GREAT BARRIER ISLAND BITTERN SURVEY

18TH OCTOBER 2023

Report compiled by John Ogden,
Sue Moore (Department of Conservation)
and Lotte McIntyre
on behalf of Oruawharo Medlands Ecovision

ORUAWHARO MEDLANDS ECOVISION

Department of Conservation
Te Papa Atawbai

SUMMARY

Two teams of 'listeners' were deployed at 16 stations around the Whangapoua/Okiwi and Kaitoke /Medlands wetlands on Great Barrier Island for half an hour before, and one hour after, sunset on October 18th 2023. Bittern were heard booming at 50% of stations, with greater activity at Whangapoua than Kaitoke. The largest number of sequential booms in 90 minutes was 30, and the median number of booms per sequence was three. Where booming was heard frequently the median time between sequences was two to four minutes The Bittern Index (separate definite boomers) was five at Whangapoua wetland and two in the Kaitoke area, but in both areas it is likely that more bittern were present. With some assumptions, the results suggest a minimum bittern population of 14 and a possible maximum of 20 for Great Barrier Island. These figures are c. twice previous estimates (2012 , 2020) but this is confounded with the number of observers also increasing. It is recommended that the methodology is further standardised and carried out in mid-October in future years, ideally on more than one evening.

Objectives:
(1). To detect the presence / absence of bittern booming at sites chosen on the basis that boomings or sightings had occurred at them in the past.
(2). On the assumption that only male birds boomed, to provide an index of bittern abundance that might also be used to estimate minimum bittern numbers (the number of clearly different booming birds).
(3). To record the details as a base-line, so that future surveys, using the same methods at the same times and places, might indicate any numerical trends.

INTRODUCTION

The Australasian Bittern (Matuku-hūrepo, *Botaurus poiciloptilus*) is considered threatened and 'Nationally Critical' for conservation with less than 1000 birds remaining (New Zealand Birds on Line. Australasian Bittern). It declined markedly throughout New Zealand during the twentieth century as wetlands were drained and mammalian predators proliferated, and this decline appears to be continuing. For example, in the 1980s it was thought that there were c. 145 individual birds in their main North Island stronghold - Whangamarino wetlands - but only c. 15 booming males have been detected there in recent surveys (New Zealand birds on line). Likewise, records on Great Barrier Island from the 1960s (Bell & Brathwaite 1964) and 1980s (Ogle 1981) indicate that Bitterns were formerly more widespread and numerous than appeared to be the case in the early twenty-first century (Geary et al. 2012; Stewart 2020).

An excel data-base of bittern sightings and boomings on Great Barrier has been kept by J. Ogden since 2002, but the first attempt at a more comprehensive population assessment was in 2012, when the Great Barrier Island Environmental Trust and the Department of Conservation organised community groups to listen for boomings on several evenings in September at various locations around Kaitoke and Whangapoua wetlands and at other locations where the birds had been heard or seen earlier (Geary, Corin & Ogden 2012). The best overall estimate at that time was six birds (three pairs) with the possibility of another pair. On the basis of limited data, confounded with observer numbers and locations, it was tentatively suggested that a pair (minimum) of bitterns bred in the Kaitoke swamp area and young dispersed to the Whangapoua Estuary. Since then an acoustic survey in Spring 2020 (Stewart 2020, Scott & Stewart 2021) detected two (presumed male) individuals at Whangapoua and one at Kaitoke, which reversed the relative abundance at the two sites, but seemed to confirm the earlier overall numerical estimate. However, visual sightings between August and November 2020 suggested at least 6 birds in the Whangapoua Estuary, with at least another pair in the Kaitoke area (from data-base sightings), suggesting that numbers had increased slightly between 2012 and 2020[1].

Although the bittern data-base seems to show increasing numbers of observations since 2012, the impossibility of deriving numerical estimates or tends from casual observations by an increasing number of individuals, meant that a more rigorous *simultaneous* monitoring at the main sites was required. However, booming is thought to be only by male birds, and as there may be non-booming individuals at any time, including juveniles and females, booming

[1] See also items in *Environmental News* 29 (Geary 2012), 30 (Ogden 2013), 34 (Williams 2015), 44 (Scott & Stewart 2021).

provides only an index of abundance. However, such an index is presumably related to the actual abundance of bitterns, and is repeatable over years to indicate trends.

METHODS

Two teams of observers were deployed, respectively in the Whangapoua (North) and Kaitoke (South) areas (Table 1). There were 7 observation (listening) stations in the north, each point coinciding approximately with sites recorded in 2012 and/or 2020 (Fig 2). The stations were all > 500m apart (except W3 and W4 – c.400m). There were 9 listening stations in the south, six of them around Kaitoke swamp (including Police Station wetland) and three in more outlying positions where bitterns are known to have been present historically (Awana and Medlands/Oruawharo) and/or seen more recently (Whangaparapara) (Fig 3). Each station had one or two observers from approximately half an hour before sunset (7.36PM) to one hour after. Overall, eighteen people spent an hour and a half each, so 27 person/hours of observation. Observers were asked to record the time of the start of each boom sequence and the number of booms in the sequence. They also recorded the direction and estimated distance of the boom (near, intermediate, far, very far etc.) and any other relevant information.

Table 1. Locations, participants, and number of boom sequences heard.

Station code	Location (see also Figs 2 and 3 and Appendix 2)	Observers	Boom sequences
	NORTH		
W1A	Waikaro / Mabey's	Sue Moore	0
W2	Mabey rd.	Tess Van Der Wel	10
W3	E of Mabey rd.	Kirsty Prior	30
W4	Mabey rd.	Lydia Green	4
W5	E of Mabey rd.	Rory Christie	2
W6	Near DOC Office Okiwi	Ruurd Van Der Wel	7
W7A	Near Airfield Okiwi	Kate Clapshaw	17
	SOUTH		
A1	Awana	Steve Kendal	0
K1	Wiltshire lane	Hannah Gale Ryan Daly	0
K3	Whpp road: Golf course	Kim Bannister	0
K4	Hotsprings track (1)	Annamarie Clough	11
K5	Hotsprings track (2)	Lotte McIntyre	0
M1	Medlands Causeway	David McIntyre	0
O1	Okupu road (Golf course)	Frances McLure John North	0
P1	Police Station	John Ogden	22
W1*	Whangaparapara	Sarah Mathews	0

* This site requires renaming to avoid confusion with W1 at Whangapoua.

RESULTS

The evening was calm, warm and dark (new moon on 15th October). Between 7.0 and 8.35 PM the general wind direction was ENE to NNE (ie. mainly in the NE quarter) and variable between c. 3 – 4 on Beaufort scale. This direction meant that observers at the northern end of Whangapoua (W1A) and northern part of Kaitoke swamp (K5) were unlikely to hear booms further south and neither did. However, clear booming was registered by an acoustic recorder at WIA on previous nights and bitterns have been seen there regularly in past years (*pers. comms.* Scott Mabey, Chris Giblin).

Booming was recorded at six of the seven Whangapoua stations, and two of the nine southern stations (Kaitoke swamp (K4) and Police Station swamp). Excluding sites with zero booms, sequence detection in 90 minutes ranged from a minimum of two at W5 to a maximum of 30 at W3 (Table2).

At some Whangapoua stations (W2, W3, W4 and possibly W5) the timing, direction and distances of booms indicated that at least some of the sequences heard by two or three observers were the same bird.

Table 2. Median sequence characteristics for stations at which bitterns were heard.

Station	**Number of sequences**	**Median time between sequences (minutes)**	**Median no. of booms per sequence**
W2	10	3	1.5
W3	30	3	3
W4	4	16	2
W5	2	30	3
W6	6	9	4
W7A	17	4	2
K4	11	5	3
P1	22	2	3
Overall medians	**10.5**	**4.5**	**3**

Analysis of the W3 data, and the opinion of the observer, clearly indicated that at least two birds were heard. Chi-squared (with Yates' correction) for the results in Table 3 is 106.1, giving $p < 0.001$, very strongly indicating the presence of two separate booming birds, one close in the southerly direction, and one further away to the north or north-east. Of the ten sequences heard from W2 (north of W3), seven were far away to the east and coincide in time with 'far' sequences recorded to the N or NE from W3. It seems safe to conclude these were the same bird. Station W4 is close to W3 but with a low hill between. In contrast to W3, only four sequences were recorded at this station, all with only two booms heard and all far away. All of these correspond in time (within a 2-minute margin of time recording error) with sequences from W3, but do not correspond in the number of booms heard or the direction. This suggests that being further from the booming location reduces accuracy of boom detection and distance.

Only two sequences were heard at W5 (further south) at least one of which corresponds with a distant sequence heard coming from the SSE direction at W3.

Table 3. Contingency table for thirty booming sequences from different directions and distances at Station W3. Significant associations in bold. Marginal totals in italics.

	Direction		
	S or SE	N or NE	
Close	**9**	5	*14*
Far	1	**15**	*16*
	10	*20*	*30*

Overall, the data from W2,3,4, and 5 demonstrate at least two birds on the eastern side of Whangapoua Estuary. The variability of call direction (and in some cases timing) suggests that more birds might have been booming but were not clearly distinguished.

Only seven sequences were heard from W6, but as these were all recorded as 'close' and coming from the NW, it seems most likely these were from a separate bird. At W7A the first six sequences (before 7.30PM) were all

recorded as ‘distant’. At 7.31 the observer (Kate Clapshaw) saw and photographed *two* bitterns together near the station (Fig.1). In the next (post-sunset) hour a bird called eleven times with a 2- or 3-boom sequence close-by to the east. There is no doubt that two birds were present at 7A after 7.30, and it seems likely that one of these was the pre-sunset ‘more distant’ boomer. Two bitterns have been heard booming at W7A on other nights too (one much louder than the other).

The records from Kaitoke do not permit ‘triangulation’ because booms were heard only at one station (K4). This was surprising as bitterns have been seen or heard at all the other locations except K5 in recent years (since c. 2012). The observer at K4 thought it possible that one boom came from a different bird as the direction was slightly different.

Station P1 was re-located c. 150m north on Gray Road due to the presence of a dog. At P1 most of the calls clearly came from the same bird situated maybe 100m into the wetland in front of the Police Station. The sequence frequency (2 mins) and the number of booms per sequence (3 or 4) were high. Booms had been heard regularly over the previous several weeks at this location, and at all times of day (*pers. comm*. Jacques Goussard). However, on the survey evening the first two barely audible calls appeared to come from the far NE corner of the swamp, so it is possible a second bird was present. Booming has also frequently been heard at this location in past years, including 2022.

Fig 1. Two bitterns near Station 7A, shown clearly on photo enlargement. (Photo Kate Clapshaw 7.31PM, 18/10/23).

Fig 2. Whangapoua area showing stations and approximate locations of boomers (red ovals).

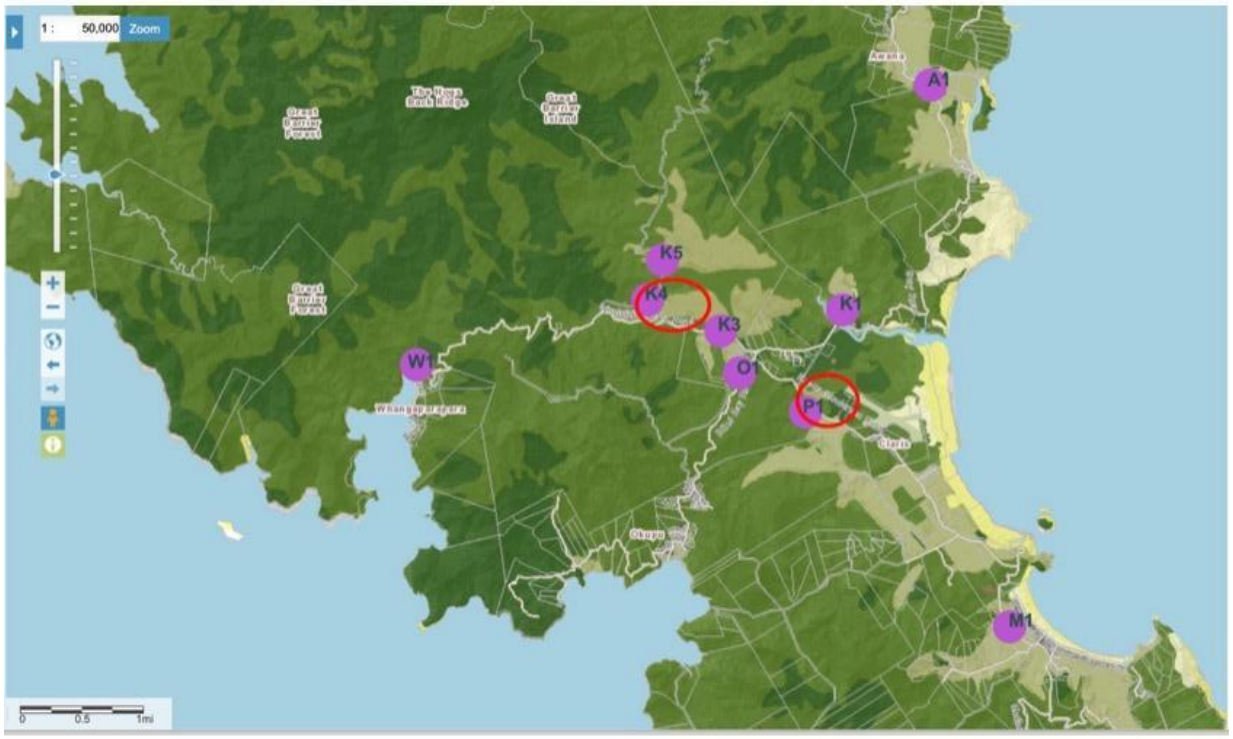

Fig 3. Kaitoke area showing stations and approximate locations of definite boomers (red ovals)

Meeting the survey objectives:
Objective 1. Bitterns were detected at 8/16 (50%) of stations.
Objective 2. The survey detected a minimum of two boomers and a possible maximum of four in the Kaitoke/Medlands area, and a minimum of five or maximum of six in the Whangapoua/Okiwi area. Thus, the Bittern Booming Index for Whangapoua/ Okiwi is certainly 5, and possibly 6, and for the Kaitoke/Police station swamp is 2, possibly 4.
Objective 3. The base-line data are included in Appendices to this report. Some modifications to methods are suggested for future surveys

DISCUSSION

The results suggest that (1) the greatest bittern concentration on Great Barrier Island is around Whangapoua Estuary (including the Okiwi area). This agrees with historical information and many sightings in that area in recent years. There are probably at least four pairs occupying the territories indicated in Fig 2. The observation of two birds together at W7A this year, and of four bitterns together close to W1A in August 2020 (*pers. comm*. Chris Giblin) is further evidence of likely breeding in those two locations. (2) There is probably one pair occupying the southern arm of Kaitoke swamp and another on the Police Station swamp (where two bitterns have been seen together in the past). Although single birds are often recorded from the Medland/Oruawharo area, which is also a historic location (Bell & Brathwait 1964, Ogle 1981) there is no evidence of current occupants. The same applies to the Awana area, where bitterns were formerly present.

Assuming that each boomer is associated with a female bird, it can be concluded that there are at least 14 bitterns currently present on Great Barrier Island. If other possible boomers are included the population could be as high as twenty. While these figures are more than double earlier estimates, it cannot be concluded that they represent an increase (though they may) because fewer observers were involved in the earlier work. In this context it can be noted that bitterns may have the potential for rapid increase: they lay a relatively large clutch (3 – 5 eggs) and the

long breeding season implies a possibility of two broods/year. Young birds disperse after fledging and there appears to be adequate unoccupied wetland habitat for them to colonise; indeed, putative young birds have been seen at several wetland locations (e.g. Medlands/Oruawharo).

The methods used provide a minimum Index of Bittern Abundance of seven for the whole island, but the true population is likely to be closer to double this, or even greater. While there is still considerable uncertainty about the true population size, the Index provides a means for comparison. It would be interesting to do this on several consecutive nights to assess its repeatability. On balance this method, carried out at the same time and the same stations each year might be the best way of assessing population trends over multiple years.

Recommendations:
A standardised data sheet, from the protocol suggested by O'Donnell & Williams (2015), should be used by each recorder. This protocol was used in 2012 but not in the current survey. Use of the protocol ensures that all relevant data are recorded and retained.

In even slightly windy conditions, it can be hard to determine the direction of distant booms. This applies especially where nearby structures or topography reflect sound. A compass should be used at each location to set up the initial directions.

Distance is also difficult to determine especially if there is wind, but probably 4 categories (close, medium close, far and very far) are adequate. The latter category is close to the limits of audibility. However, it is presumably possible for 'quiet' booms to sound further away than they are.

Notwithstanding the possible subjectivity in determining distance and direction, this information can be very useful in determining the number of distinct birds by triangulation (cf. Table 2).

Standardising the timing between observers is also important so that booms heard simultaneously by different observers can be recognised as the same bird. The start of each boom sequence should be timed as accurately as possible – which is not always easy in semi-darkness or when a boom is close to the limits of hearing.

Repetition of the survey on two or three consecutive nights would give more confidence in the Bittern Index.

A consistent team of observers, though not imperative as the methodology is simple, should be aimed for.

ACKNOWLEDGEMENTS

Oruawharo Medlands Ecovision wishes to thank all the participants listed in Table 1 and others who have contributed to the data-base. Also thanks to the staff of the Department of Conservation on Great Barrier Island for their willing cooperation in this project.

REFERENCES

Bell, B.D. & Brathwaite, D. H. 1964. The birds of Great Barrier and Arid Islands. *Notornis* vol. 10 no. 8: 363-383.

Geary A, Corin S. & Ogden J. 2012. Monitoring Report. Australasian Bittern. Great Barrier Island 2012. Department of Conservation. GRBAO 22380. Pp 9.

O'Donnell, C.F.J. & Williams, E.M. (2015). Protocols for the inventory and monitoring of populations of the endangered Australasian Bittern (*Botaurus poiciloptilus*) in New Zealand. Publishing team, Department of Conservation.

Ogle, C. C. 1981. Great Barrier Island wildlife survey. *Tane* 27: 177-200. (see also: Ogle C. C. 1980. Wildlife and wildlife habitats of Great Barrier Island. N.Z. Wildlife Service, Department of Internal Affairs, Wellington. Fauna Survey Unit Report No. 24. Pp.55.).

Scott, B. & Stewart, P. 2021. Australasian Bittern accoustic survey. *Environmental News* 44: 10-11.

Stewart, P. 2020. Autonomous Acoustic Bittern Distribution Survey in the Southern Auckland Region and on Waiheke and Great Barrier/Aotea Islands, 2020. Sound Counts Contract Report 2021-01. Pp.16.

APPENDIX 1. Raw data from sites where booming was heard 18/10/23.

Station	Time	Time between sequences	Number of booms(when 2-3 or 3-4 maximum taken)	Distance	Direction
W2	7.46pm		1	Far	East
W2	7.51pm	5	1	Far	East
W2	7.55pm	4	1	Far	East
W2	7.58pm	3	1	Far	East
W2	7.59pm	1	3	Far	East
W2	8.01pm	2	3	Far	East
W2	8.02pm	1	2	Far	East
W2	8.05pm	3	1	Far	East
W2	8.17pm	12	3	Far	East
W2	8.26pm	9	2	Far	East
Mean		**4.4**	**1.9**		
St. Dev.		**3.7**	**0.9**		
Median		**3**	**1.5**		
Station	**Time**	**Time between sequences**	**No of booms**	**Distance**	**Direction**
W3	7.01pm		3	Close	E/SE
W3	7.03pm	2	1	Far	N/NE
W3	7.05pm	2	4	Far	E/NE
W3	7.09pm	4	4	Far	N/NE
W3	7.15pm	6	2	Close	S
W3	7.20pm	5	4	Close	E
W3	7.21pm	1	4	Close	S
W3	7.24pm	3	3	Far	NE
W3	7.28pm	4	2	Close	SE
W3	7.31pm	3	2	Far	N
W3	7.32pm	1	3	Far	NNE
W3	7.33pm	2	2	Close	SE
W3	7.35pm	3	4	Very far	NE
W3	7.38pm	3	3	Far	SSE
W3	7.40pm	2	4	Very far	NE
W3	7.42pm	2	3	Close	ESSE
W3	7.47pm	5	3	Close	SSE
W3	7.50pm	3	3	Close	SSE
W3	7.59pm	9	4	Far	NE

W3	8.02pm		3	4	Far	NE
W3	8.04pm		2	3	Far	N
W3	8.05pm		1	3	Close	N
W3	8.08pm		3	4	Very far	N
W3	8.10pm		2	3	Close	N
W3	8.11pm		1	3	Far	N
W3	8.11pm		1	3	Close	N
W3	8.15pm		4	3	Far	N
W3	8.19pm		5	4	Far	N
W3	8.23pm		4	3	Close	S
W3	8.27pm		5	4	Close	NNE
Mean	green = poss same as W2	**3.1**		**3.2**		
St. Dev.		**1.8**		**0.8**		
Median		**3.0**		**3.0**		
Station	**Time**	**Time between sequences**		**Number of booms**	**Distance**	**Direction**
W4	7.44pm			2	Far	NW
W4	8.05pm	21		2	Far	NW
W4	8.08pm	3		2	Far	SE
W4	8.26pm	18		2	Far	SE
Mean		**14.0**		**2.0**		
St. Dev.		**9.6**		**0.0**		
Median		**16.0**		**2.0**		
Station	**Time**	**Time between sequences**		**Number of booms**	**Distance**	**Direction**
W5	7.38pm			Unknown	Mid range	E
W5	8.08pm			3	Mid range	E
Mean		**30**		**3**		
St. Dev.		**0**		**0**		
Median		**30**		**3**		
Station	**Time**	**Time between sequences**		**Number of booms**	**Distance**	**Direction**
W6	7.06pm			2	close	NW
W6	7.14pm	8		4	close	NW
W6	7.16pm	2		4	close	NW
W6	7.26pm	10		1	close	NW
W6	7.39pm	13		4	close	NW
W6	7.41pm	2		2	close	NW
W6	8.21pm	40		4	close	NW
Mean		**12.5**		**3.2**		

St. Dev.		**14.2**	**1.3**		
Median		**9.0**	**4.0**		
Station	**Time**	**Time between sequences**	**No. of booms**	**Distance**	**Direction**
W7A	6.40pm		2	Distant	East (towards mountains)
W7A	6.44pm	4	1	Very distant	South (towards DOC office)
W7A	6.46pm	2	3	Very distant	South (towards DOC office)
W7A	6.47pm	1	2	Distant	East
W7A	7.06pm	19	3	Fairly distant	East
W7A	7.29pm	23	2	Very distant	South (towards DOC office)
W7A	7.37pm	8	2	Close	East
W7A	7.40pm	3	3	Close	East
W7A	7.44pm	4	2	Close	East
W7A	7.51pm	7	3	Close	East
W7A	7.56pm	5	3	Close	East
W7A	7.58pm	2	3	Close	East
W7A	8.06pm	8	2	Close	East
W7A	8.09pm	3	2	Close	East
W7A	8.26pm	17	2	Close	East
W7A	8.29pm	3	3	Not as close	East
W7A	8.33pm	4	2	Not as close	East
Mean		**7.1**	**2.4**		
St. Dev.		**6.7**	**0.6**		
Median		4.0	**2.0**		
Station	**Time**	**Time between sequences**	**No. booms**	**Distance**	**Direction**
K4	7.11pm		3	Far	E
K4	7.16pm	5	3	Far	E
K4	7.25pm	11	3	Far	E
K4	7.33pm	8	3	Far	E
K4	7.41pm	8	3	Far	E
K4	7.43pm	2	3	Far	E
K4	7.47pm	4	3	Far	E
K4	7.51pm	4	3	Far	E
K4	7.56pm	5	3	Far	E
K4	8pm	4	3	Far	E
K4	8.10pm	10	3	Near	SE
AVG		**6.1**	**3.0**		
ST Dev		**3.0**	**0.0**		
Median		**5.0**	**3.0**		

Station	Time	Time between sequences	Booms	Distance	Direction
P1	7.36	6	2	far	E
P1	7.44	8	1	far	E
P1	7.5	6	3	med	SE
P1	7.52	2	3	med	SE
P1	7.59	7	2	med	SE
P1	8	1	3	med	SE
P1	8.01	1	3	med	SE
P1	8.09	8	3	med	SE
P1	8.12	3	3	med	SE
P1	8.14	2	4	med	SE
P1	8.15	1	4	med	SE
P1	8.17	2	3	med	SE
P1	8.19	2	4	med	SE
P1	8.21	2	3	med	SE
P1	8.23	2	4	med	SE
P1	8.25	2	4	med	SE
P1	8.28	3	4	med	SE
P1	8.3	2	4	med	SE
P1	8.34	4	4	med	SE
P1	8.37	3	4	med	SE
P1	8.43	6	4	med	SE
P1	8.5	7	3	med	SE
AVG		**3.5**	**3.3**		
STDEV		**2.4**	**0.8**		
Median		**2.0**	**3.0**		

APPENDIX 2. Station locations.

Station	Latitude S	Longitude E
W1	36.1185	175.4027

W1a	36.1193	175.4087
W2	36.1271	175.4048
W3	36.1351	175.4048
W4	36.1350	175.4003
W5	36.1455	175.3995
W6	36.1522	175.4055
W7	36.1576	175.4141
W7a	36.1499	175.4156
A1	36.20162	175.47339
K1	36.22865	175.46119
K3	36.23151	175.44286
K4	36.22798	175.432637
K5	36.22309	175.43463
M1	36.26588	175.48718
O1	36.23872	175.44539
P1 (2023)	36.24065	175.45577
W1*	36.1418	175.2390