



Annual Glacier Volumes in New Zealand

1993 - 2001

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Annual Glacier Volumes in New Zealand, 1993 - 2001

Clive Heydenrych, Dr Jim Salinger, Professor Blair Fitzharris¹ and Trevor Chinn²

NIWA - AUCKLAND
National Institute of Water and
Atmospheric Research Limited

P O Box 109 695 Auckland
Tel (09) 375 2050
Fax (09) 375 2051

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¹ University of Otago

² Alpine and Polar Processes

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Executive Summary

1. This report details the current state of knowledge in developing an estimate of glacier ice volume (measured in water equivalents km^3) for New Zealand. The work undertaken in this report is a significant step to better understanding the South Island glacier responses to climate forcing.
2. This is the first time that the calculation of glacier ice volume has been undertaken from data obtained from the end of summer snowline surveys. A working group was established by National Institute of Water and Atmospheric Research (NIWA) to develop a methodology to establishing annual glacier volume changes through the Southern Alps.
- 3.. Much of the raw data used in this report originates from the 1978 New Zealand Glacier Inventory and the annual New Zealand Glacier Snowline Survey conducted since.
4. Annual values of South Island glacier ice volumes have been calculated for the eight years 1993/94 to 2000/01, using 1992/93 as the base year. Since the 1992/93 glacier year, ice volumes have fluctuated from a minimum of 53.3km^3 of water equivalent in 1993 to a maximum of 59.3 km^3 in 1996/97 after a series of cooler years with largely west to southwest circulation. Subsequently, temperatures have increased, leading to stabilization or loss of ice volume.
5. The annual regression linking ice area and volume for the Index Glaciers is consistent with seasonal climate patterns. Glacier volumes also have shown a strong correlation to inter-seasonal and decadal climate patterns of atmospheric circulation.
6. Based on the results of this study and other work, the net gain of glacial volumes pre-1997 is likely to decrease. Two out of the last four years have shown a net decrease in glacier volume, whilst three of these have shown an increase in the equilibrium line altitude (ELA) for the glacier year. Located somewhere near the middle of a glacier the end-of-summer snowline indicates an equilibrium line where snowfall exactly equals snow loss over the past glacial year. An increase in ELA indicates a decrease in glacier snow mass.

1. Introduction

The National Institute of Water and Atmospheric Research Ltd. (NIWA) has been commissioned by the Ministry of Environment (MfE) to estimate the annual glacier volume for New Zealand since 1994. MfE requires this information for their State of Environment Reporting of water resources in New Zealand.

A working group comprised of NIWA (Jim Salinger, Clive Heydenrych and Andrew Tait) and Professor Blair Fitzharris (Otago University) and Trevor Chinn (Alpine and Polar Processes Consultancy) was established to determine a suitable methodology to calculate the volume balance for each year. The working group met in Dunedin on 22-23 April 2002 to define a methodology to undertake the necessary calculations to provide the values required by MfE. While the New Zealand Glacier Snowline Survey Programme has established a hugely valuable record of long-term glacier features, no data are available on the glacier volume for the Southern Alps. The present report thus forms the first calculation in New Zealand (and to our knowledge the world), in obtaining a regional annual glacier ice volume based on end of season snowline monitoring of glaciers.

Raw data used in the study are largely based on the 1978 New Zealand Glacier Inventory and the New Zealand Glacier Snowline Survey Programme, which commenced in 1978.

The annual Snowline Survey Programme has monitored the end of summer snowline of 49 key index glaciers as a surrogate for determining annual mass balance of glacier ice. The end of summer snowline level, referred to as the Equilibrium Line Altitude (ELA), indicates the previous glacial season of snow accumulation. If the long term ELA remains at a steady height (approximately middle of the glacier), then the glacier will be in a steady state. If the long term ELA is trending upward (defined as positive), then the glacier is in retreat. Conversely if the long term ELA is trending downward (defined as negative) then the glacier is in a state of accumulation. Every season is defined relative to the long term ELA as either been positive (base height of accumulated previous season's snow level is high) or negative (if snow level is low).

2. Methodology

2.1 Definition of measured parameter

After some discussions the working group agreed on the following parameters as appropriate indicators:

- *The annual total volume of ice of New Zealand, expressed in water equivalents (km^3).*
- *Annual change in ice volume expressed in water equivalents (km^3) (with base year of 1993).*

Note that the conversion of an ice volume to a water equivalent (WE) volume is approximately 1 to 0.9.

2.2 Different Methodologies

Only two glaciers (Tasman and Ivory) have had detailed mass balance studies undertaken in New Zealand (Anderton 1975). The lack of detailed glacier data for the Southern Alps, and the cost of running detailed mass balance studies led to the New Zealand Glacier Snowline Survey Programme as a surrogate to determining the mass balance of the glaciers (Chinn and Salinger (1999). In Europe and North America, a number of methods have been used to determine annual mass balance of glaciers (Unesco 1991-2001, Dyurgerov 2002). Most of these methods involve considerable detailed programmes on these detailed methods are beyond the current scope of New Zealand funding institutions.

To provide an indication of possible methodologies, the working group reported on the following methods that have been used internationally to calculate annual glacier ice volumes (expressed as water equivalents) .

2.2.1. Change in Area

Uses change of glacier area as a measure of change in glacier volume (ΔV) measured in cubic metres (Dyurgerov and Meier 2000).

2.2.2. Parameterisation scheme

Uses total length, maximum and minimum altitude, total surface area, mean slope factor, mean basal shear stress to calculate to calculate ice thickness of ablation area. Average thickness and then glacier volume is calculated for the entire glacier using the complex parameterisation scheme (Haeberli and Hoelzle, 1995).

2.2.3. Index glacier: area-volume

Uses total area, total length, type and an estimated depth to calculate estimated volume of 49 index glaciers and then estimates the glacier volume (in WE) of 3144 glaciers in New Zealand. (Chinn, 2001), (Chinn and Salinger 1999).

2.3. Discussion on the methods

The Haeberli (method 2) parameterisation scheme was not considered appropriate for New Zealand considering the number of parameters that have not been measured for New Zealand conditions. It was agreed that a combination of methods 1 and 2 would be appropriate for calculating change in glacier ice volume (in WE) for New Zealand.

2.4. Proposed method for establishing glacier volume in New Zealand

Based on the measured data obtained from the index glacier monitoring since 1977, volume change (ΔV) (in WE) are to be calculated based on the following relationship:

$$\Delta V_{ti} = \frac{MB_{g_{ti}}}{2} [A_{acc(ti)}(H_{max_{ti}} - ELA_{ti}) - A_{ab(ti)}(ELA_{ti} - H_{min_{ti}})]$$

Where:

t = years 1994-2002	Hmax = maximum elevation of glacier
i = index glacier	Hmin = minimum elevation of glacier
MBg = Mass balance gradient	ELA = end of season equilibrium line altitude
A_{acc} = Area of accumulation	A_{abl} = Area of ablation

Based on mass balance monitoring on the Ivory and Tasman glaciers a MBg was calculated to be 2.3 m/100m (western glaciers) and 1.1 m/100m (eastern glaciers).

2.5. Calculation steps

1. Based on the 1978 glacier inventory monitoring programme, the total glacier volume for New Zealand has been estimated at 53.29km³.
2. This estimate was assumed to be constant to 1993, less the Tasman and Hooker glacier calving between 1983 and 1993.
3. ELAs are obtained for each index glacier (49 in number) for all years (1993-2002).
4. For each index glacier ΔV_{ti} is obtained.
5. A regression equation (f_{ti}) (assumed linear relationship) between change in volume (ΔV_{ti}) and change in area (ΔA_{ti}) is obtained for all index glaciers for all years where $\Delta V_{ti} = f_{ti} \Delta A_{ti}$
6. ΔV_{ti} is then totaled for all years for all glaciers based on the inventory data.
7. Glacier ice volume is then calculated from 1993 as the change ΔV_{ti} to 53.29km³ and subsequent total ice volumes.

2.6. Error estimation

It has been estimated that the error would be potentially higher for the smaller glaciers than the larger glaciers. However the small glaciers only constitute a small percentage of the total glacier volume and the error should not be significant.

2.7. Case study : Ivory Glacier

Based on measured data and knowledge of the retreat of the glacier, ΔV was calculated for the Ivory based on the above methodology.

- The Ivory glacier had an estimated volume of 18.62 X 10⁶m³ in 1978.
- A ΔV_{ivory} was calculated to be -1.70 X 10⁶m³
- This equates to 10.9 years for the whole glacier to melt
- The glacier in fact melted completely over 9-10 years after 1978.

3. Results

The annual change in glacier volume for 49 index glaciers is shown in Appendix 1. The Southern Alps acts as a single regional entity in its response to seasonal synoptic climate variations (Lamont et al 1999). Therefore a single regression equation was established for all index glaciers for each year as is shown in Table 1 and Figures 1-9 (Appendix 1).

Table 1. Linear regression equations for index glaciers (volume versus area)

Glacier Year	Linear Regression	R ² value
1992/1993	$y = 2.751x - 0.35$	R2 = 0.642
1993/1994	$y = 1.48x - 0.19$	R2 = 0.451
1994/1995	$y = 2.547x - 0.26$	R2 = 0.643
1995/1996	$y = -0.869x - 0.11$	R2 = 0.035
1996/1997	$y = 2.151x - 0.19$	R2 = 0.631
1997/1998	$y = 0.068x - 0.19$	R2 = 0.005
1998/1999	$y = -1.254x - 0.08$	R2 = 0.592
1999/2000	$y = -0.903x - 0.15$	R2 = 0.567
2000/2001	$y = 2.128x - 0.36$	R2 = 0.687

Where y=volume and x=area

Total area of 1158 km² and water equivalent volume 53.29 km³ for the New Zealand Glaciers was established in the 1978 Inventory Glacier survey undertaken by the former Ministry of Works (Chinn 2001). Although there have been some changes to glaciers since that date, these changes are considered to be relatively minor apart from the loss of ice volume through the calving of the Tasman and Hooker glaciers. .

Table 2 shows the total base glacier water equivalent volume (km³), adjusted to take into account the change in the Tasman and Hooker glaciers, the annual change and accumulated glacier water equivalent volume changes since 1993.

Table 2. New Zealand Glacier Ice Volume since 1993

Glacier Year	Base Volume (km ³)	Change in Volume (km ³)	Accumulated Volume (km ³)
1992/1993	53.28	0.00	53.28
1993/1994	53.26	1.70	54.96
1994/1995	53.23	2.93	57.86
1995/1996	53.21	-1.00	56.84
1996/1997	53.19	2.47	59.29
1997/1998	53.17	0.08	59.35
1998/1999	53.15	-1.44	57.89
1999/2000	53.12	-1.04	56.83
2000/2001	53.10	2.44	59.25

4. Discussion

The present report details the first attempt in New Zealand to establish annual glacier ice volume changes. The methodology used in the study to calculate glacier water equivalent volumes was considered by the working group to be the best available at the present time given our current state of knowledge and complexity of the glacier – climate systems.

Table 3. Climate conditions over the Southern Alps for years 1993-2001

Glacier Year	Climate	Implications for Alpine Ice volume	Change in Volume (km ³)
1993/1994	Cold year with southwest winds. Temperatures 0.6°C below normal and above average rainfall in Alpine regions.	High	1.7
1994/1995	Very frequent westerlies and southwesterlies producing 50% more precipitation in the Alps, and temperatures 0.3°C below normal.	High	2.9
1995/1996	Milder northerlies and north westerlies producing temperatures 0.5°C above average, and precipitation 125 – 150% of average in alpine areas.	Less-Average	-1.0
1996/1997	More lows tracking over New Zealand and easterlies over southern New Zealand. Temperatures 0.3°C below average.	Higher	2.5
1997/1998	Higher frequency of anticyclones and westerly winds over the south, southerlies further north. Temperatures 0.2°C below normal, but a very warm summer.	Average	0.1
1998/1999	Stronger westerly and northwesterly winds over New Zealand, temperatures 0.8°C above average, with above normal precipitation on the West Coast.	Less	-1.4
1999/2000	Very anticyclonic, with weaker westerlies than normal. Temperatures 0.7°C above normal, and rainfall slightly below normal.	Less	-1.0
2000/2001	More northwesterlies over the South Island, temperatures 0.2°C above normal. Rainfall close to average.	Average-High	2.4

Change in water equivalent volume for the Southern Alps glaciers has been shown to vary between 0-5% from year to year. This is of similar magnitude to glacier responses shown in the Northern Hemisphere (UNESCO, 1991 – 2001).

The regression equations obtained from the Index Glaciers appear to be consistent with the climatic conditions for each of the years shown in Table 3. Years with the largest loss of ice volume (1998/99 and 1999/2000) were all much warmer than normal. The highest year where ice volume increased most (1994/195) was a cool year with much more precipitation in the Southern Alps. Years 1995/96 and 1997/98 with low R^2 values actually correspond to less net gain/loss of snow cover years. All the other years have strong gains or losses, and generally have R^2 values greater than 0.5.

Seasonal and decadal climatic features such as the El Nino/La Nina and Interdecadal Pacific Oscillation (IPO) are known to have significant impacts on New Zealand climate. Similarly El Nino/La Nina systems have been shown to have significant impacts on glacier balances (Fitzharris et al. 1997). The IPO which changes phase about every 20-30 years, and appears to have changed to its negative phase about 1998 (Salinger and Mullan, 1999; Salinger et al. 2001). There is thus a possible change to more frequent northeasterly wind flow over New Zealand during the next 20 years or so. This is likely to result in reduced snow accumulation in the Southern Alps and a net reduction in glacier volumes. Since 1997/98 there have been net negative changes in glacier volumes (Data from year 2001/2002 is known to be negative for mass balance changes, but not yet published at the time of preparing this report).

Conclusions

This report details the current state of knowledge in developing an estimate of glacier ice volume (measured in water equivalents km^3) for New Zealand. The work undertaken in this report is a significant step to better understanding the South Island glacier responses to climate forcing.

The annual regression linking ice area and volume for the Index Glaciers is consistent with seasonal climate patterns. Glacier volumes also have shown a strong correlation to inter-seasonal and decadal climate patterns of atmospheric circulation.

Based on the results of this study and other work, the net gain of glacial volumes pre-1997 is expected to decrease over the next twenty years. Three of the last four years have shown a net decrease in glacial volume.

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Appendix 1

Glacier	Order Nrth- Sth	Year	MBg W=2.3 E=1.1	ELA (m)	Snow Hmax (m)	Snow Hmin (m)	Snow Area Acc (ha)	Snow Area Ab (ha)	Total area (ha)	Change Vol (m3)
Ella	2	1993	2.3	2154	2265	2000	5.3	0.0	5.3	6.79E+06
Fraerie										
Queen	3	1993	1.1	2030	2215	1920	5.7	0.0	5.7	5.84E+06
Franklin	4	1993	2.3	1850	1978	1650	8.9	0.0	8.9	1.30E+07
Rolleston	6	1993	2.3	1767	1860	1620	19.1	0.0	19.1	2.04E+07
Carrington	7	1993	1.1	1665	1952	1545	15.5	0.0	15.5	2.45E+07
Browning	8	1993	2.3	1564	1628	1480	2.0	2.1	4.1	-4.86E+05
Retreat	9	1993	2.3	1720	1888	1465	22.8	5.9	28.7	2.68E+07
Marmaduke	10	1993	2.3	1865	1998	1655	90.3	2.2	92.5	1.33E+08
Avoca	11	1993	1.1	1950	2080	1850	9.8	0.0	9.8	7.01E+06
Jaspur	12	1993	2.3	1735	1788	1570	14.1	0.0	14.1	8.59E+06
Kea	13	1993	2.3	1832	2020	1570	76.9	0.0	76.9	1.66E+08
Dainty	14	1993	2.3	1918	2130	1778	43.7	1.6	45.3	1.04E+08
Butler	15	1993	2.3	1835	1988	1650	72.1	2.5	74.6	1.21E+08
Douglas	16	1993	1.1	2120	2290	1780	33.9	0.0	33.9	3.17E+07
Seige	17	1993	2.3	1630	2150	1340	151.9	0.0	151.9	9.08E+08
Vertebrae 40	18	1993	2.3	1878	1965	1746	73.1	2.5	75.6	6.94E+07
Salisbury	19	1993	2.3	1860	2030	1645	279.9	32.0	311.9	4.68E+08
Jalf	20	1993	2.3	1732	2055	1550	102.1	0.0	102.1	3.79E+08
Chancellor	21	1993	2.3	1830	1950	1545	24.1	0.0	24.1	3.32E+07
Langdale	23	1993	2.3	2238	2328	1950	40.4	0.0	40.4	4.18E+07
Ridge	24	1993	1.1	2244	2315	2087	73.5	0.0	73.5	2.87E+07
Jack	25	1993	2.3	1930	2008	1750	21.1	0.4	21.5	1.82E+07
Jackson	26	1993	2.3	2053	2165	1990	49.0	3.2	52.2	6.08E+07
McKenzie	27	1993	2.3	1915	2078	1720	46.4	2.3	48.7	8.17E+07
Blair	28	1993	1.1	1980	2090	1812	17.7	8.7	26.4	2.64E+06
Glenmary	29	1993	1.1	2186	2272	2032	49.5	9.0	58.5	1.58E+07
Lindsay	30	1993	2.3	1754	1875	1550	52.5	0.0	52.5	7.31E+07
Stuart	31	1993	2.3	1728	1850	1515	31.6	0.0	31.6	4.43E+07
Brewster	32	1993	2.3	1905	2280	1750	234.7	14.8	249.5	9.86E+08
Thurneyston	33	1993	1.1	1970	2132	1865	101.9	15.9	117.8	8.16E+07
Findlay	35	1993	2.3	1664	1890	1561	62.9	4.3	67.2	1.58E+08
Caria	36	1993	2.3	1426	1660	1366	17.1	0.0	17.1	4.61E+07
Snowy	37	1993	1.1	2092	2240	2020	40.7	12.4	53.1	2.82E+07
Fog	38	1993	1.1	1995	2122	1888	18.2	0.0	18.2	1.27E+07
Llawrenry	40	1993	2.3	1460	1670	1300	17.1	0.9	18.1	3.96E+07
Gendarme	41	1993	2.3	1628	1804	1418	46.4	2.9	49.4	8.69E+07
Gunn	42	1993	2.3	1533	1810	1471	48.1	5.6	53.7	1.49E+08
Ailsa	43	1993	2.3	1605	1830	1555	18.8	4.1	22.9	4.63E+07
Bryant	44	1993	1.1	1752	2010	1630	17.2	12.5	29.7	1.60E+07
Larkins	45	1993	1.1	1962	2206	1630	27.5	0.0	27.5	3.69E+07
Barrier	46	1993	2.3	1632	1900	1360	57.6	0.0	57.6	1.77E+08
Irene	47	1993	2.3	1515	1700	1400	18.0	0.0	18.0	3.82E+07
Merrie	48	1993	2.3	1505	1688	1350	16.2	0.0	12.8	3.41E+07
Caroline	49	1993	2.3	1425	1600	1220	10.0	0.0	10.0	2.01E+07
Ella	2	1994	2.3	2154	2265	2000	5.3	0.0	5.3	6.79E+06

Fraerie Queen	3	1994	1.1	2030	2215	1920	5.7	0.0	5.7	5.84E+06
Franklin	4	1994	2.3	1850	1978	1650	8.8	0.1	8.9	1.28E+07
Rolleston	6	1994	2.3	1767	1860	1620	17.4	1.7	19.1	1.58E+07
Carrington	7	1994	1.1	1665	1952	1545	15.5	0.0	15.5	2.45E+07
Browning	8	1994	2.3	1564	1628	1480	4.1	0.0	4.1	3.00E+06
Retreat	9	1994	2.3	1720	1888	1465	28.7	0.0	28.7	5.54E+07
Marmaduke	10	1994	2.3	1865	1998	1655	78.5	14.0	92.5	8.61E+07
Avoca	11	1994	1.1	1950	2080	1850	7.2	2.6	9.8	3.72E+06
Jaspur	12	1994	2.3	1735	1788	1570	14.1	0.0	14.1	8.59E+06
Kea	13	1994	2.3	1832	2020	1570	68.1	8.8	76.9	1.21E+08
Dainty	14	1994	2.3	1918	2130	1778	36.9	8.4	45.3	7.65E+07
Butler	15	1994	2.3	1835	1988	1650	53.6	21.0	74.6	4.96E+07
Douglas	16	1994	1.1	2120	2290	1780	31.2	2.7	33.9	2.42E+07
Seige	17	1994	2.3	1630	2150	1340	78.4	73.5	151.9	2.24E+08
Vertebrae 41	18	1994	2.3	1878	1965	1746	71.1	4.5	75.6	6.43E+07
Salisbury	19	1994	2.3	1860	2030	1645	229.0	82.9	311.9	2.43E+08
Jalf	20	1994	2.3	1732	2055	1550	41.5	60.6	102.1	2.71E+07
Chancellor	21	1994	2.3	1830	1950	1545	23.0	1.1	24.1	2.80E+07
Langdale	23	1994	2.3	2238	2328	1950	13.9	26.6	40.4	-7.37E+07
Ridge	24	1994	1.1	2244	2315	2087	66.3	7.2	73.5	1.97E+07
Jack	25	1994	2.3	1930	2008	1750	17.7	3.8	21.5	7.99E+06
Jackson	26	1994	2.3	2053	2165	1990	37.1	15.0	52.2	3.69E+07
McKenzie	27	1994	2.3	1915	2078	1720	29.7	19.0	48.7	1.31E+07
Blair	28	1994	1.1	1980	2090	1812	22.7	3.7	26.4	1.03E+07
Glenmary	29	1994	1.1	2186	2272	2032	47.4	11.1	58.5	1.30E+07
Lindsay	30	1994	2.3	1754	1875	1550	52.5	0.0	52.5	7.31E+07
Stuart	31	1994	2.3	1728	1850	1515	28.0	3.6	31.6	3.04E+07
Brewster	32	1994	2.3	1905	2280	1750	222.5	27.0	249.5	9.11E+08
Thurneyston	33	1994	1.1	1970	2132	1865	103.4	14.4	117.8	8.38E+07
Findlay	35	1994	2.3	1664	1890	1561	46.9	20.3	67.2	9.78E+07
Caria	36	1994	2.3	1426	1660	1366	17.1	0.0	17.1	4.61E+07
Snowy	37	1994	1.1	2092	2240	2020	52.5	0.6	53.1	4.25E+07
Fog	38	1994	1.1	1995	2122	1888	17.6	0.6	18.2	1.19E+07
Park Pass	39	1994	2.3	1815	1962	1610	138.1	75.5	213.6	5.55E+07
Llawrenry	40	1994	2.3	1460	1670	1300	15.6	2.5	18.1	3.31E+07
Gendarme	41	1994	2.3	1628	1804	1418	40.6	8.8	49.4	6.08E+07
Gunn	42	1994	2.3	1533	1810	1471	33.4	20.3	53.7	9.19E+07
Ailsa	43	1994	2.3	1605	1830	1555	14.7	8.2	22.9	3.33E+07
Bryant	44	1994	1.1	1752	2010	1630	23.4	6.3	29.7	2.90E+07
Larkins	45	1994	1.1	1962	2206	1630	23.4	4.1	27.5	2.40E+07
Barrier	46	1994	2.3	1632	1900	1360	55.2	2.3	57.6	1.63E+08
Irene	47	1994	2.3	1515	1700	1400	11.1	6.9	18.0	1.44E+07
Merrie	48	1994	2.3	1505	1688	1350	11.7	1.1	12.8	2.28E+07
Ella	2	1995	2.3	2154	2265	2000	5.3	0.0	5.3	6.79E+06
Fraerie Queen	3	1995	1.1	2030	2215	1920	5.7	0.0	5.7	5.84E+06
Franklin	4	1995	2.3	1850	1978	1650	8.9	0.0	8.9	1.30E+07
Rolleston	6	1995	2.3	1767	1860	1620	19.1	0.0	19.1	2.04E+07
Carrington	7	1995	1.1	1665	1952	1545	15.5	0.0	15.5	2.45E+07
Browning	8	1995	2.3	1564	1628	1480	4.1	0.0	4.1	3.00E+06
Retreat	9	1995	2.3	1720	1888	1465	28.7	0.0	28.7	5.54E+07
Marmaduke	10	1995	2.3	1865	1998	1655	92.1	0.4	92.5	1.40E+08
Avoca	11	1995	1.1	1950	2080	1850	8.8	1.0	9.8	5.74E+06

Jaspur	12	1995	2.3	1735	1788	1570	14.1	0.0	14.1	8.59E+06
Kea	13	1995	2.3	1832	2020	1570	76.9	0.0	76.9	1.66E+08
Dainty	14	1995	2.3	1918	2130	1778	41.9	3.4	45.3	9.69E+07
Butler	15	1995	2.3	1835	1988	1650	74.6	0.0	74.6	1.31E+08
Douglas	16	1995	1.1	2120	2290	1780	33.9	0.0	33.9	3.17E+07
Seige	17	1995	2.3	1630	2150	1340	151.9	0.0	151.9	9.08E+08
Vertebrae 42	18	1995	2.3	1878	1965	1746	73.1	2.5	75.6	6.94E+07
Salisbury	19	1995	2.3	1860	2030	1645	296.7	15.2	311.9	5.42E+08
Jalf	20	1995	2.3	1732	2055	1550	102.1	0.0	102.1	3.79E+08
Chancellor	21	1995	2.3	1830	1950	1545	24.1	0.0	24.1	3.32E+07
Langdale	23	1995	2.3	2238	2328	1950	40.4	0.0	40.4	4.18E+07
Ridge	24	1995	1.1	2244	2315	2087	70.8	2.7	73.5	2.53E+07
Jack	25	1995	2.3	1930	2008	1750	21.5	0.0	21.5	1.93E+07
Jackson	26	1995	2.3	2053	2165	1990	44.3	7.8	52.2	5.14E+07
McKenzie	27	1995	2.3	1915	2078	1720	43.9	4.8	48.7	7.14E+07
Blair	28	1995	1.1	1980	2090	1812	23.3	3.1	26.4	1.12E+07
Glenmary	29	1995	1.1	2186	2272	2032	47.6	10.9	58.5	1.33E+07
Lindsay	30	1995	2.3	1754	1875	1550	52.5	0.0	52.5	7.31E+07
Stuart	31	1995	2.3	1728	1850	1515	31.6	0.0	31.6	4.43E+07
Brewster	32	1995	2.3	1905	2280	1750	227.6	21.9	249.5	9.42E+08
Thurneyston	33	1995	1.1	1970	2132	1865	109.4	8.4	117.8	9.26E+07
Findlay	35	1995	2.3	1664	1890	1561	65.2	2.0	67.2	1.67E+08
Caria	36	1995	2.3	1426	1660	1366	17.1	0.0	17.1	4.61E+07
Fog	38	1995	1.1	1995	2122	1888	18.2	0.0	18.2	1.27E+07
Park Pass	39	1995	2.3	1815	1962	1610	187.6	26.0	213.6	2.56E+08
Llawrenry	40	1995	2.3	1460	1670	1300	18.1	0.0	18.1	4.36E+07
Gendarme	41	1995	2.3	1628	1804	1418	49.4	0.0	49.4	9.99E+07
Gunn	42	1995	2.3	1533	1810	1471	53.3	0.4	53.7	1.70E+08
Ailsa	43	1995	2.3	1605	1830	1555	19.8	3.1	22.9	4.94E+07
Bryant	44	1995	1.1	1752	2010	1630	29.7	0.0	29.7	4.21E+07
Larkins	45	1995	1.1	1962	2206	1630	27.5	0.0	27.5	3.69E+07
Barrier	46	1995	2.3	1632	1900	1360	57.6	0.0	57.6	1.77E+08
Irene	47	1995	2.3	1515	1700	1400	18.0	0.0	18.0	3.82E+07
Merrie	48	1995	2.3	1505	1688	1350	12.8	0.0	12.8	2.69E+07
Caroline	49	1995	2.3	1425	1600	1220	10.0	0.0	10.0	2.01E+07
Ella	2	1996	2.3	2154	2265	2000	4.4	0.9	5.3	4.05E+06
Fraerie										
Queen	3	1996	1.1	2030	2215	1920	5.7	0.0	5.7	5.84E+06
Franklin	4	1996	2.3	1850	1978	1650	8.7	0.2	8.9	1.23E+07
Rolleston	6	1996	2.3	1767	1860	1620	16.8	2.3	19.1	1.40E+07
Carrington	7	1996	1.1	1665	1952	1545	14.9	0.6	15.5	2.31E+07
Browning	8	1996	2.3	1564	1628	1480	1.4	2.7	4.1	-1.59E+06
Retreat	9	1996	2.3	1720	1888	1465	11.7	17.1	28.7	-2.75E+07
Marmaduke	10	1996	2.3	1865	1998	1655	82.2	10.3	92.5	1.01E+08
Avoca	11	1996	1.1	1950	2080	1850	3.6	6.2	9.8	-8.74E+05
Jaspur	12	1996	2.3	1735	1788	1570	13.6	0.5	14.1	7.33E+06
Kea	13	1996	2.3	1832	2020	1570	31.3	45.7	76.9	-7.00E+07
Dainty	14	1996	2.3	1918	2130	1778	21.0	24.3	45.3	1.19E+07
Butler	15	1996	2.3	1835	1988	1650	62.1	12.5	74.6	8.26E+07
Douglas	16	1996	1.1	2120	2290	1780	31.4	2.5	33.9	2.47E+07
Seige	17	1996	2.3	1630	2150	1340	80.5	71.4	151.9	2.43E+08
Vertebrae 43	18	1996	2.3	1878	1965	1746	71.1	4.5	75.6	6.43E+07
Salisbury	19	1996	2.3	1860	2030	1645	267.9	44.0	311.9	4.15E+08
Jalf	20	1996	2.3	1732	2055	1550	17.3	84.9	102.1	-1.14E+08

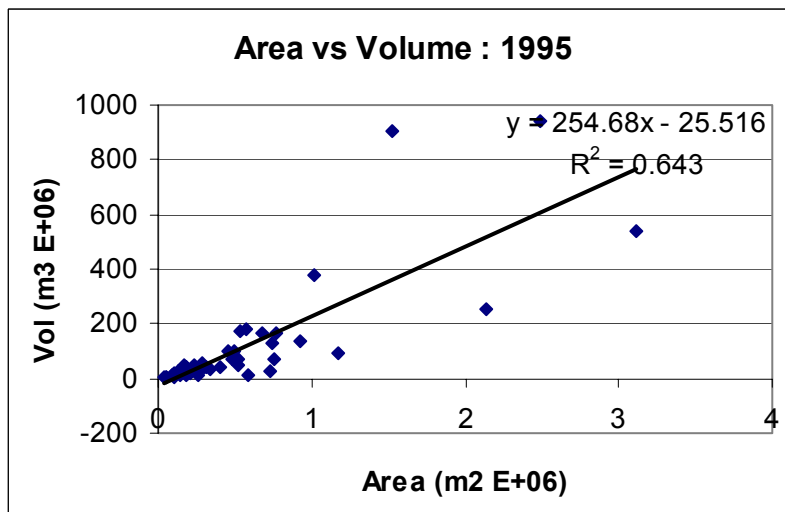
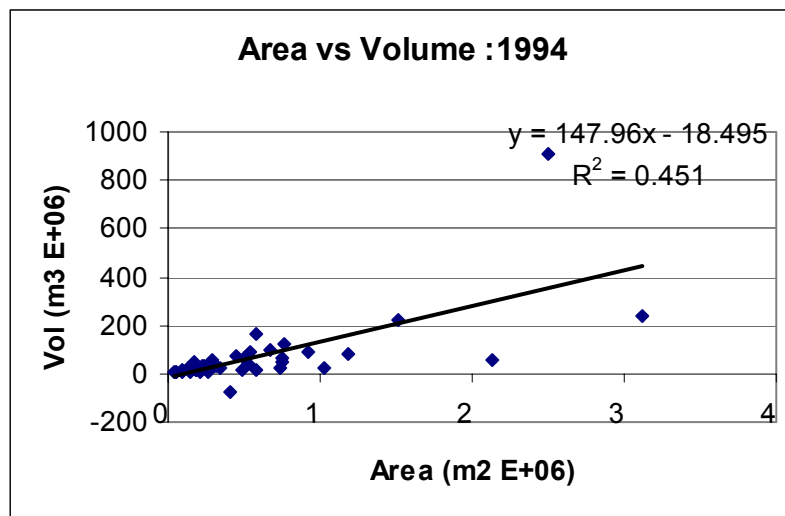
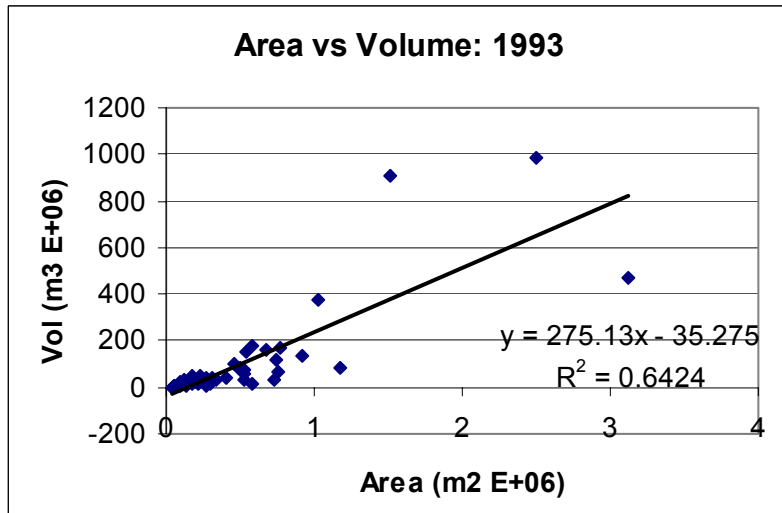
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Langdale	23	1996	2.3	2238	2328	1950	24.6	15.8	40.4	-2.70E+07
Ridge	24	1996	1.1	2244	2315	2087	70.0	3.5	73.5	2.43E+07
Jack	25	1996	2.3	1930	2008	1750	7.6	13.9	21.5	-2.18E+07
Jackson	26	1996	2.3	2053	2165	1990	30.0	22.2	52.2	2.25E+07
McKenzie	27	1996	2.3	1915	2078	1720	29.9	18.8	48.7	1.38E+07
Blair	28	1996	1.1	1980	2090	1812	18.4	8.0	26.4	3.78E+06
Glenmary	29	1996	1.1	2186	2272	2032	46.3	12.3	58.5	1.15E+07
Lindsay	30	1996	2.3	1754	1875	1550	24.5	28.1	52.5	-3.18E+07
Stuart	31	1996	2.3	1728	1850	1515	21.2	10.4	31.6	4.39E+06
Brewster	32	1996	2.3	1905	2280	1750	89.9	159.6	249.5	1.03E+08
Thurneyston	33	1996	1.1	1970	2132	1865	94.1	23.7	117.8	7.01E+07
Findlay	35	1996	2.3	1664	1890	1561	47.5	19.6	67.2	1.00E+08
Caria	36	1996	2.3	1426	1660	1366	17.1	0.0	17.1	4.61E+07
Snowy	37	1996	1.1	2092	2240	2020	41.0	12.1	53.1	2.86E+07
Fog	38	1996	1.1	1995	2122	1888	18.2	0.0	18.2	1.27E+07
Park Pass	39	1996	2.3	1815	1962	1610	143.2	70.4	213.6	7.60E+07
Llawrenry	40	1996	2.3	1460	1670	1300	10.5	7.5	18.1	1.16E+07
Gendarme	41	1996	2.3	1628	1804	1418	45.2	4.2	49.4	8.15E+07
Gunn	42	1996	2.3	1533	1810	1471	40.1	13.6	53.7	1.18E+08
Ailsa	43	1996	2.3	1605	1830	1555	16.3	6.6	22.9	3.83E+07
Bryant	44	1996	1.1	1752	2010	1630	29.1	0.6	29.7	4.09E+07
Larkins	45	1996	1.1	1962	2206	1630	27.5	0.0	27.5	3.69E+07
Barrier	46	1996	2.3	1632	1900	1360	55.5	2.1	57.6	1.65E+08
Irene	47	1996	2.3	1515	1700	1400	12.1	5.8	18.0	1.81E+07
Merrie	48	1996	2.3	1505	1688	1350	11.5	1.3	12.8	2.20E+07
Caroline	49	1996	2.3	1425	1600	1220	8.9	1.1	10.0	1.54E+07
Rolleston	6	1997	2.3	1767	1860	1620	19.1	0.0	19.1	2.04E+07
Carrington	7	1997	1.1	1665	1952	1545	15.5	0.0	15.5	2.45E+07
Browning	8	1997	2.3	1564	1628	1480	4.1	0.0	4.1	3.00E+06
Retreat	9	1997	2.3	1720	1888	1465	25.2	3.5	28.7	3.84E+07
Marmaduke	10	1997	2.3	1865	1998	1655	91.9	0.7	92.5	1.39E+08
Avoca	11	1997	1.1	1950	2080	1850	9.8	0.0	9.8	7.01E+06
Jaspur	12	1997	2.3	1735	1788	1570	14.1	0.0	14.1	8.59E+06
Kea	13	1997	2.3	1832	2020	1570	76.9	0.0	76.9	1.66E+08
Dainty	14	1997	2.3	1918	2130	1778	40.3	5.0	45.3	9.02E+07
Butler	15	1997	2.3	1835	1988	1650	74.6	0.0	74.6	1.31E+08
Douglas	16	1997	1.1	2120	2290	1780	33.9	0.0	33.9	3.17E+07
Seige	17	1997	2.3	1630	2150	1340	116.4	35.5	151.9	5.78E+08
Vertebrae 44	18	1997	2.3	1878	1965	1746	72.3	3.3	75.6	6.73E+07
Salisbury	19	1997	2.3	1860	2030	1645	276.9	35.0	311.9	4.55E+08
Jalf	20	1997	2.3	1732	2055	1550	99.5	2.6	102.1	3.64E+08
Chancellor	21	1997	2.3	1830	1950	1545	24.1	0.0	24.1	3.32E+07
Langdale	23	1997	2.3	2238	2328	1950	40.4	0.0	40.4	4.18E+07
Ridge	24	1997	1.1	2244	2315	2087	73.5	0.0	73.5	2.87E+07
Jack	25	1997	2.3	1930	2008	1750	20.2	1.3	21.5	1.54E+07
Jackson	26	1997	2.3	2053	2165	1990	44.9	7.3	52.2	5.25E+07
McKenzie	27	1997	2.3	1915	2078	1720	48.7	0.0	48.7	9.12E+07
Glenmary	29	1997	1.1	2186	2272	2032	55.5	3.0	58.5	2.37E+07
Lindsay	30	1997	2.3	1754	1875	1550	69.0	1.7	52.5	9.21E+07
Stuart	31	1997	2.3	1728	1850	1515	31.6	0.0	31.6	4.43E+07
Brewster	32	1997	2.3	1905	2280	1750	226.3	23.2	249.5	9.35E+08
Thurneyston	33	1997	1.1	1970	2132	1865	103.9	14.0	117.8	8.45E+07

Findlay	35	1997	2.3	1664	1890	1561	62.0	5.2	67.2	1.55E+08
Caria	36	1997	2.3	1426	1660	1366	17.1	0.0	17.1	4.61E+07
Snowy	37	1997	1.1	2092	2240	2020	53.1	0.0	53.1	4.32E+07
Fog	38	1997	1.1	1995	2122	1888	18.2	0.0	18.2	1.27E+07
Park Pass	39	1997	2.3	1815	1962	1610	160.2	53.4	213.6	1.45E+08
Llawrenry	40	1997	2.3	1460	1670	1300	17.7	0.4	18.1	4.21E+07
Gendarme	41	1997	2.3	1628	1804	1418	47.3	2.1	49.4	9.06E+07
Gunn	42	1997	2.3	1533	1810	1471	36.2	17.5	53.7	1.03E+08
Ailsa	43	1997	2.3	1605	1830	1555	15.2	7.8	22.9	3.47E+07
Bryant	44	1997	1.1	1752	2010	1630	29.0	0.7	29.7	4.07E+07
Larkins	45	1997	1.1	1962	2206	1630	27.5	0.0	27.5	3.69E+07
Barrier	46	1997	2.3	1632	1900	1360	57.6	0.0	57.6	1.77E+08
Irene	47	1997	2.3	1515	1700	1400	18.0	0.0	18.0	3.82E+07
Merrie	48	1997	2.3	1505	1688	1350	12.8	0.0	12.8	2.69E+07
Caroline	49	1997	2.3	1425	1600	1220	10.0	0.0	10.0	2.01E+07
Ella	2	1998	2.3	2154	2265	2000	2.9	2.4	5.3	-5.23E+05
Fraerie Queen	3	1998	1.1	2030	2215	1920	5.7	0.0	5.7	5.84E+06
Franklin	4	1998	2.3	1850	1978	1650	0.8	8.0	8.9	-1.72E+07
Rolleston	6	1998	2.3	1767	1860	1620	4.8	14.3	19.1	-1.90E+07
Carrington	7	1998	1.1	1665	1952	1545	8.7	6.8	15.5	9.22E+06
Browning	8	1998	2.3	1564	1628	1480	0.6	3.5	4.1	-3.01E+06
Retreat	9	1998	2.3	1720	1888	1465	7.3	21.4	28.7	-4.87E+07
Marmaduke	10	1998	2.3	1865	1998	1655	26.8	65.7	92.5	-1.18E+08
Avoca	11	1998	1.1	1950	2080	1850	1.0	5.3	9.8	-2.23E+06
Jaspur	12	1998	2.3	1735	1788	1570	5.8	8.3	14.1	-1.23E+07
Kea	13	1998	2.3	1832	2020	1570	31.7	45.2	76.9	-6.76E+07
Dainty	14	1998	2.3	1918	2130	1778	10.2	35.1	45.3	-3.15E+07
Butler	15	1998	2.3	1835	1988	1650	16.1	58.5	74.6	-9.62E+07
Douglas	16	1998	1.1	2120	2290	1780	10.7	23.2	33.9	-3.34E+07
Seige	17	1998	2.3	1630	2150	1340	30.8	121.1	151.9	-2.19E+08
Vertebrae 45	18	1998	2.3	1878	1965	1746	62.0	13.6	75.6	4.14E+07
Salisbury	19	1998	2.3	1860	2030	1645	223.2	88.7	311.9	2.17E+08
Jalf	20	1998	2.3	1732	2055	1550	15.8	86.3	102.1	-1.22E+08
Chancellor	21	1998	2.3	1830	1950	1545	10.7	13.4	24.1	-2.92E+07
Langdale	23	1998	2.3	2238	2328	1950	5.4	35.0	40.4	-1.10E+08
Ridge	24	1998	1.1	2244	2315	2087	47.0	25.5	73.5	-3.66E+06
Jack	25	1998	2.3	1930	2008	1750	11.2	10.3	21.5	-1.14E+07
Jackson	26	1998	2.3	2053	2165	1990	27.1	25.1	52.2	1.67E+07
McKenzie	27	1998	2.3	1915	2078	1720	25.5	23.1	48.7	-4.04E+06
Blair	28	1998	1.1	1980	2090	1812	16.4	10.1	26.4	6.02E+05
Glenmary	29	1998	1.1	2186	2272	2032	32.3	26.2	58.5	-6.87E+06
Lindsay	30	1998	2.3	1754	1875	1550	14.5	38.1	52.5	-6.92E+07
Stuart	31	1998	2.3	1728	1850	1515	26.9	4.7	31.6	2.62E+07
Brewster	32	1998	2.3	1905	2280	1750	67.0	182.5	249.5	-3.66E+07
Thurneyston	33	1998	1.1	1970	2132	1865	85.3	32.5	117.8	5.72E+07
Findlay	35	1998	2.3	1664	1890	1561	29.1	38.1	67.2	3.04E+07
Caria	36	1998	2.3	1426	1660	1366	12.5	4.7	17.1	3.03E+07
Snowy	37	1998	1.1	2092	2240	2020	6.4	46.7	53.1	-1.33E+07
Fog	38	1998	1.1	1995	2122	1888	1.8	16.5	18.2	-8.44E+06
Park Pass	39	1998	2.3	1815	1962	1610	105.8	107.8	213.6	-7.53E+07
Llawrenry	40	1998	2.3	1460	1670	1300	9.2	8.9	18.1	5.79E+06
Gendarme	41	1998	2.3	1628	1804	1418	26.5	22.9	49.4	-1.77E+06
Gunn	42	1998	2.3	1533	1810	1471	25.4	28.3	53.7	6.08E+07

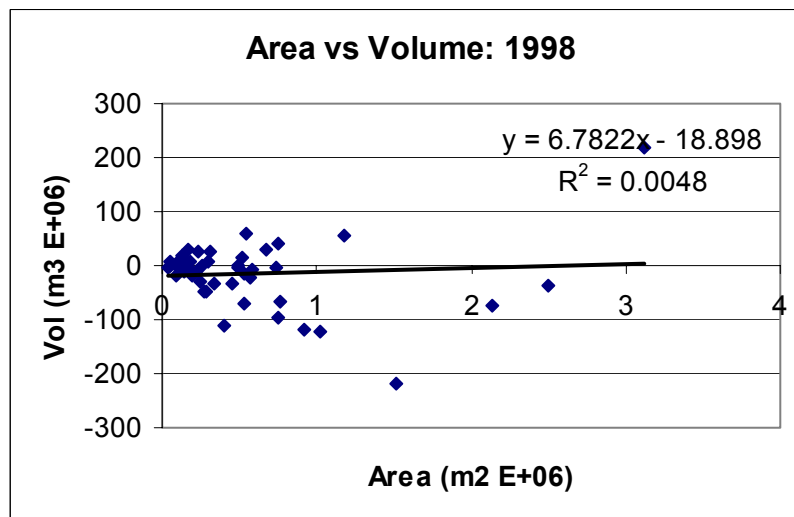
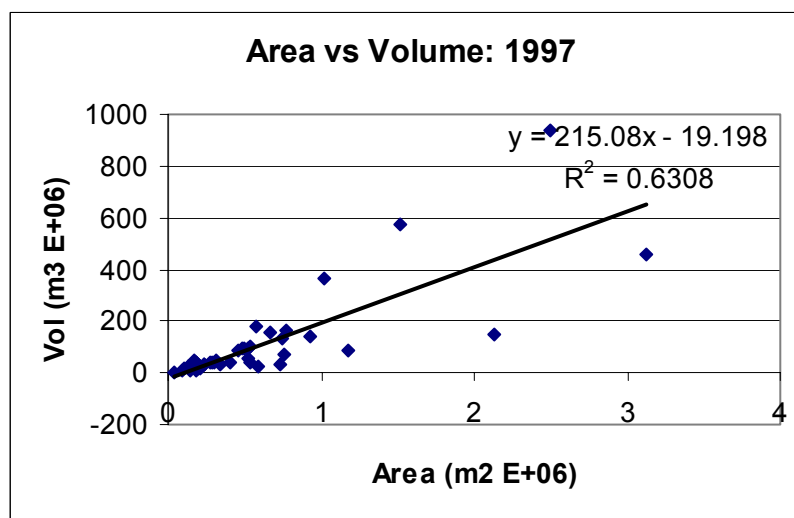
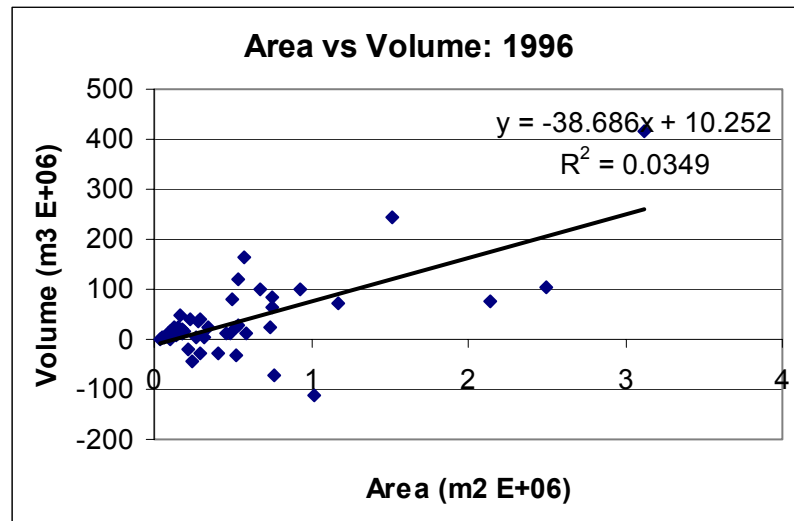
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Bryant	44	1998	1.1	1752	2010	1630	13.2	16.5	29.7	7.58E+06
Larkins	45	1998	1.1	1962	2206	1630	0.9	26.6	27.5	-4.72E+07
Barrier	46	1998	2.3	1632	1900	1360	25.1	32.4	57.6	-2.39E+07
Irene	47	1998	2.3	1515	1700	1400	4.7	13.2	18.0	-7.42E+06
Merrie	48	1998	2.3	1505	1688	1350	10.7	2.1	12.8	1.87E+07
Caroline	49	1998	2.3	1425	1600	1220	7.4	2.6	10.0	8.92E+06
Ella	2	1999	2.3	2154	2265	2000	0.0	5.3	5.3	-9.42E+06
Fraerie										
Queen	3	1999	1.1	2030	2215	1920	0.0	5.7	5.7	-3.47E+06
Franklin	4	1999	2.3	1850	1978	1650	0.3	8.6	8.9	-1.94E+07
Rolleston	6	1999	2.3	1767	1860	1620	0.8	18.3	19.1	-3.01E+07
Carrington	7	1999	1.1	1665	1952	1545	2.9	12.6	15.5	-3.65E+06
Browning	8	1999	2.3	1564	1628	1480	0.0	4.1	4.1	-3.94E+06
Retreat	9	1999	2.3	1720	1888	1465	1.9	26.8	28.7	-7.49E+07
Marmaduke	10	1999	2.3	1865	1998	1655	21.5	71.0	92.5	-1.39E+08
Avoca	11	1999	1.1	1950	2080	1850	0.0	3.2	9.8	-1.77E+06
Jaspur	12	1999	2.3	1735	1788	1570	0.0	14.1	14.1	-2.67E+07
Kea	13	1999	2.3	1832	2020	1570	1.5	75.5	76.9	-2.24E+08
Dainty	14	1999	2.3	1918	2130	1778	4.2	41.1	45.3	-5.61E+07
Butler	15	1999	2.3	1835	1988	1650	8.0	66.5	74.6	-1.27E+08
Douglas	16	1999	1.1	2120	2290	1780	8.9	25.0	33.9	-3.85E+07
Seige	17	1999	2.3	1630	2150	1340	4.4	147.5	151.9	-4.66E+08
Vertebrae 46	18	1999	2.3	1878	1965	1746	2.6	72.9	75.6	-1.08E+08
Salisbury	19	1999	2.3	1860	2030	1645	116.7	195.2	311.9	-2.54E+08
Jalf	20	1999	2.3	1732	2055	1550	0.0	102.1	102.1	-2.14E+08
Chancellor	21	1999	2.3	1830	1950	1545	0.0	24.1	24.1	-7.89E+07
Langdale	23	1999	2.3	2238	2328	1950	7.6	32.8	40.4	-1.01E+08
Ridge	24	1999	1.1	2244	2315	2087	53.3	20.2	73.5	3.35E+06
Jack	25	1999	2.3	1930	2008	1750	2.0	19.5	21.5	-3.86E+07
Jackson	26	1999	2.3	2053	2165	1990	8.6	43.5	52.2	-2.04E+07
McKenzie	27	1999	2.3	1915	2078	1720	2.8	45.9	48.7	-9.76E+07
Blair	28	1999	1.1	1980	2090	1812	6.0	20.4	26.4	-1.52E+07
Glenmary	29	1999	1.1	2186	2272	2032	13.4	45.1	58.5	-3.19E+07
Lindsay	30	1999	2.3	1754	1875	1550	0.9	51.6	52.5	-1.20E+08
Stuart	31	1999	2.3	1728	1850	1515	5.5	26.1	31.6	-5.62E+07
Brewster	32	1999	2.3	1905	2280	1750	8.2	241.3	249.5	-3.95E+08
Thurneyston	33	1999	1.1	1970	2132	1865	38.7	79.1	117.8	-1.12E+07
Findlay	35	1999	2.3	1664	1890	1561	2.1	65.0	67.2	-7.16E+07
Caria	36	1999	2.3	1426	1660	1366	0.0	17.1	17.1	-1.18E+07
Snowy	37	1999	1.1	2092	2240	2020	53.1	0.0	53.1	4.32E+07
Fog	38	1999	1.1	1995	2122	1888	0.7	17.5	18.2	-9.77E+06
Park Pass	39	1999	2.3	1815	1962	1610	62.1	151.5	213.6	-2.52E+08
Llawrenry	40	1999	2.3	1460	1670	1300	0.3	17.8	18.1	-3.20E+07
Gendarme	41	1999	2.3	1628	1804	1418	2.3	47.0	49.4	-1.09E+08
Gunn	42	1999	2.3	1533	1810	1471	0.8	53.0	53.7	-3.53E+07
Ailsa	43	1999	2.3	1605	1830	1555	0.0	22.9	22.9	-1.32E+07
Bryant	44	1999	1.1	1752	2010	1630	1.0	28.7	29.7	-1.79E+07
Larkins	45	1999	1.1	1962	2206	1630	1.0	26.5	27.5	-4.72E+07
Barrier	46	1999	2.3	1632	1900	1360	0.0	57.6	57.6	-1.80E+08
Irene	47	1999	2.3	1515	1700	1400	2.2	15.8	18.0	-1.61E+07
Merrie	48	1999	2.3	1505	1688	1350	0.5	12.3	12.8	-2.10E+07
Caroline	49	1999	2.3	1425	1600	1220	0.0	10.0	10.0	-2.36E+07

Ella	2	2000	2.3	2154	2265	2000	0.0	5.3	5.3	-9.42E+06
Fraerie Queen	3	2000	1.1	2030	2215	1920	0.0	5.7	5.7	-3.47E+06
Franklin	4	2000	2.3	1850	1978	1650	0.6	8.3	8.9	-1.82E+07
Rolleston	6	2000	2.3	1767	1860	1620	0.6	18.5	19.1	-3.06E+07
Carrington	7	2000	1.1	1665	1952	1545	0.5	15.0	15.5	-9.16E+06
Browning	8	2000	2.3	1564	1628	1480	0.0	4.1	4.1	-3.94E+06
Retreat	9	2000	2.3	1720	1888	1465	2.4	11.4	28.7	-2.88E+07
Marmaduke	10	2000	2.3	1865	1998	1655	23.8	68.8	92.5	-1.30E+08
Avoca	11	2000	1.1	1950	2080	1850	1.1	2.5	9.8	-5.65E+05
Jaspur	12	2000	2.3	1735	1788	1570	0.0	14.1	14.1	-2.67E+07
Kea	13	2000	2.3	1832	2020	1570	2.3	74.6	76.9	-2.20E+08
Dainty	14	2000	2.3	1918	2130	1778	11.8	33.5	45.3	-2.52E+07
Butler	15	2000	2.3	1835	1988	1650	3.6	71.0	74.6	-1.45E+08
Douglas	16	2000	1.1	2120	2290	1780	8.0	26.0	33.9	-4.11E+07
Seige	17	2000	2.3	1630	2150	1340	24.3	127.6	151.9	-2.81E+08
Vertebrae 47	18	2000	2.3	1878	1965	1746	18.1	57.5	75.6	-6.92E+07
Salisbury	19	2000	2.3	1860	2030	1645	132.5	179.4	311.9	-1.85E+08
Jalf	20	2000	2.3	1732	2055	1550	0.0	102.1	102.1	-2.14E+08
Chancellor	21	2000	2.3	1830	1950	1545	8.6	15.5	24.1	-3.88E+07
Langdale	23	2000	2.3	2238	2328	1950	12.4	28.0	40.4	-7.99E+07
Ridge	24	2000	1.1	2244	2315	2087	44.9	28.7	73.5	-7.22E+06
Jack	25	2000	2.3	1930	2008	1750	2.9	18.6	21.5	-3.60E+07
Jackson	26	2000	2.3	2053	2165	1990	15.5	36.7	52.2	-6.61E+06
McKenzie	27	2000	2.3	1915	2078	1720	5.8	42.8	48.7	-8.51E+07
Blair	28	2000	1.1	1980	2090	1812	6.2	20.3	26.4	-1.50E+07
Glenmary	29	2000	1.1	2186	2272	2032	20.2	38.3	58.5	-2.29E+07
Lindsay	30	2000	2.3	1754	1875	1550	1.5	51.1	52.5	-1.18E+08
Stuart	31	2000	2.3	1728	1850	1515	0.0	26.1	31.6	-6.38E+07
Brewster	32	2000	2.3	1905	2280	1750	29.2	220.4	249.5	-2.67E+08
Thurneyston	33	2000	1.1	1970	2132	1865	31.7	86.1	117.8	-2.15E+07
Findlay	35	2000	2.3	1664	1890	1561	7.8	59.3	67.2	-5.00E+07
Caria	36	2000	2.3	1426	1660	1366	0.0	17.1	17.1	-1.18E+07
Snowy	37	2000	1.1	2092	2240	2020	10.5	42.6	53.1	-8.33E+06
Fog	38	2000	1.1	1995	2122	1888	1.3	16.9	18.2	-9.08E+06
Park Pass	39	2000	2.3	1815	1962	1610	71.3	142.3	213.6	-2.15E+08
Llawrenry	40	2000	2.3	1460	1670	1300	0.6	17.4	18.1	-3.05E+07
Gendarme	41	2000	2.3	1628	1804	1418	6.1	43.3	49.4	-9.22E+07
Gunn	42	2000	2.3	1533	1810	1471	0.5	53.2	53.7	-3.64E+07
Ailsa	43	2000	2.3	1605	1830	1555	0.8	22.1	22.9	-1.07E+07
Bryant	44	2000	1.1	1752	2010	1630	1.9	27.9	29.7	-1.61E+07
Larkins	45	2000	1.1	1962	2206	1630	1.5	26.0	27.5	-4.55E+07
Barrier	46	2000	2.3	1632	1900	1360	3.3	54.3	57.6	-1.60E+08
Irene	47	2000	2.3	1515	1700	1400	1.5	16.5	18.0	-1.87E+07
Ella	2	2001	2.3	2154	2265	2000	4.6	0.8	5.3	4.51E+06
Fraerie Queen	3	2001	1.1	2030	2215	1920	4.6	0.0	5.7	4.65E+06
Franklin	4	2001	2.3	1850	1978	1650	8.9	0.0	8.9	1.30E+07
Rolleston	6	2001	2.3	1767	1860	1620	16.6	2.5	19.1	1.35E+07
Carrington	7	2001	1.1	1665	1952	1545	17.3	0.0	15.5	2.73E+07
Browning	8	2001	2.3	1564	1628	1480	2.2	1.9	4.1	-2.31E+05
Retreat	9	2001	2.3	1720	1888	1465	21.4	7.3	28.7	2.01E+07
Marmaduke	10	2001	2.3	1865	1998	1655	75.3	17.2	92.5	7.37E+07
Avoca	11	2001	1.1	1950	2080	1850	0.0	7.1	9.8	-3.92E+06

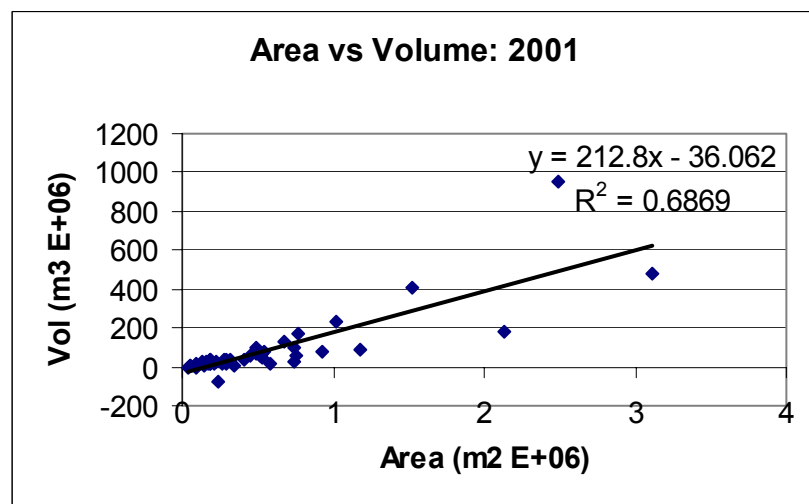
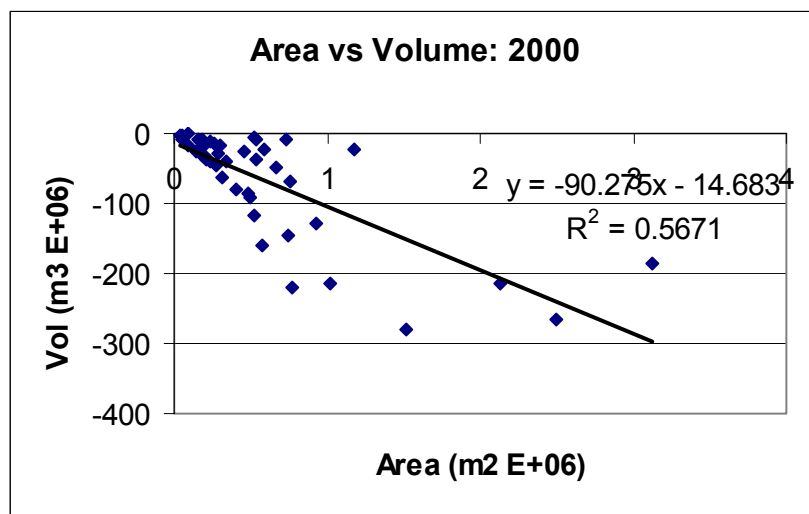
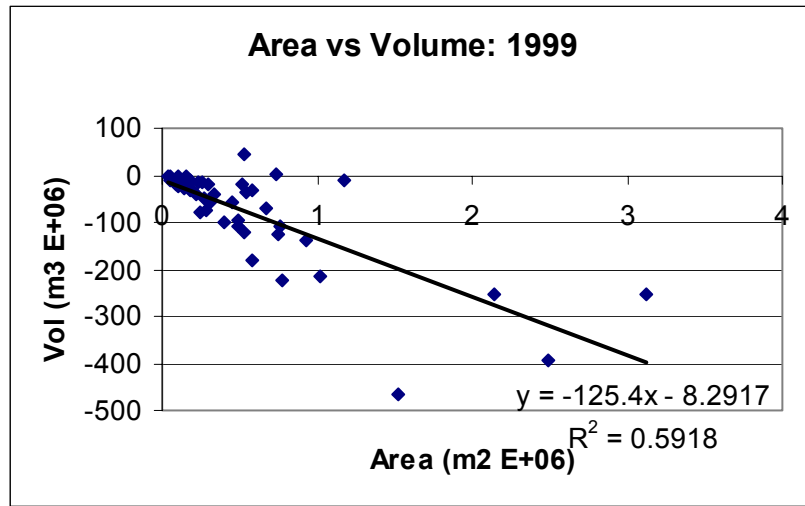
Jaspur	12	2001	2.3	1735	1788	1570	13.9	0.2	14.1	8.09E+06
Kea	13	2001	2.3	1832	2020	1570	76.9	0.0	76.9	1.66E+08
Dainty	14	2001	2.3	1918	2130	1778	33.0	12.3	45.3	6.05E+07
Butler	15	2001	2.3	1835	1988	1650	67.3	7.3	74.6	1.03E+08
Douglas	16	2001	1.1	2120	2290	1780	22.2	6.6	33.9	8.42E+06
Seige	17	2001	2.3	1630	2150	1340	97.6	54.3	151.9	4.03E+08
Vertebrae 48	18	2001	2.3	1878	1965	1746	68.0	7.5	75.6	5.66E+07
Salisbury	19	2001	2.3	1860	2030	1645	281.7	30.2	311.9	4.76E+08
Jalf	20	2001	2.3	1732	2055	1550	76.1	26.0	102.1	2.28E+08
Chancellor	21	2001	2.3	1830	1950	1545	0.0	24.1	24.1	-7.89E+07
Langdale	23	2001	2.3	2238	2328	1950	40.4	0.0	40.4	4.18E+07
Ridge	24	2001	1.1	2244	2315	2087	73.5	0.0	73.5	2.87E+07
Jack	25	2001	2.3	1930	2008	1750	20.4	1.1	21.5	1.61E+07
Jackson	26	2001	2.3	2053	2165	1990	45.0	7.2	52.2	5.28E+07
McKenzie	27	2001	2.3	1915	2078	1720	43.9	4.8	48.7	7.15E+07
Blair	28	2001	1.1	1980	2090	1812	23.8	2.7	26.4	1.19E+07
Glenmary	29	2001	1.1	2186	2272	2032	47.8	10.7	58.5	1.35E+07
Lindsay	30	2001	2.3	1754	1875	1550	51.1	1.4	52.5	6.77E+07
Stuart	31	2001	2.3	1728	1850	1515	30.6	1.0	31.6	4.06E+07
Brewster	32	2001	2.3	1905	2280	1750	228.7	20.8	249.5	9.49E+08
Thurneyston	33	2001	1.1	1970	2132	1865	107.8	10.0	117.8	9.03E+07
Findlay	35	2001	2.3	1664	1890	1561	54.0	13.1	67.2	1.25E+08
Caria	36	2001	2.3	1426	1660	1366	9.2	8.0	17.1	1.91E+07
Snowy	37	2001	1.1	2092	2240	2020	52.7	0.4	53.1	4.28E+07
Fog	38	2001	1.1	1995	2122	1888	17.4	0.8	18.2	1.17E+07
Park Pass	39	2001	2.3	1815	1962	1610	168.2	45.4	213.6	1.77E+08
Llawrenry	40	2001	2.3	1460	1670	1300	15.7	2.3	18.1	3.37E+07
Gendarme	41	2001	2.3	1628	1804	1418	48.5	0.9	49.4	9.59E+07
Gunn	42	2001	2.3	1533	1810	1471	28.1	16.4	53.7	7.78E+07
Ailsa	43	2001	2.3	1605	1830	1555	10.5	7.7	22.9	2.28E+07
Bryant	44	2001	1.1	1752	2010	1630	29.2	0.5	29.7	4.11E+07
Larkins	45	2001	1.1	1962	2206	1630	27.5	0.0	27.5	3.69E+07
Irene	47	2001	2.3	1515	1700	1400	17.6	0.4	18.0	3.69E+07
Merrie	48	2001	2.3	1505	1688	1350	12.4	0.4	12.8	2.53E+07



Figures 1,2,3



Figures 4,5,6



Figures 7,8,9