

Demography of Black-necked Swans *Cygnus melancoryphus* in three Chilean wetland areas

ROBERTO SCHLATTER, JUAN SALAZAR, ALEX VILLA and JAVIERA MEZA

Numbers and distribution of Black-necked and Coscoroba Swans were poorly known until they were censused in Magallanes, southernmost Chile in 1971. This survey revealed a concentration of swans in this region with almost 11,000 Black-necked and 403 Coscoroba Swans. Recent censuses have focused upon a Black-necked Swan breeding population in Laguna El Peral (33° 30'S), a 16 ha nature sanctuary (eight pairs breeding, maximum 50 migration), Laguna Torca (34° 46'S) a 65 ha nature reserve (11-18 breeding pairs, 80-210 migration). Competition for nesting sites appears to be the principal cause for a stable breeding population in these two areas.

In the largest breeding area under study, Río Cruces, (38° 42'S; 4877 ha nature sanctuary), the total number of birds remained fairly stable at 800 birds from 1982-83 until 1985-86 when effective protection has led to a doubling of the population every season since. Breeders have increased from 90 to 250 pairs (1986-89).

Between January and late May 1989 there was a sharp increase, from 2178 to 6426 birds. This was a result of immigration due to climatic drought in Argentina. Protection has been a key factor responsible for the increase of the breeding populations in the two study areas.

The Black-necked Swan *Cygnus melancoryphus* has an almost continuous distribution on the southern cone of South America, including wetlands from southeastern Brazil, southeast Paraguay, almost all Argentina, the southern two-thirds of Chile, and Uruguay. An estimated 100,000 birds live within this ample range; approximately 20,000 in Chile, 50,000 in Argentina (from several sources pers. comm.), at least 20,000 in Uruguay (Rilla pers. comm.) and about 2-3000 in southernmost Brazil (Menegheti pers. comm.). The total number of Black-necked Swans in Chile has never been censused, but there are some partial counts available (Markham 1971, Drouilly 1976, Salazar 1988, Villa 1988).

From 1985 Corporación Nacional Forestal (CONAF) has started regular swan counts in Laguna El Peral, Laguna Torca, and with the aid of the University Austral de Chile, in Río Cruces Nature Sanctuary. These three wetlands are legally protected and have been wardened from 1985 onwards.

This paper reviews the censuses of the Black-necked Swan for these three localities, which have a different history, size, ecological conditions and degree of disturbance. The main question is whether protection has encouraged the establishment, increase and maintenance of an

appropriate carrying capacity of the wetlands for Black-necked Swans.

Study Areas

1) *Laguna El Peral* is a nature sanctuary in central Chile (33° 30'S and 71° 36'W) (see Fig. 1). The lake has a surface area of about 16.3 ha and a maximum depth of 3 m. It is surrounded by riparian vegetation and has a rich submerged vegetation of *Myriophyllum* spp. Around it there are sandy shores with recreational apartments. The main coastal road passes nearby and in summer has heavy traffic due to many visitors. At least 23 waterfowl species live in this restricted coastal pond.

2) *Laguna Torca* (34° 46'S, 72° 02'W) is a nature reserve composed of three parts, one of which covers a surface of 204 ha and is connected to the lagune. It lies close to the sea and is surrounded by sand dunes and Monterrey pine plantations. Sixty-five ha (32%) is covered with *Typha angustifolia* and *Scirpus californicus*. Submerged vegetation is comprised of an association of *Myriophyllo-Ceratophylletum* and the free floating vegetation is *Lemno-Azolletum* (Ramírez & San Martín 1984). Vichuquén is a larger lake,

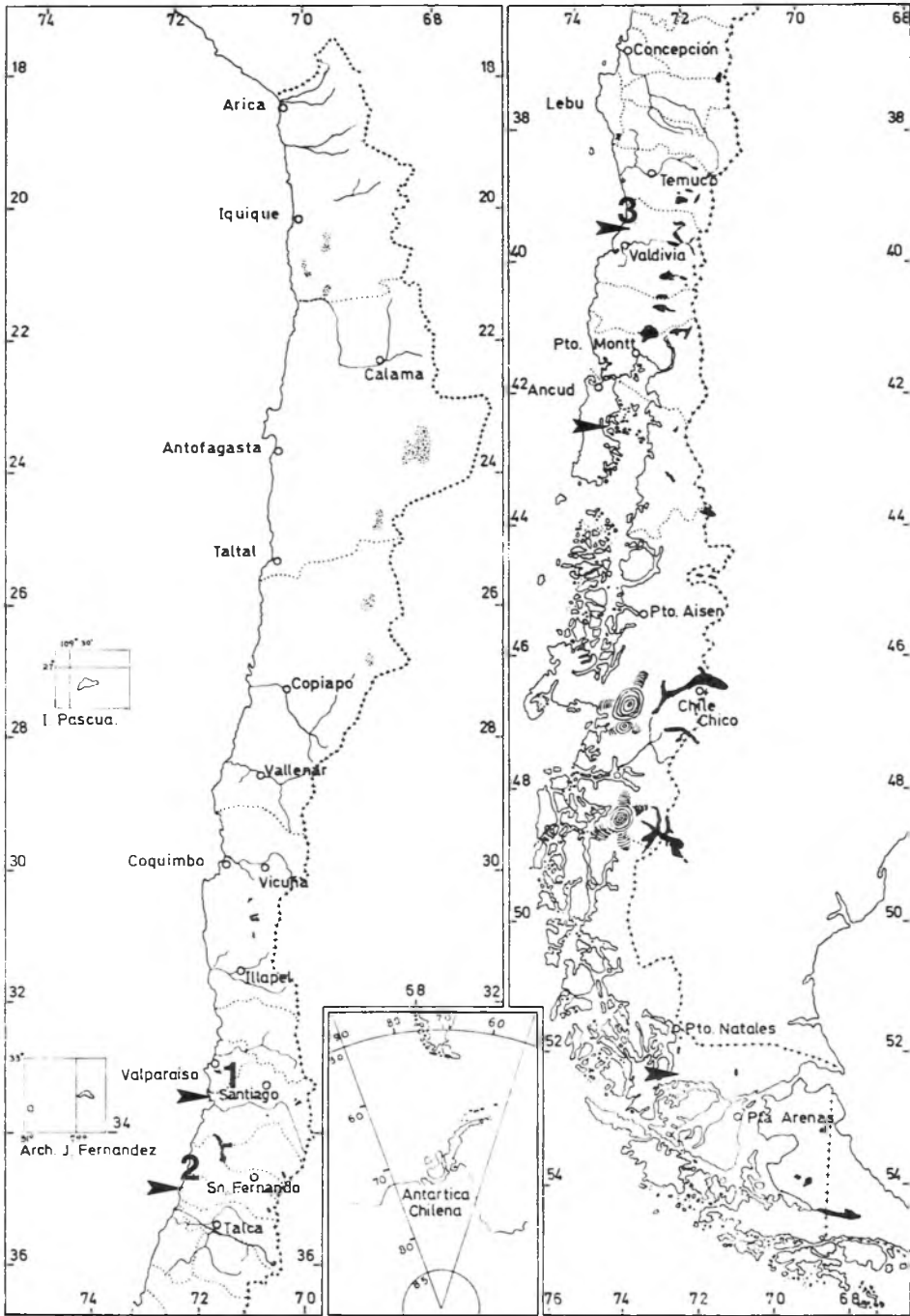


Figure 1. Wetland sites studied for demography of Black-necked Swans in Chile. 1 = Laguna El Peral, 2 = Laguna Torca and 3 = Río Cruces. Other arrows show future areas to be controlled at Chiloé island and Pto. Natales.

nearby, which is also a seashore and freshwater recreational site. During summer there is a lot of recreational activity (sailing, motorboat waterskiing and other sports). At least 80 bird species visit or reside in this area.

3) *Río Cruces Nature Sanctuary* (39°35'-39°47'S and 73°07'-73°16'W) is a RAMSAR site, 4877 ha in size, 25 km long and on average about 2 km wide. It consists of a main river basin and adjacent sunken lowlands. This area sunk about 1-2 m during an important earthquake which struck from Valdivia to Chiloé in May 1960. The area has an average tide of less than 1 m and submerged vegetation is dominated by *Egeria densa*. Prior to the earthquake the lowlands were cattle ranges and some areas still bear wetland woods dominated by *Myrceugenia planipes* and *Temu divaricatum* and stands of *Drymis winteri*. The emergent vegetation is composed of *Scirpus californicus*, *Typha angustifolia*, *Juncus multiceps* and some stands of *Phragmites australis*. The area is relatively undisturbed. At least 60 species of bird species have been recorded in the area.

Methods

At Laguna El Peral censuses were carried out daily during summer 1984-85. Since 1985 monthly counts were undertaken.

Counts were made from vantage points and by foot, around the lagune perimeter between 10.00 and 16.30. For Laguna Torca a similar method was used, but higher vantage sites were selected to cover this larger wetland area.

At Río Cruces regular counts have been undertaken since the end of 1985, when two wardens together could manage to count this large area in less than two days. A Zodiac rubber boat and a 10 HP outboard motor were used, together with binoculars and a spotting scope. Reference counts were carried out from several high vantage points. Since the end of 1988 monthly aerial surveys have been undertaken, using a Cessna highwing airplane. The area is counted from an altitude of about 700 m at the slowest speed possible. Two practiced birdwatchers census from the air independently and numbers are compared with simultaneous counts from a boat. Error on average does not exceed 6% and never 10%.

Results

1. Laguna El Peral

Laguna El Peral is a small, strongly eutrophic

pond surrounded by riparian vegetation (Ramírez *et al.* 1987). Swans occupy most of the central open-water zone free of reeds (about 60% of the total surface). The first year-round census data (from April 1979 to March 1980, Riveros *et al.* 1981) revealed an average of 35.3 individuals (maximum 54, minimum 20). Censuses by Meza (1989) for 1985-88 showed slightly higher average numbers (up to 44.7 ind. in 1988) with sharp fluctuations, from 28 to 109 birds (Fig. 2). The El Peral adult swan population does not show any trend in fluctuations due to season; 81% of the census figures fluctuated between 22 and 50 individuals. The numbers of breeding pairs remained stable between five and eight (about 20% of total population).

2. Laguna Torca

Censuses at Laguna Torca started in the early 1970s (Drouilly 1976) and were relatively regular from 1978 onwards. Since 1982, when two wardens were employed to protect the area, the local swan population has steadily increased. An average of 298 swans were counted in 1983, 328 in 1984, 435 in 1985, 447 in 1986 and 402 birds in 1987. Previous numbers did not exceed on average 120-150 swans (Fig. 3). The Torca Black-necked Swan population fluctuated seasonally with a peak during summer and a minimum during winter (Glade 1985). The highest number recorded was 850 birds and the lowest 50. The seasonal fluctuations in swan numbers are probably due to seasonal fluctuations in water level. During the winter months the water level increases making the food stocks in Laguna Torca less accessible and causing the swans to disperse to nearby waterbodies. In summer the water level is lowered, the adjacent waterbodies become too dry, and the swans return to Laguna Torca again. The local breeding population did not exceed 8% of the total swan population.

3. Río Cruces and adjacent sunken wetlands

Data on Black-necked Swan numbers in these areas were published recently by Salazar (1988). Wardening started here at the end of 1982. A second warden was employed by the end of 1985 and from then on the swan population has increased significantly until the end of 1988 ($y = 559.7 + 1162 x$, $r = 0.81$, $P < 0.001$) (Fig. 4). Regression slope = 1.162 and was also highly significant (74.00, $df = 39$).

A major drought which affected Argentina (A. Casas pers. comm.), Brazil and Uruguay (Menegheti pers. comm. and newspaper reports

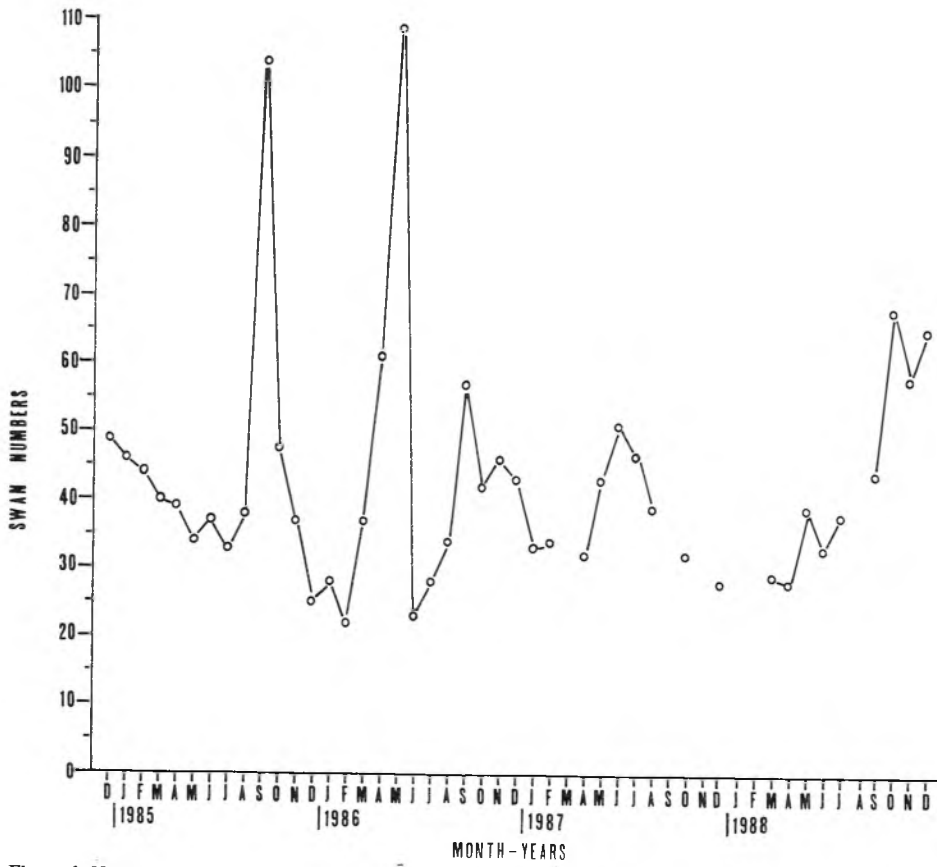


Figure 2. Numbers of Black-necked Swans at Laguna El Peral, Chile.

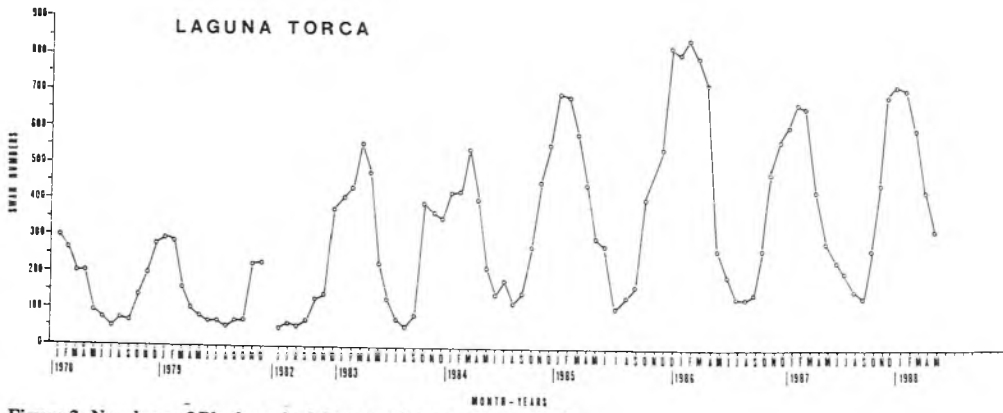


Figure 3. Numbers of Black-necked Swans at Laguna Torca, Chile.

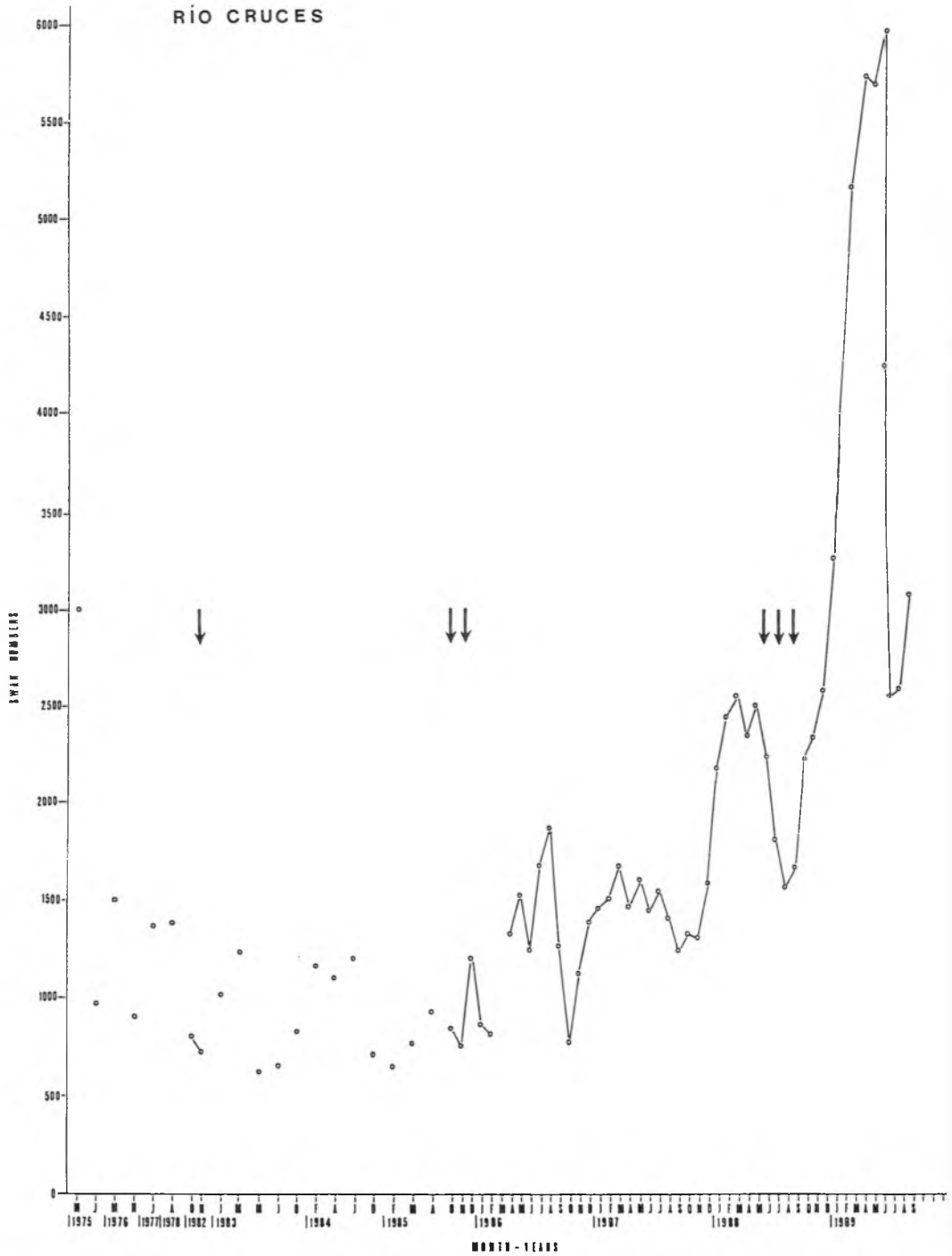


Figure 4. Numbers of Black-necked Swans at the Rio Cruces Ramsar site, southern Chile. Arrows indicate employment of wardens.

from Brazil) from the end of 1988 onwards forced Black-necked Swans to move towards southern Chile from January to May 1988. More than 4,000 Black-necked Swans arrived and spread along the Río Cruces wetland. Also, other lakes, estuaries, ponds and slow running rivers in southern Chile became occupied by groups of dispersing swans. The severe drought forced birds to reach even the Antarctic peninsula in January and February 1989 (pers. obs. and pers. comm. of various sources). Swan numbers at Río Cruces have increased more than in other waterfowl reserves. The number of breeding pairs has also increased from 55 pairs (1986-87 breeding season), 121 (1987-88) up to 243 (1988-89), reaching proportions of up to 13% of the total population in the most recent years (1987-88).

Monthly fluctuations in numbers show a decrease during spring and early summer (Fig. 4, 1986, 87 and 88) which is difficult to explain. There may be competitive and aggressive interactions at the start of the breeding season, which begins at that time, stimulating non-breeders to move away from the area.

Discussion

Chile, on the western slope of the southern Andes, is a rather young geological region. Its southern lakes are of glacial origin, of oligotrophic nature and with very little littoral endemic vegetation. Colonization of cosmopolitan water plants by anthropogenic causes, erosion, sedimentation of many waterbodies due to wrong hydrographic basin management and earthquake slides have caused changes to the ecological nature of some of these lakes, especially to the coastal waterbodies. The earthquake of 1960, which affected a great part of southern Chile (Illies 1970), caused the sinking of Río Cruces and the coastal valleys near Valdivia south to Ancud, Chiloé. This made it possible for waterbirds to colonize these waterbodies, initially with strong human interference.

For many waterbird species Chile is a marginal area. The Planalto and La Plata, Paraná and Paraguay river wetland system seems to be a key ornithoogeographical centre (Schlatter *et al.* 1983) from where many waterfowl have

spread towards the south and west of the Andes in search of productive patagonian ponds, lakes and estuaries, even to the other side of the Andes.

Events like the recent regional drought may have helped many waterbird species, like Coscoroba Swans *Coscoroba coscoroba* and Black-necked Swans to colonize the most productive Chilean waterbodies in recent times. The increase in productivity of those wetlands due to human mismanagement later attracted more and more bird species. However, bird numbers could not increase while there was disturbance from egg collectors, hunting and other human interference. Recent protection of these three wetlands has shown that avian populations can increase rapidly especially at Laguna Torca and Río Cruces. Expansive population growth has occurred at Río Cruces. After the earthquake, sunken terrain was colonized by *Egeria densa* and riparian vegetation. Also some endemic mirtacean communities have allowed swans to feed and breed in large numbers.

Laguna El Peral has reached a maximum carrying capacity. Torca must be near maximum population levels, breeding pairs have remained stable in numbers after many years (Schlatter *et al.* 1991) and during 1989-90 season no swans bred. In both places nesting sites, food and water level seem to be the key habitat controlling factors. Aggressiveness is another important problem. At Río Cruces foraging should be studied to evaluate how many swans can be supported per hectare of submerged vegetation. Previously it was thought that Black-necked Swans did not move from their traditional areas. However, the events after the regional drought, and the first observations of swans marked with plastic neck collars, showed that the swans can disperse over long distances. A national marking and banding programme is being implemented to study this aspect in more detail.

Protection of sites and wardening has succeeded in increasing swan numbers. Along the central coast of Chile new areas are now studied in order to protect them. This year hopefully counts will start at Chiloé and Pto. Natales area (Fig. 1) to evaluate changes in numbers, migration patterns and breeding habits of the Black-necked Swan along its latitudinal distribution in the Chilean range.

This study was financed by project S-88-31 DID, UACH and Fauna funds of CONAF. Financial assistance to attend the symposium was provided by Royal Society, British Council, IWRB and UACH.

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- Roberto Schlatter**, Inst. Zoología, Casilla 567, Universidad Austral de Chile.
Juan Salazar, Conaf X Región, Ismael Valdés 431, Valdivia.
Alex Villa, Conaf VII Región, 2 Poniente 1180 Pl, Talca.
Javiera Meza, Conaf V Región, Valparaíso, 3 Norte 541, Viña del Mar, Chile.