests with eggs - which appeared to be re-nesting attempts, as most of the new nests were not at the same sites as earlier nests.

The red-billed gull nests present in November appeared to have all fledged and there was another nest along with eight adults present at another site.

The white-fronted tern nests that had been present during the November count had fledged chicks that were mostly creching around the outside of the gull colony.

In addition there were another approximately 300 new white-fronted tern nests with eggs, mostly at the west end of the gull colony.

**Observation** – during the surveys no black-fronted tern nesting attempts were observed at any of the survey sites, nor was any colony found during the November aerial survey.

## THREATS

While high river levels can seriously impact upon the Mararoa Weir and Lillburn colonies in particular, during this survey river levels were not seen to adversely impact upon the species monitored. The possible loss of a nesting colony at the Lillburn site and the movement of the Weir colony to a higher point on the spit, may be attributable to high river/lake levels prior to this survey commencing (i.e. September). All three sites do face very real threats from vegetation, predator and human interference. These threats, and possibilities for protecting the colonies from them, are summarised below.

### Mararoa Weir

Meridian Energy cleared most of the vegetation from this site during the previous year, mainly by bulldozing lupins from the spit (Colin Sinclair, pers comm, see Photo 1). This action has certainly benefited the colony as cover such as lupins encourages predators – stoats, ferrets and cats, to live in the area.

**Photo 1.** Lupins at Mararoa Site pre control work (*photo taken by Colin Sinclair*).



The controlled grazing of the pasture that borders the spit is probably also of benefit as it increases the open buffer around the colony, making it less attractive to predators. However, some planned plantings in this area may be beneficial.

During the November survey there was a noticeable increase in weeds on the spit, however the disturbance to the colony from carrying out a weed control programme while chicks are present in the colony, would far outweigh the benefits of removing the weeds. This is largely due to the fact that birds with chicks are very susceptible to disturbance and abandonment and the scattered nature of the plants gives only limited cover for predators. However, it will be important that a weed control programme is carried out once the colony is no longer active this season (*this has been carried out by Meridian Energy following advice from T. McClelland, Colin Sinclair pers comm*). It would be beneficial if a weed programme could include spraying of the lupins on the edge of the spit.

Predators are a real threat to this colony and a predator control programme on the edge of the colony, especially at the base of the spit, would be of benefit. A suggested control programme is outlined in the Recommendations section below. Assistance/advice for predator control could possibly come from the Southern Institute of Technology's Pest Control (Predator) programme, Environment Southland or the Department of Conservation.



## **Lillburn**

There is a varying amount of vegetation on the "Lillburn Islands" and it would be beneficial to remove this vegetation, ideally by spraying or hand pulling, so as to reduce any cover for predators and make the site more attractive to birds.

## **Lagoon**

This colony is at greatest risk from humans and/or associated dogs, especially during the whitebaiting season (15 August to 30 November) when there can be large numbers of people in the area. The current location of the mouth probably reduces this disturbance as access is now largely restricted to boats which generally go straight past the colony, compared with previously when access from the west end was usually by 4 wheel bike which had to go past/through the colony.

Other than via boat from the lagoon, access to the mouth from the east end is along a reasonably well defined, if temporary, 4 wheel bike track which runs mainly along the crest of the spit. During the November survey a 4-wheel bike drove past the colony on this track – the effect was minimal and only temporary, possibly in part at least due to the bike travelling at a slow speed.

Another possible source of disturbance to the colony is the presence of whitebaiters fishing in the vicinity, especially a temporary (hopefully) hut that has been built within 50 m of the colony. The effect of these whitebaiters appeared to also be minimal as they did not walk through the colony and did not rush around.

An additional, although not obvious, risk is the presence of fishermen fishing in the lagoon, especially in boats. During the November survey a single boat with two lines out was observed catching two gulls on shiny lures, both gulls were released apparently unharmed.

The location of the new river mouth should provide increased protection to the colony from predators as they now have to travel a greater distance from the base of the spit. While there is considerable cover for predators along much of the spit, the colony is distanced from the nearest significant cover.

## **RECOMMENDATIONS**

Based on the 2000/2001 survey, the following recommendations are made:

- River information, similar to that provided to the Guardians of the Lakes – but made available on a monthly, rather than six-monthly basis (as six-monthly does not meet the time requirements of these surveys), would be of benefit when trying to determine whether river flows attribute to nesting attempt losses or locations.

- That an aerial survey be carried out for the length of the Waiau River and ideally up the tributaries, i.e., Whitestone, Mararoa and Eglinton, to identify the breeding colonies early on in the season, i.e., Sept/Oct. This would be particularly useful for locating black-fronted tern breeding sites as none were observed on the main river this season.
- To carry out additional checks on the colonies in:
  - September to check colony locations to see if colonies are lost due to high river levels etc, early in the season and monitor where these birds may re-nest.
  - January to check the final status of late breeding birds, e.g., the lagoon colony this year.
- That all spraying at the weir be carried out before September and then again after December to avoid disturbing nesting birds.
- That the colonies, especially the weir colony, not be entered when chicks are present as they will frequently go into the river and may be lost downstream.
- That the site of the weir colony continues to be subject to an intensive weed control programme – removing all vegetation on the gravel spit so as to remove cover for predators.
- That a trapping programme be put in place at the weir colony to reduce losses to predators/ monitor the potential impact of predators. This would need to be kill traps, i.e. Fenns for mustelids and Conibars for feral cats, so as to minimise the resources required to check them, i.e., kill traps need only be checked weekly while non-lethal traps need to be checked daily.

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## APPENDIX 1

### Synopsis of the New Monitoring Programme for Birds on the Waiau River

1. Surveys to be held during October, November, December - to cover the time when birds are most vulnerable to changes in waterflow (i.e. breeding) - the post breeding (March) and winter (July) surveys to be discontinued, as the data usefulness is limited to relative presence/absence of species (and there is ample data on this now from previous surveys) and does not incorporate impacts of changes in waterflow (given birds are very mobile at these times).
2. Surveys to focus on high-priority species (in terms of national/regional significance and potential for impact upon breeding success due to changes in waterflow) such as black-billed gulls; white-fronted terns; dotterels (both banded and black-capped); black-fronted terns, rather than low-priority species such as feral geese; paradise shelduck; black-backed gull; etc.
3. Survey sites to be the known nesting sites at: Te Waewae Lagoon (both eastern and western ends); Clifden/Wairaki Reach; and the gravel areas above the Mararoa Weir, as these are the predominant breeding sites for high-priority species.
4. October survey to focus on nesting attempts (e.g. location, density, and number of nests); November survey to focus on nesting pairs (e.g. how many nests being utilised); December survey to focus on nesting success (e.g. presence of chicks).

This refinement will provide Meridian Energy and the Waiau Working Party with more specific, relevant information as to the possible impacts of activities (both natural, such as flooding; and man-induced, such as flow releases, shingle extraction, and weed encroachment and removal) on specific, high-priority avian species.