

# **Lobster Survey**

## **Te Awaatu (The Gut) Marine Reserve, Doubtful Sound**

**SOUTHLAND CONSERVANCY**  
**December 2003**



Department of Conservation  
*Te Papa Atawhai*

# **2003 LOBSTER SURVEY**

## **Te Awaatu, Marine Reserve, Doubtful Sound**

Murray Willans  
December 2003

Published by  
Department of Conservation  
Te Anau Area Office  
PO Box 29  
Te Anau

# ***CONTENTS***

<b><u>EXECUTIVE SUMMARY</u></b>	<b>4</b>
<b><u>1.0 BACKGROUND</u></b>	<b>5</b>
<b><u>2.0 METHODS</u></b>	<b>6</b>
2.1 Site Selection	
2.2 Survey Technique	
<b><u>3.0 RESULTS</u></b>	<b>9</b>
3.1 Abundance	
3.2 Size	
<b><u>4.0 DISCUSSION</u></b>	<b>12</b>
<b><u>5.0 RECOMMENDATIONS</u></b>	<b>13</b>
<b><u>ACKNOWLEDGEMENTS</u></b>	<b>13</b>
<b><u>REFERENCES</u></b>	<b>14</b>
<b><u>APPENDIX 1</u></b>	<b>15</b>
Data of actual Vs estimate lobster size	
<b><u>APPENDIX 2</u></b>	<b>16</b>
Lobster data	

## Executive Summary

1. To assess the effectiveness of the Te Awaatu Marine Reserve as a conservation tool, Spiny Lobster *Jasus edwardsii* monitoring was set up in Milford Sound. This work compliments that been previously done in Te Awaatu Reserve in 1999 and 2001, Piopiotahi Marine Reserve, and at other Marine Reserves in New Zealand.
2. Six monitoring sites were resurveyed. Three inside the Marine Reserve and three outside.
3. Each monitoring site contained 10 x 50m x 10m transects which were sited at depths of 7m to 17 metres.
4. A technique which estimates the size of the lobsters was used
5. 489 lobsters were counted at the sites within the reserve and 163 at the sites outside the reserve.
6. The lobsters inside the reserve were larger by an average of 16.79 mm.
7. There were 41 large ( $\geq 120$ mm) lobsters at the sites inside the reserve compared to only 6 large lobsters at the sites outside.
9. It is intended that these sites will be re-measured in April 2005

## 1.0 Background

Te Awaatu Marine Reserve, Doubtful Sound, along with Piopiotahi Marine Reserve, Milford Sound was gazetted in September 1993. Two species present within these reserves have been monitored since that time. Monitoring of coral populations has been carried out since 1995 in Te Awaatu (Miller 1995, Miller and Mundy 1999, Miller and Mundy 2000). In 1999 the Department of Conservation began the monitoring of spiny lobster *Jasus edwardsii* in Te Awaatu marine reserve (Kelly 1999) and repeated in 2001 (Smith 2001) and in April of this year it was repeated. In March 2000 lobster monitoring was also carried out at Piopiotahi (Munn 2000) and repeated in April 2002 (Smith 2002).

*J. edwardsii* is a good indicator species of the effectiveness of the marine reserve for a number of reasons;

- they are economically, culturally and recreationally important
- they are an ecologically important species
- they have widespread public recognition
- size and abundance work has been carried out in other marine reserves around New Zealand enabling comparisons to be made.

The objectives, therefore, of the Te Awaatu Marine Reserve Lobster monitoring programme are to;

1. Along with the work in Piopiotahi, assess the effectiveness of the Marine Reserve as a conservation tool.
2. Provide some information on the current population status of *Jasus edwardsii* in Doubtful Sound.
3. Monitor changes and trends in the population characteristics of *J. edwardsii* in and around Te Awaatu Marine Reserve.
4. Be compatible with regional, national or international marine protected area monitoring schemes.

## 2.0 Methods

### 2.1 Site Selection

Six sites were surveyed (Fig. 1), three inside the Marine Reserve and three outside the reserve, all of the sites were chosen to replicate the 2001 survey (Smith 2001) The sites were chosen considering a number of factors.

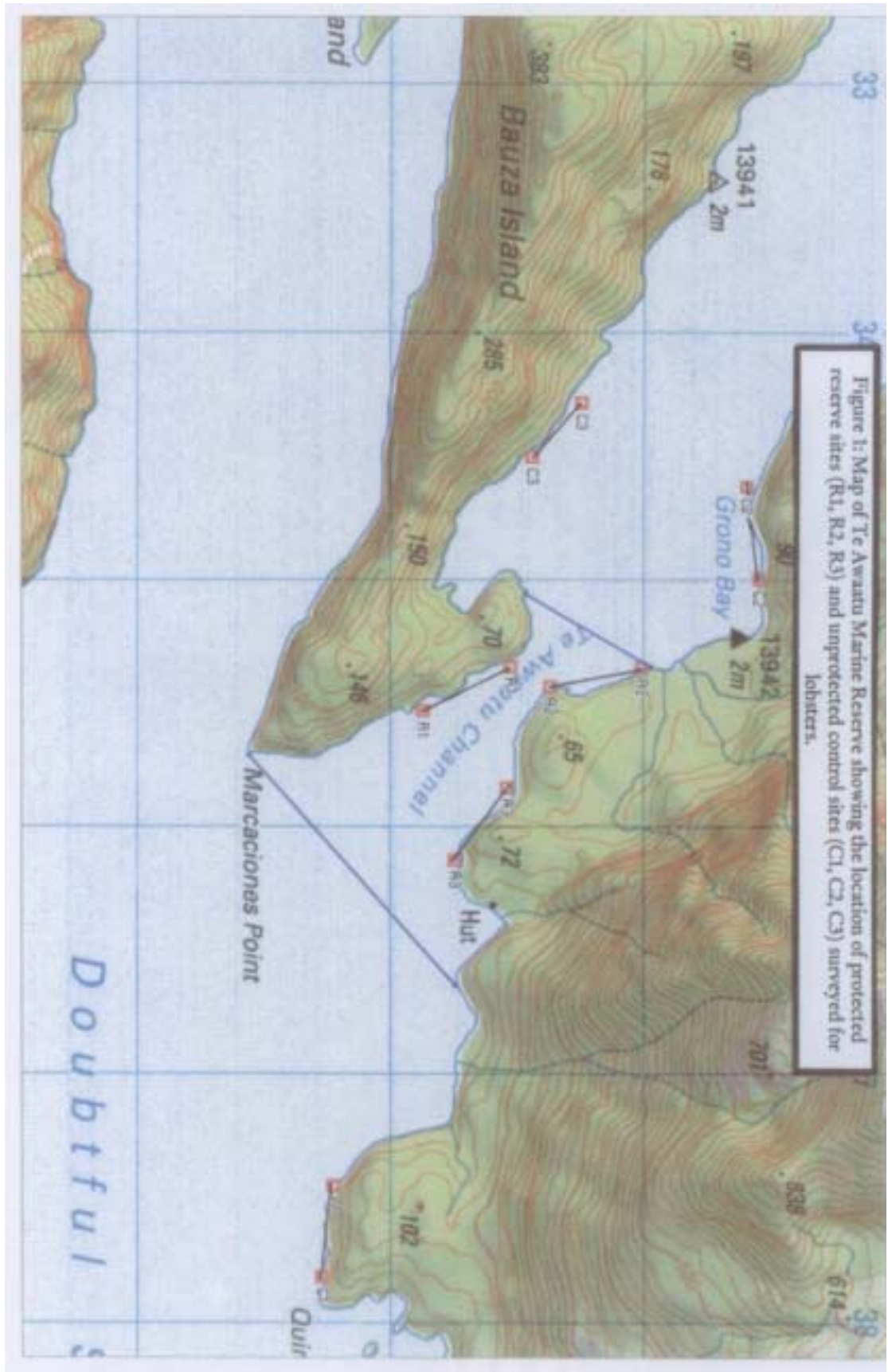
The sites were chosen considering a number of factors;

- lobsters were known to be present
- the habitat seemed reasonable
- as far as possible, similar sites were chosen inside the reserve as outside
- sites were chosen at the outer edge of the reserve and further down the sound

Sampling at each site was restricted to a depth range of 7 – 17 metres. This range was below the freshwater layer and ensured that repetitive multi day diving could be conducted safely.

The grid references of all sites are listed below;

<b>Site</b>	<b>Easting</b>	<b>Northing</b>		<b>Site</b>	<b>Easting</b>	<b>Northing</b>
C1 West	2037457	5527736		R1 West	2035330	5528551
C1 East	2037964	5527738		R1 East	2035560	5528262
C2 West	2034495	5529461		R2 West	2035258	5529101
C2 East	2035000	5529434		R2 East	2035427	5528675
C3 West	2034245	5528741		R3 West	2035893	5528425
C3 East	2034644	5528455		R3 East	2036282	5528263

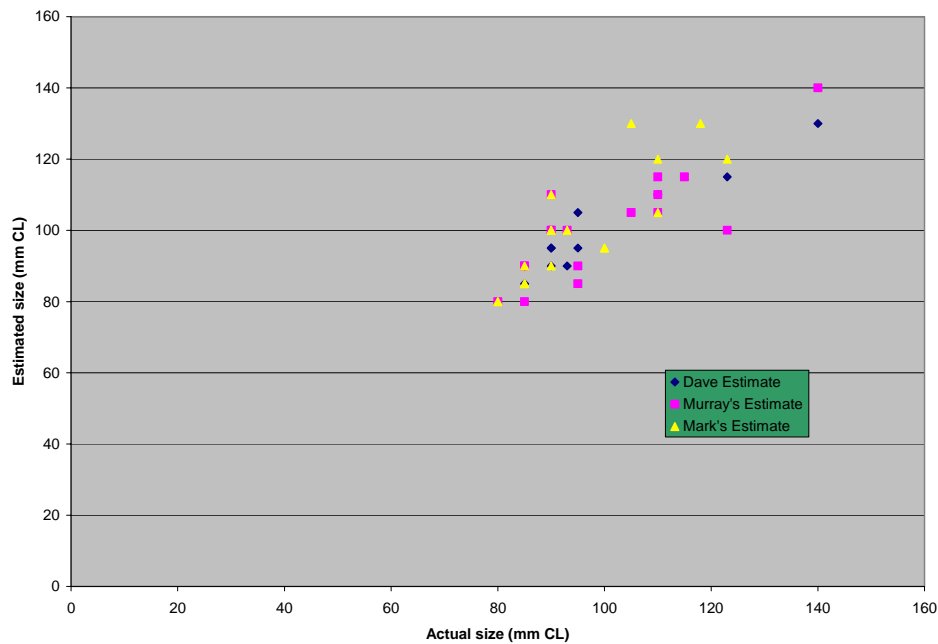


## **2.2 Survey Technique**

Each site contained 10 x 50 metre transects. Transects were established using a 50m cord line which was laid out on the bottom at a depth of approximately 12 m. Each transect position was recorded by GPS. Counting of lobsters was then done on 5m either side of this line. The size, sex and number (where possible) of lobsters within each transect were recorded (MacDiarmid 1991, Kelly 1999). An underwater torch was used to ensure all lobsters within crevices or under rocks were counted and to aid with size and sex estimation. The sex of lobsters was determined by the presence or absence of chelae (pincers) on the fifth walking legs (females – chelae present, males – no chelae) and/or pleopods (females – biramous pleopods, males - uniramous). Pleopods are leaf like appendages under the tail of lobsters. Females use pleopods to hold the egg mass during brooding.

The size of the lobsters was estimated to the nearest 5mm-carapace length (Figure 2). To be confident that the divers were able to estimate lobster sizes with the required level of accuracy, each diver estimated and then caught and measured between fourteen and seventeen lobsters. The capture of these lobsters took place outside of any survey sites. A representative range of lobsters was checked in this way. The difference between the actual and estimated lobster sizes were measured using linear regression analysis with a correlation coefficient average of 0.880. Individual measures were; Willans 0.834, Mawhinney 0.840 and Johnson 0.962. These figures demonstrate a high correlation between actual measurement and the estimates. Base data is attached as Appendix 1.

FIGURE 2. RELATIONSHIP BETWEEN ACTUAL ROCK LOBSTER SIZE (MM CL) AND ESTIMATED SIZE FOR THE 2 SENSORS CONDUCTING A SURVEY OF ROCK LOBSTER IN DOUBTFUL SOUND.



### 3.0 Results

#### 3.1 Abundance

The apparent suitability of all six sites was reasonably similar. There were crevices and holes in which a lobster or lobsters could be expected to be found in most transects. A total of lobsters were recorded within the reserve and lobsters outside the reserve. The total number of lobsters at each site and each transect are recorded below (figure 3)

FIGURE 3. TOTAL NUMBER OF LOBSTERS COUNTED PER TRANSECT AND PER SITE AT DOUBTFUL SOUND MONITORING SITES, APRIL 2003

SITE	TRANSECT	NUMBERS OF LOBSTERS
<i>Inside Reserve</i>		
R1	1	5
	2	0
	3	23
	4	8
	5	0
	6	1
	7	10
	8	0
	9	2
	10	29
	<b>Total for R1</b>	<b>78</b>
R2	1	16
	2	23
	3	4

	4	1
	5	0
	6	18
	7	73
	8	1
	9	47
	10	104
	<b>Total for R2</b>	<b>287</b>
R3	1	11
	2	0
	3	17
	4	5
	5	24
	6	18
	7	1
	8	0
	9	23
	10	24
	<b>Total for R3</b>	<b>123</b>
<b>Total inside Marine Reserve</b>		<b>488</b>

SITE	TRANSECT	NUMBERS OF LOBSTERS
<i>Outside Reserve</i>		
C1	1	0
	2	0
	3	18
	4	0
	5	0
	6	0
	7	0
	8	0
	9	0
	10	0
	<b>Total</b>	<b>18</b>
C2	1	1
	2	0
	3	0
	4	3
	5	1
	6	0
	7	0
	8	44
	9	26
	10	0
	<b>Total</b>	<b>75</b>
C3	1	8
	2	8
	3	17
	4	1
	5	9
	6	3
	7	0
	8	6
	9	15
	10	2
	<b>Total</b>	<b>69</b>
<b>Total outside Marine Reserve</b>		<b>162</b>

Lobsters are more numerous inside the Te Awaatu Marine Reserve than outside it. The density of lobsters within the reserve was 16.3 per 50m transect compared with 5.4 outside the reserve in 2003. This compares with 14.7 per 50m transect inside the reserve and 2.2 per 50m transect outside the reserve in 2001. Base data is attached as Appendix 2.

### **3.2 SIZE**

The mean size of lobsters inside the marine reserve was 91.51 mm while outside the reserve it was 74.72 mm (Figure 4). A 2-tailed T-Test was used to test the difference between the two means. The 12.94mm difference between the two means is significant ( $t=7.590$ ,  $P = 0.021$ ). Figure 5 shows the size comparison between the reserve and control sites in Doubtful Sound in 2003 and 2001.

Of interest was the number of large lobsters present within the marine reserve. 9% ( $n = 41$ ) of lobsters within the reserve were greater than or equal to 120mm. Only 2 of these were 150mm – 175mm carapace length. This size would translate to a weight range of c2.8kg to around 4kg. By comparison 3.7% ( $n = 6$ ) lobsters were 120mm or greater outside the reserve and none were greater than 150mm.

FIGURE 4: SIZE DISTRIBUTION AND NUMBERS OF ROCK LOBSTERS FROM DOUBTFUL SOUND TAKEN FROM SITES WITHIN TE AWAATU MARINE RESERVE AND ASSOCIATED CONTROL SITES, APRIL 2003.

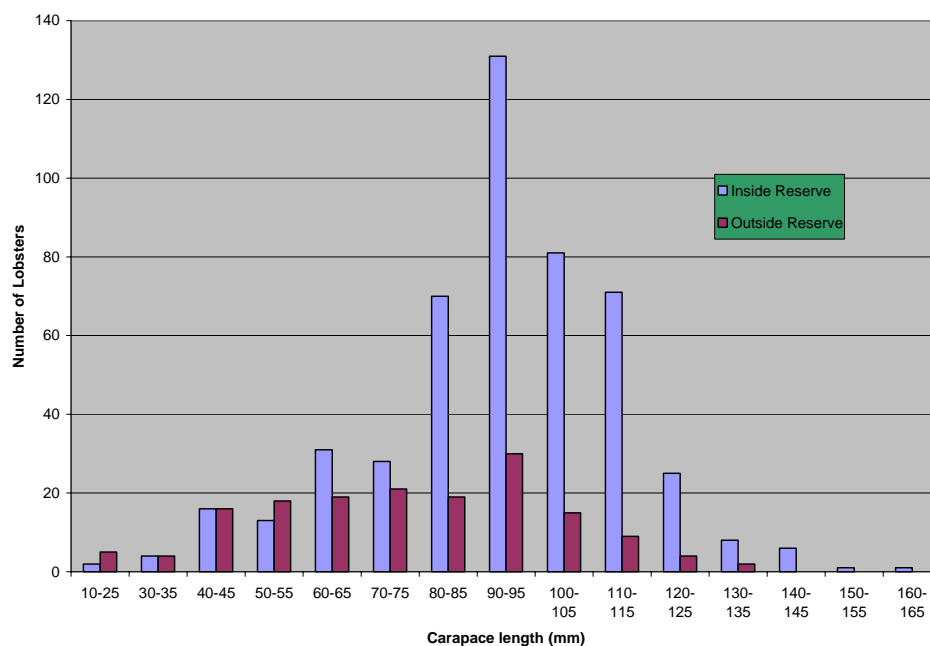


FIGURE 5: SIZE COMPARISONS OF THE ROCK LOBSTERS FROM TE AWAATU MARINE RESERVE AND CONTROL SITES IN DOUBTFUL SOUND – APRIL 2003 AND APRIL 2001.

SITE	2003 MEAN	2001 MEAN	2003 N	2001 N	2003 STD DEV	2001 STD DEV
R1	89.58	103.68	78	103	19.20	30.08
R2	92.28	93.10	287	238	22.58	27.36
R3	90.93	100.05	123	102	20.44	29.67
<b>Combined Reserve</b>	<b>91.51</b>	<b>98.94</b>	<b>488</b>	<b>443</b>	<b>21.53</b>	<b>28.60</b>
C1	58.33	80.00	18	16	20.36	26.42
C2	73.93	97.76	75	29	25.95	20.65
C3	80	91.26	69	22	24.20	20.11
<b>Combined Control</b>	<b>74.72</b>	<b>91.42</b>	<b>162</b>	<b>67</b>	<b>25.28</b>	<b>34.57</b>

## 4.0 Discussion

These results demonstrate that for the Spiny lobster *Jasus edwardsii*, the Te Awaatu Marine Reserve is having a positive effect. Lobsters are far more common in the reserve than outside and there has been an increase in lobster numbers both inside and outside the reserve.

The average size of the lobsters inside and outside the reserve has declined since the 2001 survey. It is difficult to determine the cause of this.

## **5.0 Recommendations**

- 1 This work should be repeated in April 2005.

## **Acknowledgements**

Dave Johnson from Tawaki Dive.

The diving for this work was completed by Murray Willans, Mark Mawhinney and Dave Johnson.

This report draws largely on the work done in Doubtful Sound by Dr Shane Kelly of Coastal and Aquatic Systems Ltd, Auckland and the 2000, 2001 and 2002 reports by Allan Munn and Elton Smith, Department of Conservation, Te Anau Area Office.

## References

- Cole R.G., Ayling M.J., Creese R.G. (1990) Effects of marine reserve protection at Goat Island northern New Zealand. *NZ Journal of Marine and Freshwater Res* 24: 297 –210
- Kelly S (1999) Marine reserves and the spiny lobster *Jasus edwardsii*. Unpublished Ph.D thesis, University of Auckland.
- Kelly S (1999) 1999 Lobster survey of Te Awaatu (the gut) Marine Reserve, Doubtful Sound. Unpublished Dept of Conservation report, Southland Conservancy.
- MacDiarmid A.B., (1991) Seasonal changes in depth distribution, sex ratio and size frequency of spiny lobster *Jasus edwardsii* on a coastal reef in northern NZ. *Marine ecological prog ser* 70: 129 – 141
- MacDiarmid A.B., Breen P.A. (1993) Spiny lobster population changes in a marine reserve. *Proceedings of the second international temperate reef symposium*. NIWA Marine, Wellington p 47-56.
- Miller K.J. (1995) Size frequency distribution of red corals at Te Awaatu Marine Reserve, Doubtful Sound, Fiordland. NIWA report to Department of Conservation.
- Miller K.J., Mundy C, (1999) Population structure, damage frequency and growth rates of red coral in Doubtful Sound. Contract report to Department of Conservation.
- Miller K.J., Mundy C, (2000) **Monitoring Red Corals in the Te Awaatu Marine Reserve, Doubtful Sound, Fiordland: 1995 – 2000.**
- Munn, A. (2000). **Lobster Survey of Piopiotahi Marine Reserve, Milford Sound. Southland Conservancy, Department of Conservation.**
- Ryan P., Paulin C., *Fiordland Underwater, New Zealands hidden wilderness* (1998) Exisle publishing Ltd.
- Smith, E.D. (2001). **Lobster Survey of Te Awaatu Marine Reserve, Doubtful Sound. Southland Conservancy, Department of Conservation.**
- Smith, E.D. (2002). **Lobster Survey of Piopiotahi Marine Reserve, Milford Sound. Southland Conservancy, Department of Conservation.**

## Appendix 1.

### Rock Lobster carapace length, actual and estimates Doubtful Sound, March 2003

Dave		Murray		Mark	
Actual	Estimate	Actual	Estimate	Actual	Estimate
95	105	123	100	123	120
123	115	95	85	118	130
110	110	110	105	110	120
90	95	90	100	90	110
85	90	85	80	85	90
93	90	93	100	93	100
85	90	85	90	85	85
90	95	90	100	90	100
85	90	85	90	85	85
95	95	95	90	105	130
90	90	105	105	90	90
80	80	90	110	80	80
85	85	80	80	100	95
140	130	140	140	80	80
		110	115	100	95
		110	110	90	100
		115	115	110	105

Willans - correlation coefficient, 0.834

Johnson - correlation coefficient, 0.962

Mawhinney - correlation coefficient, 0.840

Average correlation coefficient, 0.880

## Appendix 2.

### Data collected from rock lobster transects, Doubtful Sound - April 2003

Inside the Reserve					Outside the Reserve						
R1	Size	R2	Size	R3	Size	C1	Size	C2	Size	C3	Size
Transect	(mm)	Transect	(mm)	Transect	(mm)	Transect	(mm)	Transect	(mm)	Transect	(mm)
T1 (5)	100	T1 (16)	75	T1 (11)	90	T1 (0)	nil	T1 (1)	90	T1 (8)	75
	70		70		60	T2 (0)	nil	T2 (0)	nil		90
	105		80		115	T3 (18)	60	T3 (0)	nil		95
	110		80		110		90	T4 (3)	50		130
	90		110		100		50		110		80
T2 (0)	nil		95		90		90		110		90
T3 (23)	139		85		80		75	T5 (1)	125		80
	100		90		100		30	T6 (0)	nil		90
	80		95		120		40	T7 (0)	nil	T2 (8)	65
	80		90		40		60	T8 (44)	85		65
	100		90		100		70		75		130
	70		85	T2 (0)	nil		70		100		45
	70		95	T3 (17)	100		40		95		60
	95		110		40		40		95		90
	90		115		110		25		95		90
	90		130		90		30		75		95
	95	T2 (23)	60		100		75		75	T3 (17)	115
	95		50		40		70		95		90
	130		60		40		60		100		85
	105		45		45		75		95		120
	90		65		40	T4 (0)	nil		95		90
	85		95		90	T5 (0)	nil		50		80
	80		55		65	T6 (0)	nil		50		95
	78		80		50	T7 (0)	nil		60		120
	85		95		100	T8 (0)	nil		60		115
	130		75		95	T9 (0)	nil		105		100
	30		60		50	T10 (0)	nil		45		90
	85		100		50				100		105
	110		95		100				90		40
T4 (8)	95		90	T4 (5)	85				85		40
	90		90		115				50		50
	30		60		90				60		90
	55		80		95				50		95
	90		100		100				105	T4 (1)	110
	110		90	T5 (24)	80				55	T5 (9)	20
	110		80		80				50		70
	95		95		80				100		70
T5 (0)	nil		95		90				50		80
T6 (1)	105		95		110				50		80
T7 (10)	95	T3 (4)	85		95				60		75
	90		85		100				40		75
	90		90		95				40		80
	120		100		100				50		70
	55	T4 (1)	135		95				80	T6 (3)	75
	90	T5 (0)	nil		90				40		80
	110	T6 (18)	90		80				110		65
	95		90		80				20	T7 (0)	nil

	95	90	90		20	T8 (6)	115
	110	95	130		25		115
T8 (0)	nil	80	90		125		115
T9 (2)	90	100	85		30		100
	75	140	90		30		85
T10 (30)	80	110	85		45		95
	95	110	110		45	T9 (15)	95
	105	115	90		60		40
	80	90	95		80		40
	90	100	90		80		90
	85	95	100		85		65
	85	100	T6 (18)	75	60		65
	85	110		90	100		65
	75	90		85	90		50
	75	90		95	75		50
	110	105		90	100		65
	75	T7 (73)	120	85	45		50
	75		60	75	70		50
	75		95	75	100		70
	90		55	85	90		60
	95		80	60	65		40
	80		60	60	100	T10 (2)	80
	65		60	80	105		70
	95		95	55	85		
	100		70	70	80		
	65		100	70	75		
	90		95	95	50		
	120		65	110	50		
	95		40	115	100		
	115		45	T7 (1)	90		
	75		110	T8 (0)	80		
	100		90	T9 (23)	90		
	60		90		90		
	70		120		T10 (0)	nil	
			100				
			105				
			95				
			65				
			105				
			95				
			80				
			120				
			85				
			65				
			80				
			80				
			90				
			65				
			95				
			100				
			90				
			90				
			110				
			95				
			110				

	80	T10 (24)	95
	90		85
	60		125
	100		70
	95		70
	85		80
	110		100
	100		90
	110		135
	110		130
	100		95
	90		95
	20		110
	40		115
	40		120
	35		90
	70		80
	80		90
	45		65
	60		85
	70		85
	110		110
	80		100
	110		100
	90		
	85		
	70		
	110		
	90		
	100		
	80		
	80		
	95		
	65		
	105		
T8 (1)	140		
T9 (47)	110		
	120		
	115		
	115		
	120		
	115		
	110		
	65		
	110		
	115		
	140		
	90		
	90		
	95		
	100		
	100		
	95		
	95		

95  
85  
95  
80  
80  
80  
105  
105  
100  
100  
105  
90  
90  
90  
95  
100  
95  
70  
50  
95  
60  
60  
100  
60  
60  
95  
70  
95  
90  
T10 (104) 110  
110  
120  
125  
100  
90  
90  
130  
110  
85  
120  
80  
100  
105  
105  
100  
100  
85  
95  
125  
100  
100  
40  
115  
110

115  
100  
90  
90  
100  
100  
100  
120  
40  
120  
120  
115  
115  
115  
115  
120  
120  
120  
115  
115  
115  
115  
115  
105  
105  
105  
110  
110  
110  
110  
120  
100  
35  
115  
120  
115  
100  
100  
140  
100  
55  
80  
95  
100  
100  
95  
120  
60  
10  
100  
90  
80  
40  
85

55  
75  
110  
80  
40  
95  
120  
105  
100  
85  
80  
80  
100  
65  
65  
120  
95  
95  
105  
50  
80  
90  
80  
150  
160

