How people responded to the April 2007 tsunami warning in Cairns and Townsville

David King, Centre for Disaster Studies, James Cook University reports on some remarkable responses to warnings in Far North Queensland.

Abstract

Following the Indian Ocean Tsunami in 2004 there was heightened international awareness of this hazard and strategies were developed to improve tsunami warning systems worldwide. Australian emergency management and scientific agencies such as EMA, Geoscience Australia, the Bureau of Meteorology and state emergency management departments released warning and behaviour information through websites, and the development of warning systems has been ongoing. Despite the enormity of the tsunami, research on tsunami awareness has been limited. The tsunami warning that took place on 2nd April 2007 was a rare opportunity to record how people responded. Surveys carried out by the Centre for Disaster Studies showed that most (76%) people heard the warning while it was current during the morning of 2nd April, primarily before 0930, but that most people sought no extra information (70%) and took no action (53%). Townsville was significantly more laid back than Cairns, but only 35 per cent considered future tsunami warnings to be unlikely or are not bothered about them. People called for more information and advice. There were strong levels of concern about the warning, future warnings and knowledge of correct actions. However, significant proportions of residents did not know whether or not they lived in a storm surge zone.

Introduction

Early on the morning of 2nd April a tsunami warning was issued for the east coast of Australia following a strong earthquake off the coast of the Solomon Islands around Gizo. The GA website recorded an 8.1 earthquake at 2039 UTC, followed by other lesser earthquakes. This would have been at 0639 Queensland time, such that the warning was issued during early daylight hours, predicting initial impact on the Queensland coast, around Cooktown, after 0930 with subsequent impacts further southwards. Willis Island was identified as an initial point of impact before the tsunami reached the mainland. Information was relayed by media outlets, but regular updates were available on the BoM website, specifically information at around 0930 that nothing significant had been detected at Willis Island.

Following the warnings there was a strong reaction amongst residents in Cairns and there was significant media interest and coverage. This was the first time an official tsunami warning had been issued to mainland Australia since the Indian Ocean tsunami at the end of 2004. Only four articles have appeared in this journal addressing aspects of the relevance of that tsunami to Australian communities. Paterson (2006) was mainly concerned with the response, and Handmer and Choong (2006) looked at aspects of recovery, while Gurtner and I (2005) were particularly interested in how a tourist destination dealt with such a disaster. The only tsunami awareness and warning study was that conducted by Bird and Dominey-Howes (2006) in a limited pilot study that was aimed at developing a methodology for a much larger survey. Thus the April 2007 warning provided an opportunity to ascertain actual response and behaviour that can contribute to future tsunami education. This is the first survey of actual response to a real tsunami warning since the Indian Ocean tsunami occurred.

Household survey method

A sample household telephone survey was carried out in Townsville and Cairns in the days following the warning. Both sets of surveys were completely random, based on the Telstra white pages phone book.

Questions were intended to be unambiguous and brief in order to retain the interest of respondents, as call centre surveys and telesales have reduced the effectiveness of research surveys, while the proliferation of mobile phones, especially among younger residents, is consistently skewing responses from conventional landlines. On the other hand mobile phones offer great potential for rapid transmission of warnings.

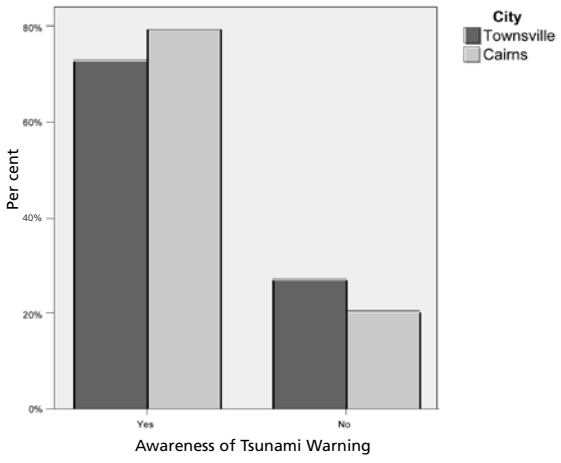
The warning

There is a statistically significant difference between Townsville and Cairns of residents' awareness of the tsunami warning, but as table 1 indicates, the proportions are high in each city, with a mean of 76%. This is a high response rate, but it must be noted that the situation for informing the population was probably the best that could be expected. A Monday morning travel to work period is a time when many people will be listening to radio or television and communicating with family and colleagues.

Table 1. Awareness of tsunami warning

Aware of Warning	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
Yes	291	72.9%	255	79.2%	546	75.7%
No	108	27.1%	66	20.5%	174	24.1%
Not stated			1	.3%	1	.1%
Total	399	100%	322	100%	721	100%

Figure 1. Awareness of tsunami warning



The following tables, 2 to 5, record the source of information of the tsunami warning by city, age group, length of residence, gender and living arrangements.

Table 2. Source of awareness of tsunami warning

Heard about warning	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
Commercial TV	83	28%	46	18%	129	23%
ABC TV			1	0%	1	0%
Sky News	1	0%			1	0%
Weather Channel	1	0%			1	0%
Commercial local radio	83	28%	83	33%	166	30%
ABC radio	18	6%	11	4%	29	5%
Word of mouth	59	20%	65	25%	124	23%
Shops/ commercial premises	5	2%	5	2%	10	2%
Work	35	12%	36	14%	71	13%
Other	3	1%	4	2%	7	1%
At school delivering children	7	2%	4	2%	11	2%
Total	295	100%	255	100%	550	100%

The three sources of information that are dominant are commercial TV, commercial local radio and word of mouth. The category of work may also be added to word of mouth. Table 2 breaks down the source of information by city and this is the primary categorisation used in most of the rest of the tables. The differences in sources are statistically significant for city and age group, but for the other socio-demographic categories of length of residence, and gender, the differences are not statistically different, although interesting variations are still evident. Gender is particularly consistent, with virtually no difference between the sexes.

Table 3. Source of awareness of tsunami warning by age group

Heard about warning	Age group							
	Under 30 years		30-50 years		Over 50 years		Total	
	No.	%	No.	%	No.	%	No.	%
Commercial TV	21	23%	49	19%	58	29%	128	23%
ABC TV			1	0%			1	0%
Sky News					1	1%	1	0%
Weather Channel					1	1%	1	0%
Commercial local radio	32	34%	84	33%	50	25%	166	30%
ABC radio	1	1%	11	4%	17	9%	29	5%
Word of mouth	26	28%	58	23%	40	20%	124	23%
Shops/commercial premises	2	2%	2	1%	6	3%	10	2%
Work	8	9%	38	15%	25	13%	71	13%
Other	3	3%	4	2%			7	1%
At school delivering children			10	4%	1	1%	11	2%
Total	93	100%	257	100%	199	100%	549	100%

Table 4. Source of awareness of tsunami warning by length of residence

Heard about warning	Length lived here					Total
	Under a year	1-5 years	5-10 years	> 10 years	All life	Row %
	Row %	Row %	Row %	Row %	Row %	Row %
Commercial TV	5	16	9	54	16	100
ABC TV				100		100
Sky News		100				100
Weather Channel				100		100
Commercial local radio	1	20	13	51	14	100`
ABC radio	3	14	7	59	17	100
Word of mouth	4	22	14	46	15	100
Shops/commercial premises	10	10		70	10	100
Work	1	17	24	39	18	100
Other	14	14	43	29		100
At school delivering children		27	18	36	18	100
Total	3	19	14	49	15	100

Table 5. Source of awareness of tsunami warning by gender

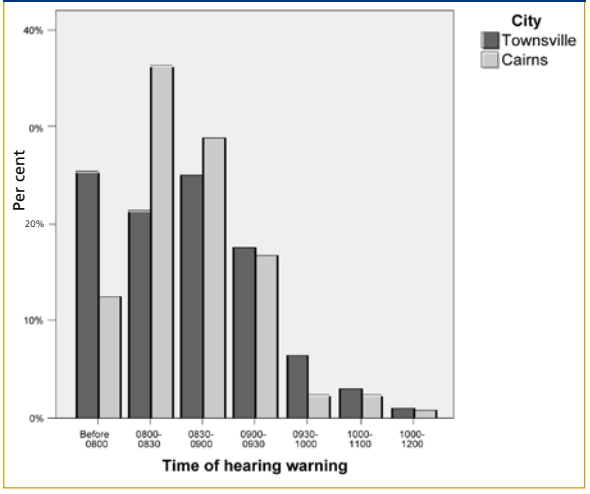
Heard about warning	Gender				Total	
	Male		Female			
	No.	%	No.	%	No.	%
Commercial TV	47	23	81	23	128	23
ABC TV			1	0	1	0
Sky News	1	0			1	0
Weather Channel			1	0	1	0
Commercial local radio	62	31	104	30	166	30
ABC radio	11	5	18	5	29	5
Word of mouth	48	24	76	22	124	23
Shops/ commercial premises			10	3	10	2
Work	28	14	43	12	71	13
Other	3	1	4	1	7	1
At school delivering children	2	1	9	3	11	2
Total	202	100	347	100	549	100

The warning was in the public domain before 0800 but only a minority 19% heard it at that time, whereas most of the 76% of the population who were aware of the tsunami warning during the morning, had become aware of it by 0900 – 74% of the aware population. This was well before the estimated impact time and therefore gave time for action. There is an interesting variation in timing before 0830, between Townsville and Cairns. Roughly the same proportion had become aware by 0830, but most of the Townsville respondents at these times indicated before 0800 whereas in Cairns it was between 0800 and 0830. It is probable that many of these were around the 8 am news and recall is more of an issue than an apparent time lag.

Table 6. Time of hearing the warning

Time of hearing warning	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
Before 0800	75	25%	32	13%	107	19%
0800-0830	63	21%	93	36%	156	28%
0830-0900	74	25%	74	29%	148	27%
0900-0930	52	18%	43	17%	95	17%
0930-1000	19	6%	6	2%	25	5%
1000-1100	9	3%	6	2%	15	3%
1000-1200	3	1%	2	1%	5	1%
Total	295	100%	100%	256	551	100%

Figure 2. Time of hearing the warning



Confirmation of the warning

Other sources of the tsunami warning were available around the same time. These served to confirm and verify the warning. Table 8 records these other sources, which follow a similar pattern to that of the initial warning information. Almost a third of respondents stated that they received no other warning information.

Table 7. Other sources of the warning

Other sources of warning	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
Comm-ercial TV	46	16%	40	16%	86	16%
BoM website	38	13%	22	9%	60	11%
Other TV news channels	3	1%			3	1%
Weather Channel	1	0%	2	1%	3	1%
Radio	59	20%	41	16%	100	18%
Word of mouth	48	16%	54	21%	102	19%
TV/radio	11	4%	7	3%	18	3%
None	84	29%	87	34%	171	31%
Other	3	1%	3	1%	6	1%
Other website	1	0%			1	0%
Total	294	100%	256	100%	550	100%

The usefulness of all of the warning sources is indicated in tables 8 and 9, broken down by city and gender. In both cases there is no significant difference, but the majority of people, 56%, found the warning information unsatisfactory in one way or another.

Table 8. Usefulness of warning information by city

Was warning info helpful	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
Yes	128	43%	117	46%	245	44%
No	146	49%	114	45%	260	47%
Unsure	3	1%	12	5%	15	3%
Confusing	2	1%	7	3%	9	2%
Vague	10	3%	4	2%	14	3%
Aware	3	1%	1	0%	4	1%
Limited	3	1%	1	0%	4	1%
Total	295	100%	256	100%	551	100%

Table 9. Usefulness of warning information by gender

Was warning info helpful	Gender				Total	
	Male		Female			
	No.	%	No.	%	No.	%
Yes	81	40	163	47	244	44
No	103	51	157	45	260	47
Unsure	7	3	8	2	15	3
Confusing	2	1	7	2	9	2
Vague	5	2	9	3	14	3
Aware	2	1	2	1	4	1
Limited	2	1	2	1	4	1
Total	202	100	348	100	550	100

Tables 10 to 12 illustrate the responses to further information needs. A majority of 70% did not seek any further information beyond the initial warnings. There is a clear and statistically significant difference between Townsville and Cairns, with a much higher proportion of Cairns residents seeking further information.

Table 10. Need for further information

Sought further inform-ation	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
Yes	65	22%	98	38%	163	30%
No	229	78%	157	61%	386	70%
Total	294	100%	255	100%	549	100%

In seeking further information the BoM website is clearly dominant, and there is little difference in that source between the two cities. Townsville residents simply did not bother looking anywhere else. Other websites include Google and 9msn. Table 12 suggests that generally more people found that additional information useful rather than not.

Table 11. Where further information was sought

Where info sought	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
BoM website	46	16%	47	18%	93	17%
Other Website	2	1%	9	4%	11	2%
Word of mouth	4	1%	16	6%	20	4%
None sought	231	78%	158	62%	389	71%
Weather channel	1	0%	4	2%	5	1%
TV/radio	8	3%	16	6%	24	4%
Other	3	1%	6	2%	9	2%
Total	295	100%	256	100%	551	100%

Table 12. Usefulness of further information

Was extra info helpful	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
Yes	44	15%	56	22%	100	18%
No	21	7%	39	15%	60	11%
None sought	228	77%	160	63%	388	70%
Unsure			1	0%	1	0%
Vague	2	1%			2	0%
Total	295	100%	256	100%	551	100%

Location and actions

There is no statistically significant difference between Cairns and Townsville in terms of the location of people at the time of hearing the tsunami warning, but the response shows a strongly different reaction. Cairns residents took the warning more seriously than people in Townsville. However, despite the media portrayal of mass panic in Cairns, only 13% of the respondents actually relocated away from the coast, although even such a small proportion will amount to many thousands of extra vehicles on the road at rush hour.

Table 12. Usefulness of further information

Was extra info helpful	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
Yes	44	15%	56	22%	100	18%
No	21	7%	39	15%	60	11%
None sought	228	77%	160	63%	388	70%
Unsure			1	0%	1	0%
Vague	2	1%			2	0%
Total	295	100%	256	100%	551	100%

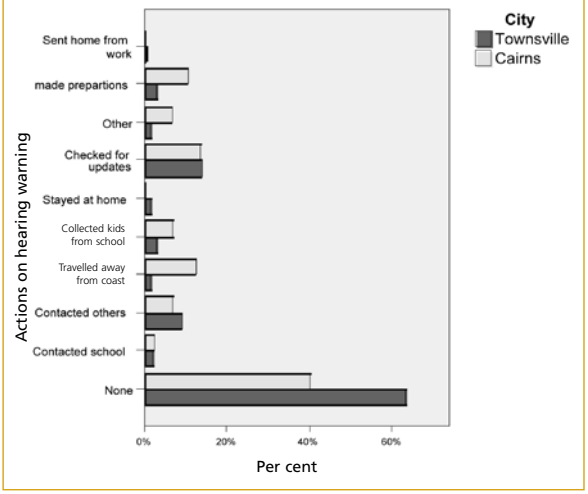
Table 13. Location of respondents on hearing warning

Where were you	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
Home	169	57%	143	56%	312	57%
Work	69	23%	55	21%	124	23%
Travelling	38	13%	42	16%	80	15%
Other	15	5%	12	5%	27	5%
On a boat			3	1%	3	1%
School	4	1%	1	0%	5	1%
Total	295	100%	256	100%	551	100%

Table 14. Response to the warning

Actions on hearing warning	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
None	187	63%	103	40%	290	53%
Contacted school	6	2%	6	2%	12	2%
Contacted others	27	9%	18	7%	45	8%
Travelled away from coast	5	2%	32	13%	37	7%
Collected kids from school	9	3%	18	7%	27	5%
Stayed at home	5	2%			5	1%
Checked for updates	41	14%	35	14%	76	14%
Other	5	2%	17	7%	22	4%
Made prep-arations	9	3%	27	11%	36	7%
Sent home from work	1	0%			1	0%
Total	295	100	256	100	551	100

Figure 3. Actions on hearing the tsunami warning



When examining actions in response to the warning it is particularly interesting that despite a very significant difference between the cities, there is no statistically significant difference once again between genders. Cairns residents reacted more strongly than those of Townsville regardless of gender. Partly this may be explained by table 16, where proximity to the sea, or perhaps a perception of proximity, is statistically significantly different between the two cities.

Table 15. Response to the warning by gender

Actions on hearing warningl	Gender				Total	
	Male		Female			
	No.	%	No.	%	No.	%
None	116	57	174	50	290	53
Contacted school	1	0	11	3	12	2
Contacted others	19	9	26	7	45	8
Travelled away from coast	13	6	24	7	37	7
Collected kids from school	3	1	24	7	27	5
Stayed at home	2	1	3	1	5	1
Checked for updates	26	13	50	14	76	14
Other	8	4	14	4	22	4
Made preparations	14	7	22	6	36	7
Sent home from work	1	0			1	0
Total	203	100	348	100	551	100

Table 16. Proximity to the sea

Close to the sea	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
Yes	77	26%	126	49%	203	37%
No	217	74%	111	44%	328	60%
Don't know			18	7%	18	3%
Total	294	100%	255	100%	549	100%

While the decision to evacuate inland or away from the coast was clearly different between Townsville and Cairns, there was a significant difference for the length of time that people had lived in either city, but no statistical significance for age group.

Table 17. Evacuation inland or away from the coast

Evacuate inland	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
Yes	10	3%	63	25%	73	13%
No	285	97%	193	75%	478	87%
Total	295	100%	256	100%	551	100%

Table 18. Evacuation inland or away from coast by length of residence

Length lived here	Evacuate inland				Total	
	Yes		No			
	No.	%	No.	%	No.	%
Less than a year	1	6	15	94	16	100
1-5 years	16	15	89	85	105	100
5-10 years	15	20	60	80	75	100
Over 10 years	34	13	238	88	272	100
All life	7	8	76	92	83	100
Total	73	13	478	87	551	100

Table 19. Evacuation inland or away from the coast by age group

Age group	Evacuate inland				Total	
	Yes		No			
	No.	%	No.	%	No.	%
Under 30 years	11	12	83	88	94	100
30-50 years	41	16	217	84	258	100
Over 50 years	21	11	178	89	199	100
Total	73	13	478	87	551	100

Very few people went down to the coast to watch for the tsunami. There is no knowledge of the extent to which the curious were informed about the real size and danger of the tsunami. Precaution takers far outnumbered the risk takers.

Table 20. Risk behaviour

Went to see	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
Yes	3	1%	15	6%	18	3%
No	292	99%	241	94%	533	97%
Total	295	100%	256	100%	551	100%

Table 21 records people's knowledge of whether or not they were located in a storm surge zone at the time of the warning. The primary intent of this question was to record perception of surge zone and then attempt to map this by phone book address. This is an area for further research, and probably needs further data analysis to exclude respondents who related this answer to a place of work rather than residence.

Table 21. Knowledge of location in storm surge zone

In storm surge zone	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
Yes	78	26%	119	46%	197	36%
No	172	58%	77	30%	249	45%
Don't know	45	15%	60	23%	105	19%
Total	295	100%	256	100%	551	100%

Knowledge and feelings

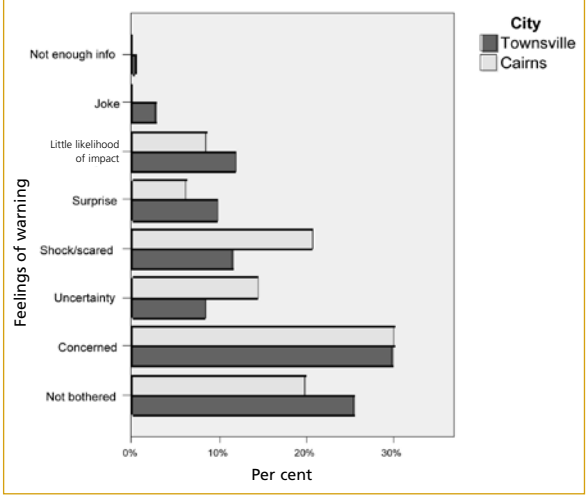
The question about people's feelings towards the warnings was open ended. The responses that were given were coded into the categories that are listed in table 22. Only a third of responses are in the unconcerned/not worried categories. The majority of people were affected by the warning, even if most made no response to it. Between the two cities, despite a significant difference in response and action, there is no statistically significant difference in the emotional response to the tsunami. There is also no statistically significant difference between males and females. Not only does this lack of a gender difference occur throughout much of this survey, we have also seen a lack of gender difference in other surveys of awareness and preparedness, and hazard behaviour etc.

Table 22. Feelings about the warning

Feelings of warning	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
Not bothered	75	25%	51	20%	126	23%
Concerned	88	30%	77	30%	165	30%
Uncert-ainty	25	8%	37	14%	62	11%
Shock/ scared	34	12%	53	21%	87	16%
Surprise	29	10%	16	6%	45	8%
Little likelihood of impact	35	12%	22	9%	57	10%
Joke	8	3%			8	1%
Not enough info	1	0%			1	0%
Total	295	100%	256	100%	551	100%

In order to contribute to future research and the development of tsunami information and education that supports a warning system, summary phrases of people's responses and concerns have been listed in the full report on the Centre's website (King 2007). These give further words and phrases that may be significant in determining the wording of educational materials and information. The same has been done for tables 23 and 24 below, which indicate, respectively, people's feelings about future tsunamis, and their knowledge of tsunamis.

Figure 4. Feelings about the warning



Although there was no difference between the cities about this specific warning, there is a strong statistically significant difference in the responses about future tsunami warnings. Here Townsville residents emerge with far fewer being unconcerned (as well as those who were concerned), but a much higher proportion than Cairns wanting to find out more/be prepared, or sure it won't happen again.

Table 23. Feelings about future tsunami warnings

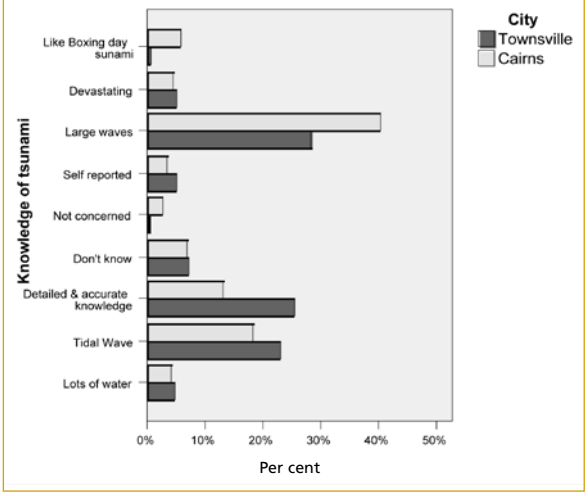
Future Warnings	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
Un-concerned	53	18%	89	35%	142	26%
Concerned	71	24%	92	36%	163	30%
Find out more	55	19%	3	1%	58	11%
Be more prepared	32	11%	42	16%	74	13%
It won't happen	51	17%	1	0%	52	9%
Don't know	26	9%	28	11%	54	10%
Evacuate	1	0%			1	0%
Other	5	2%			5	1%
Stay at home	1	0%			1	0%
Total	295	100%	255	100%	550	100%

The question prompting knowledge of tsunamis was intentionally general in order to generate a range of words, phrases and attitudes that could inform awareness and education strategies. Consequently the categories recorded in table 24 are quite separate and discontinuous. Some people simply replied that their knowledge or understanding of tsunamis was good, without providing details, while others gave long presentations.

Table 24. Knowledge of tsunamis

Knowledge of tsunami	City				Total	
	Townsville		Cairns			
	No.	%	No.	%	No.	%
Lots of water	14	5%	11	4%	25	5%
Tidal Wave	68	23%	47	18%	115	21%
Detailed & accurate knowledge	75	25%	34	13%	109	20%
Don't know	21	7%	18	7%	39	7%
Not concerned	1	0%	7	3%	8	1%
Self reported as good etc.	15	5%	9	4%	24	4%
Large waves	84	28%	103	40%	187	34%
Devastating	15	5%	12	5%	27	5%
Like Boxing day tsunami	2	1%	15	6%	17	3%
Total	295	100	256	100%	551	100%

Figure 5. Knowledge of tsunamis



7. Socio-Demographic characteristics

Non intrusive social and demographic questions were asked at the end of the survey, so that some of the hazard and warning responses could be analysed by age, sex, length of residence and family type. Both Townsville and Cairns have a high turnover of population. Comparison of survey age groups with the census data suggests that the survey was statistically representative.

Tests of statistical significance between the cities were carried out on all four socio-demographic indicators. There was no significant difference between Townsville and Cairns in terms of length of residence, age group and family type, but there is a significant difference in gender. However, it has already been indicated that on most responses there was no significant difference between sexes.

8. Concluding comments

These are important indicators towards a gap between receipt of a warning and knowledge of what to do in response. The most important anomaly is the differences in responses between Cairns and Townsville residents. Although many of the citizens of these cities like to consider themselves to be radically different and better than the other bunch, the reality is that their populations are very similar. There are three probable reasons for the slightly greater response and action in Cairns.

1. Warnings in the media referred to a potential impact on Cooktown and Cairns, and also mentioned the Whitsundays. Anecdotal suggestions from respondents were that Townsville was not mentioned. Apart from concurring with my own experience on first hearing the warning, many respondents mentioned this during interviews in justifying or explaining their non response.
2. A major source of warning information came from the Channel Seven's Sunrise program. Professor Jon Nott was interviewed live on the program and gave sensible and realistic advice, mentioning Cairns in his explanation. He is a well known hazard expert in Cairns, where he is resident, such that his advice probably had a greater impact in that city than it would in Townsville.
3. Cairns has been subject to a concerted long term cyclone awareness campaign that has been reinforced in the media, and in a succession of cyclones. It is likely that at least some of the population of Cairns has been educated to take warnings seriously and to respond to them.

While only a small proportion of the Cairns population actually evacuated away from the coast, it was this minority action that created the gridlock on the roads during the tsunami warning period. There is clearly a lesson to be learned from this part of the experience, that Cairns would have significant problems coping with a mass evacuation – whether from a tsunami threat or storm surge.

References

Bird and Dominey-Howes (2006) "Tsunami risk mitigation and the issue of public awareness" *The Australian Journal of Emergency Management*, Vol. 21 No. 4, November

Handmer and Choong (2006) "Disaster resilience through local economic activity in Phuket" *The Australian Journal of Emergency Management*, Vol. 21 No. 4, November

King D. and Gurtner Y. (2005). "After the Wave: A Wake Up Warning for Australian Coastal Locations". *Australian Journal of Emergency Management*, Vol. 20 No. 1.

King D. 2007. The April 2nd Tsunami Warning; surveys of Townsville & Cairns Residents. Centre for Disaster Studies & Bureau of Meteorology. http://www.tesag.jcu.edu.au/CDS/Pages/pdreport.htm

Paterson, Bill (2006) "Thailand's tsunami: disaster management lessons for Australia" *The Australian Journal of Emergency Management*, Vol. 21 No. 4, November

Acknowledgements

This study was funded by a James Cook University Internal Research Grant Linkage with Industry, supported and co-funded by the Bureau of Meteorology.

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