From: Claudette Rechtorik
To: Committee, EC (SEN)
Subject: RE: Inquiry into shark mitigation and deterrent measures - Hansard corrections
Date: Tuesday, 2 May 2017 12:46:01
Attachments:

Hi,
Please find attached the Envirofund community survey we carried out and the subsequent report authored by Honours student Jess Tout.

Kind regards,

Claudette Rechtorik
SEA LIFE Trust Aust/NZ

W: www.sealifetrust.org.au
W: www.oceanyouth.org
c/o SEA LIFE Sydney Aquarium, 1 – 5 Wheat Rd, Darling Harbour, 2000

Understanding current beach safety practices

Name:	Age:	Postcode:
Email:		Date:

1. How often do you swim at the beach)? (☑ **most relevant**)?

- ☐ Daily
- ☐ Weekly
- ☐ Fortnightly
- ☐ Monthly
- ☐ Less than monthly

2. What are the 3 main beaches you swim at (including surfing, kayaking, and other water activities)?

_____

3. Do the beaches you swim at have shark nets? (☑)	☐ Yes	☐ No	☐ Not sure
4. Do the nets span from headland to headland? (☑)	☐ Yes	☐ No	☐ Not sure
5. Are nets in place all year round? (☑)	☐ Yes	☐ No	☐ Not sure

6. For every 1 target shark caught the number of untargeted animals caught in nets, including turtles, dugongs, rays, dolphins and whales is approximately: **(*circle*)**

1 –10 11 – 20 21 - 40 Not sure

7. Have you ever swum at an un-netted beach? (☑)	☐ Yes	☐ No	☐ Not sure
8. Is the presence of a shark net a deciding factor in what beach you will go to swim? (☑)	☐ Yes	☐ No	☐ Not sure
9. Have you ever seen a shark in its natural environment?	☐ Yes	☐ No	☐ Not sure
10. Do you think shark nets are necessary? (☑)	☐ Yes	☐ No	☐ Not sure

11. If so, why? _____

Would you like to be added to our mailing list for information on upcoming events? ☐ Yes ☐ No

Please fax survey to SACF: 9262 2583 or mail to:
SACF, c/o Sydney Aquarium, Aquarium Pier, Darling Harbour, 2000

Thank you for your participation

Understanding Community awareness of New South Wales Shark Meshing Program

Jessica Tout

Sydney Aquarium Conservation Fund

Due: 20/11/09

Words: 2872

Abstract

In 2009 it was the first time since 1972 the Shark Meshing Program (SMP) was reviewed by NSW Department of Primary Industries. The SMP has been a tool used to reduce fatal shark attacks at metropolitan beaches by killing target sharks, including the protected Great White and Grey Nurse. Yet, it is not only sharks which are killed in the nets, which carry a staggering environmental impact upon other marine species. The combination of the 2008/2009 summer in Sydney where two of the three shark attacks that occurred were on netted beaches, as well as the public review of the SMP in early 2009, catapulted the SMP back into public limelight. Due to these events, the objective of this study was to investigate the public's understanding of the SMP by evaluating their knowledge of methods used for their protection. As well as this, assessing their understanding of marine bycatch associated with the SMP was also explored. Since 2007, 662 people were surveyed through a questionnaire prepared by Sydney Aquarium Conservation Fund (SACF). Results obtained indicate the public show a lack of understanding of how the SMP operates to protect them from target sharks. Yet despite this, 57.1% of respondents think shark nets are unnecessary. The vast majority of people surveyed did not know or were not sure if the main beach they swim at is netted, or if the nets span from headland to headland, and if the nets are in place all year round. A staggering 72.2% of respondents do not use the presence of the SMP at a beach to decide if they will swim or not.

Introduction

Assisting the Shark Meshing Program Beach Safety study was apart of my research internship with Sydney Aquarium Conservation Fund (SACF). SACF received an Envirofund grant to *'Build community awareness of shark nets and marine bycatch'*. The SMP was first introduced in Sydney in 1937 and since establishment fifty-one beaches, from Wollongong in the south to Newcastle in the north have nets in place as seen in table one below. As water temperatures rise off the East Coast of Australia, people make their summer pilgrimage to the beach where nets are in place from September 1 to April 30 each year (Green, M, Ganassin, C and Reid, D.D, 2009). Globally, this method of bather protection is seldom used, where NSW, QLD and South Africa are the only places to install shark nets (Rechtorik, C and SACF 2007). Unlike NSW, OLD and South Africa use Drum lines and comparisons between countries can be seen in table two.

Table 1 The 5 regions and 51 beaches of the SMP

Newcastle	Central Coast	Sydney North	Sydney South	Illawarra
Stockton	Lakes	Palm	Bondi	Coledale*
Nobbys	Soldiers	Whale	Bronte	Austinmer
Newcastle	The Entrance	Avalon	Coogee	Thirroul
Bar	Shelly	Bilgola	Maroubra	North Wollongong
Dixon Park*	Terrigal	Newport	Wanda*	South Wollongong
Merewether	North Avoca	Mona Vale	Elouera*	
Redhead	Avoca	Warriewood	North Cronulla*	
Swansea-Blacksmiths	Copacabana	North Narrabeen*	Cronulla	
Caves	MacMasters	Narrabeen	Wattamolla*	
Catherine Hill Bay	Killcare	Dee Why	Garie*	
	Umina	Curl Curl		
		Harbord		
		Queenscliff		
		North Steyne*		
		Manly		

* denotes beaches that were not meshed until 1972

Table2 Summary of the main features of shark control (bather protection) programs in NSW and Queensland, Australia and KwaZulu-Natal, South Africa (Green, M, et al, 2009).

	NSW	Queensland	KwaZulu-Natal
Spatial extent			
Number of beaches	51	84	36
Distance of coastline in program	250 km	1,720 km	320 km
Coverage by nets	Varies - max. 7.65 km	6.5 km	23.4 km
Temporal extent	1 September - 30 April: every weekend; & 9 weekday sets per month per beach	All year	All year, but removed from beaches south of Durban for June-July during the annual sardine run
Methods			
Mesh nets - specifications			
Total number	Varies, maximum 51	35	101
Length	150 m	186 m	most 214 m; 305 m at Durban
Depth	6 m	6 m	6 m
Mesh size	50 - 60 cm	50 cm	51 cm
Hanging coefficient	0.67	unknown	unknown
Distance from shore	~ 500 m	Varies	400 m
Position in water column	Bottom-set	Surface-set	Surface-set
Drumlines - specifications			
Total number	0	344	80
Hook size	n/a	14/0	14/0
Bait type	n/a	Sea mullet & shark	Sea mullet
Bait checking frequency	n/a	daily	unknown
Catch[A] summary			
Annual average number of sharks[B]	143 (1987 - 2007 data)	787 (1987 - 2007 data)	666 (2003 - 2007 data)
Maximum number of sharks & year	234 in 1993/94 (1987-07)	1,063 in 1989/90 (1987-07)	2,272 in 1965 (1964-2003)
Minimum number of sharks & year	76 in 2001/02 (1987-07)	521 in 2003/04 (1987-07)	513 in 2002 (1964-2003)
Annual average number of non-sharks[C]	67 (1995-07)	unknown	433 (2003-07)
Number of reported non-shark groups	7	5	6
Cost	> $800,000	$1.7M in 2004/05	unknown

A - denotes total number of animals caught and is not indicative of mortality or of number of released animals
B - denotes that 'sharks' includes target/dangerous sharks and harmless sharks (e.g. angel sharks), but excludes stingrays
C - stingrays comprise 88% and 59% of non-shark catch in NSW and KwaZulu-Natal, respectively.
(Source: http://www.shark.co.za/statistics.htm; QDPIF 2006; NSW DPI unpub. data; Dudley and Simpfendorfer 2006)

The objectives of deploying the nets by Department of Primary Industries in NSW are to *"reduce the risk of shark attack for surfers and swimmers, culling populations of large aggressive sharks and deterring large sharks from establishing territories adjacent to metropolitan swimming beaches"* (Green, M, Ganassin, C and Reid, D.D, 2009). Many people have little understanding or misconceptions of how the SMP offers to protect swimmers and surfers. The target sharks for the SMP are: tiger, great white, and bull sharks (Rechtorik, C and SACF 2009). Despite common perception, the nets in place at beaches do not span from headland to headland as they are only 150m long by 6m high as seen in figure one. As well as this, the nets are not a permanent fixture at a beach, as they need to be repaired and maintained, and need to be moved to other beaches. Nets are used on a rotating basis whereby any one beach is netted between 9 and 13 days per calendar month (SACF 2009). This means at any given time, a popular Sydney swimming beach may or may not be netted. Because the nets do not span the entire length of the beach as well as diel changes in tides, and the fact that animals are able to swim around and above the nets, 40% of sharks are caught on the beach side of the nets, as they are swimming back out to sea (SACF 2009).

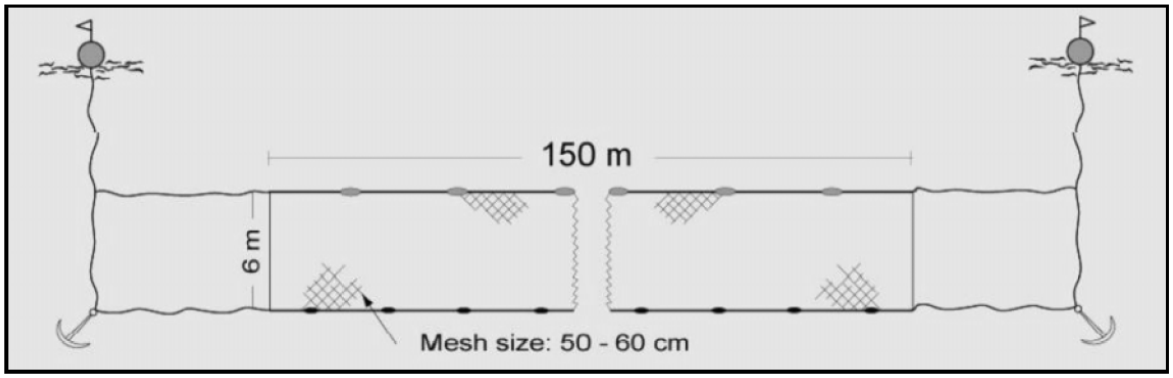

Figure 1 Indicative configuration of a 'set' net (not to scale)

The SMP is now listed as a Key Threatening Process (KTP) under the *NSW Fisheries Management Act 1994* (FM Act) and the *NSW Threatened Species Conservation Act 1995* (TSC Act) as the deployment of the nets have an adverse impact on two or more species listed under those acts (Green, M, Ganassin, C and Reid, D.D, 2009). It was rejected as a KTP under the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as it only adversely affects one species being the Grey Nurse Shark (Green, M, Ganassin, C and Reid, D.D, 2009). From 1950 to 2008 records show the SMP has a staggering adverse environmental impact on many non-target animals including the capture of 98

turtles, 143 dolphins, 7 whales, 3040 rays, 406 finfish, 1 penguin, 6 dugongs, and 4 seals, which can be seen in the table 3 below. For every one shark caught by the SMP, between twenty to forty non-target animals are caught (Rechtorik, C and SACF 2007). Many of these animals are air breathing and once entangled in a net, die slowly. This aspect of the SMP is one which the public are generally aware of; yet do not know the full extent of by-catch.

The rate of bycatch by the SMP is particularly threatening to marine animals and their populations. The six species of sea-turtles which inhabit Australian waters for example, are not only a protected species (National Parks and Wildlife Conservation Act 1975), but are also very slow growers who reach sexual maturity after their twenties (GBR MPA 2008). Although they are highly fecund, they only produce eggs every few years, where only 2% of hatchlings survive to make it to reproductive age. Many sea-turtles become entwined in the shark nets and drown as they are air breathing, which is an extremely adverse impact on their populations as breeding females have decreased up to 67% mainly due to anthropogenic factors.

Table 3 Summary of major animal groups caught in the SMP from January 1950 to 2007/08 (Green, M, Ganassin, C and Reid, D.D, 2009)

Fish	Likely composition	Number	Marine mammals, reptiles, birds	Likely composition	Number
Elasmobranchs			Dolphins	3 species	143
Hammerheads	3 species	4666	Turtles	3 species	98
Stingrays	Up to 8 families	3040	Whales[2]	4 species	7
Whalers	5 species	2949	Dugong	*Dugong dugon*	6
Angel shark	2 species	2313	Seals	2 species	4
Port Jackson	2 species	651	Penguins	*Eudyptula minor*	1
Great whites	*Carcharodon carcharias*	577	**Sub-total**		259
Grey nurse	*Carcharias taurus*	377			
Tigers	*Galeocerdo cuvier*	352			
Sevengills[1]	*Notorhynchus cepedianus*	158			
Shortfin mako	*Isurus oxyrinchus*	144			
Threshers	3 species	125			
Wobbegongs	3 species	42			
Unknown		5			
Osteichthyes					
Finfish	At least 14 species	406			
Sub-total		15,805			
Total		16,064			

[1] denotes that sevengill is the common name historically used to describe this species, but CSIRO's Codes for Australian Aquatic Biota now uses the common name of broadnose shark. For consistency and data comparisons, the term sevengill will be used in this document.

[2] denotes that 'whales' includes killer and false killer whales which are members of the dolphin family

(Source: DPI unpublished data)

Two species of sharks that are caught regularly and are target sharks of the SMP, include the Great White which in fact is listed as vulnerable under the EPBC Act, and protected in all State waters under a variety of Acts since 1998. The SMP and these Acts are like Catch-22 for the Great White as it must be protected as its populations are declining; however humans need protection from the Great Whites as it is a target species. If a shark meshing contractor finds a great white in the nets, it poses a significant dilemma. Under 2m, and if alive, the sharks are to be freed from the nets and released (Rechtorik, C and SACF 2009). The second species, the Grey Nurse is a Critically Endangered species under the EM Act as well as a Critically Endangered Population of the East Coast (EPBC Act). Despite these sharks being a target species, they are being caught at an unsustainable rate for their population as their life histories show they are slow growing and long lived with low fecundity rates.

It is hypothesised that >50% of respondents will be in favour of the SMP, yet their understanding of how the SMP operates to protect them will be little. It is also hypothesised that respondents will be aware of bycatch from the SMP, yet will not know the true extent to which non-target animals are caught.

Materials and Methods

Data Collection:

A survey was compiled by the team at Sydney Aquarium Conservation Fund which received an Envirofund grant to *'Build community awareness of shark nets and marine bycatch'* included the following questions:

1. Name
2. Age
3. Postcode
4. Email address
5. Date
6. How often do you swim at the beach?

   Daily

   Weekly

   Fortnightly

   Monthly

Less than Monthly

7. What are the 3 main beaches you swim at (including all water activities such as surfing, kayaking, etc)?

8. Do the beaches you swim at have shark nets?

Yes

No

Not sure

9. Do the nets span from headland to headland?

Yes

No

Not sure

10. Are the nets in place all year round?

Yes

No

Not sure

11 For every 1 target shark caught the number of untargeted animals caught in nets, including turtles, dugongs, rays, dolphins and whales is approximately

1-10

11-20

21-40

Not sure

12. Have you ever swum at an un-netted beach?

Yes

No

Not sure

13. Is the presence of a shark net a deciding factor in what beach you will go to swim at?

Yes

No

Not sure

14. Have you ever seen a shark in its natural environment?

Yes

No

Not sure

15. Do you think shark nets are necessary?

Yes

No

Not sure

16. If so, why?

Survey methods:

- In total 662 people were surveyed.
- People were surveyed over a period of two years, including two summer seasons 07/08 and 08/09.
- Many people were approached or were given the survey through schools, universities, surf life saving clubs, petexpo and dive associations.
- The survey was placed on SACF website as well as Facebook for visitors to fill in.
- Online surveys were collated on Benchmark Email website.

Statistical Analysis:

- All completed surveys were entered into an MS Office Excel Spreadsheet.
- Percentages of answers were calculated using MS Office Excel.
- The Excel spreadsheet was transferred into SPSS where an ANOVA with Post-Hoc comparisons was performed. A chi Squared Test was also performed on the data collected.

Results

Results obtained from this study indicates a lack of knowledge of the SMP amongst the public, where many respondents were "*not sure*" when asked questions like *"Are the nets deployed all year round?"* and *"Do the nets span headland to headland?"* as well as *"Do you know if the main beach you swim at has shark nets in place?"* and lastly *By-catch,* this can be seen in figures 2-5 Interestingly however, results show that 57.1% of respondents think shark nets are unnecessary as seen in figure 6 below. This response was unanticipated indeed, and was coupled with the fact that not only have 84.9% of respondents swum at a un-netted beach(figure 7), but also 72.2% of respondents do not use the presence of shark nets as a deciding factor of which beach they will swim at (figure 8). However, the majority of people surveyed use the beach less than monthly at 32.3%, closely followed by the weekly beach goers at 28.3%, seen in figure 9. Although the majority of people surveyed don't question if a beach is netted before they go for a swim, this is confounded as 55.8% of respondents did not know or were unsure if the main beach they swim at has nets in place as seen in figure 4 previously. The majority of people (69%) swim at Sydney beaches and have seen a shark in its natural environment 60%, seen in figures 10-11. The demographics of this survey shows that 67% of respondents were under 40 years of age as seen in figure 12.

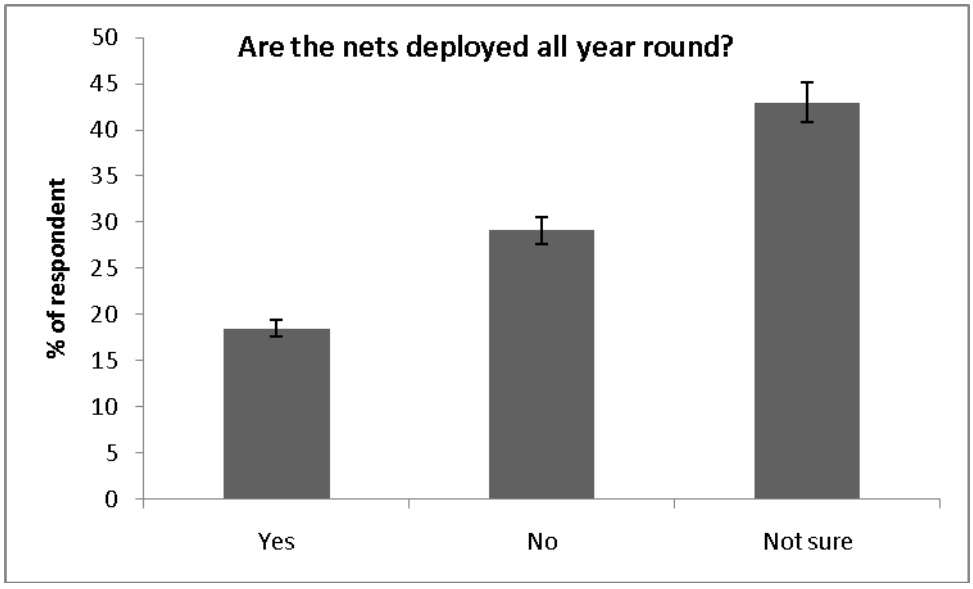

Figure 2 Histogram showing the percentage of respondents who know if the nets are deployed year round.

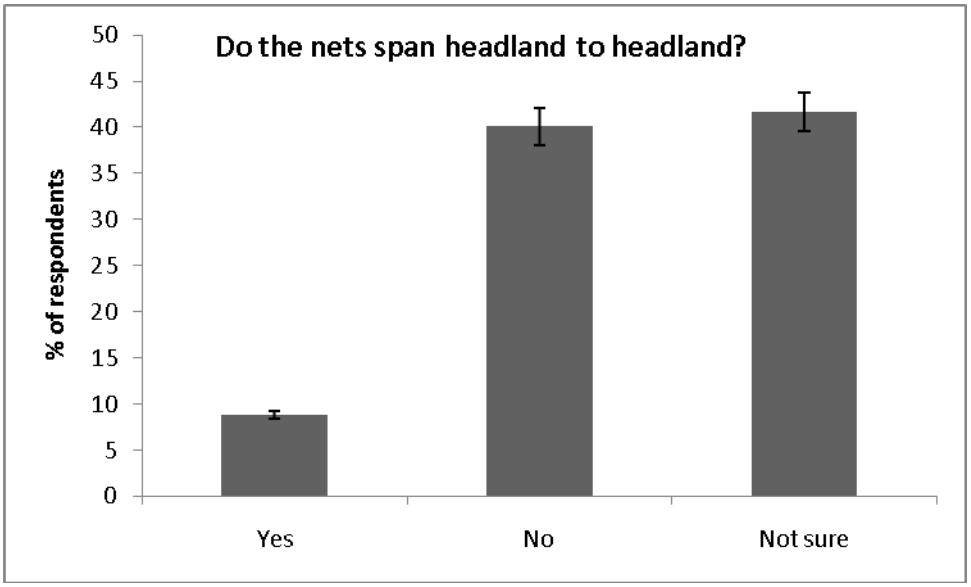

Figure 3 Histogram showing percentage of respondents who know if the nets span headland to headland

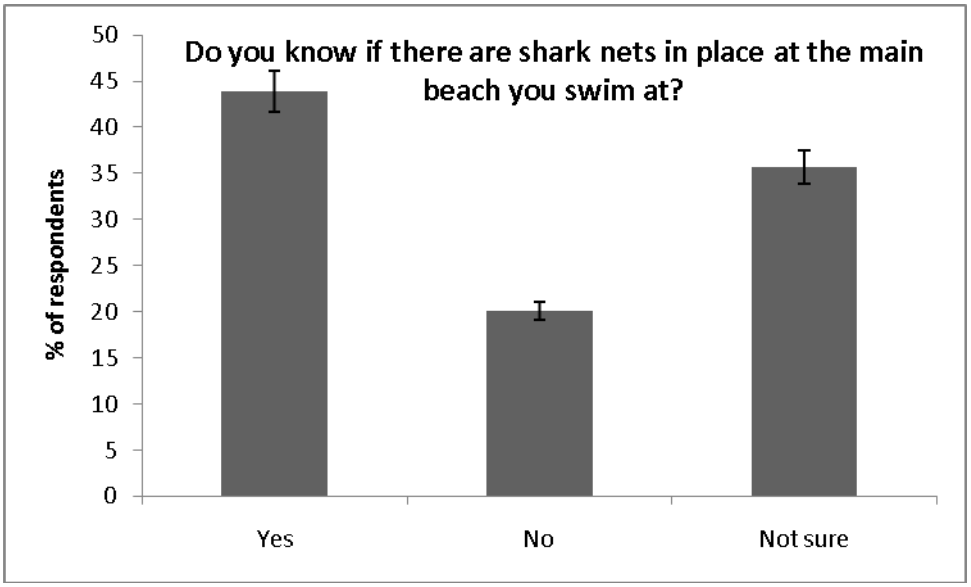

Figure 4 Histogram showing percentage of respondents who know if there are nets in place at the main beach they swim at

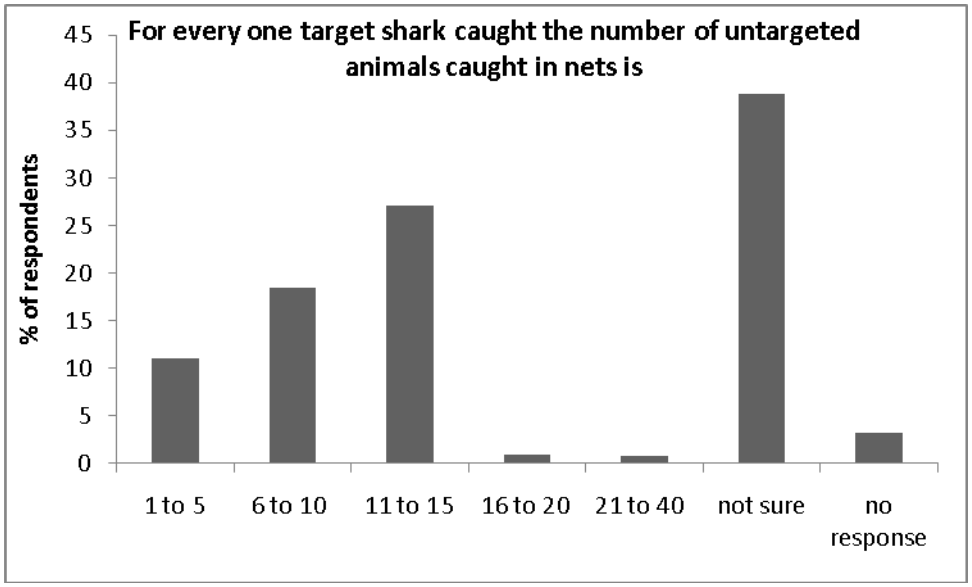

Figure 5 Histogram showing percentage of respondents who know the rate of bycatch caused by the SMP

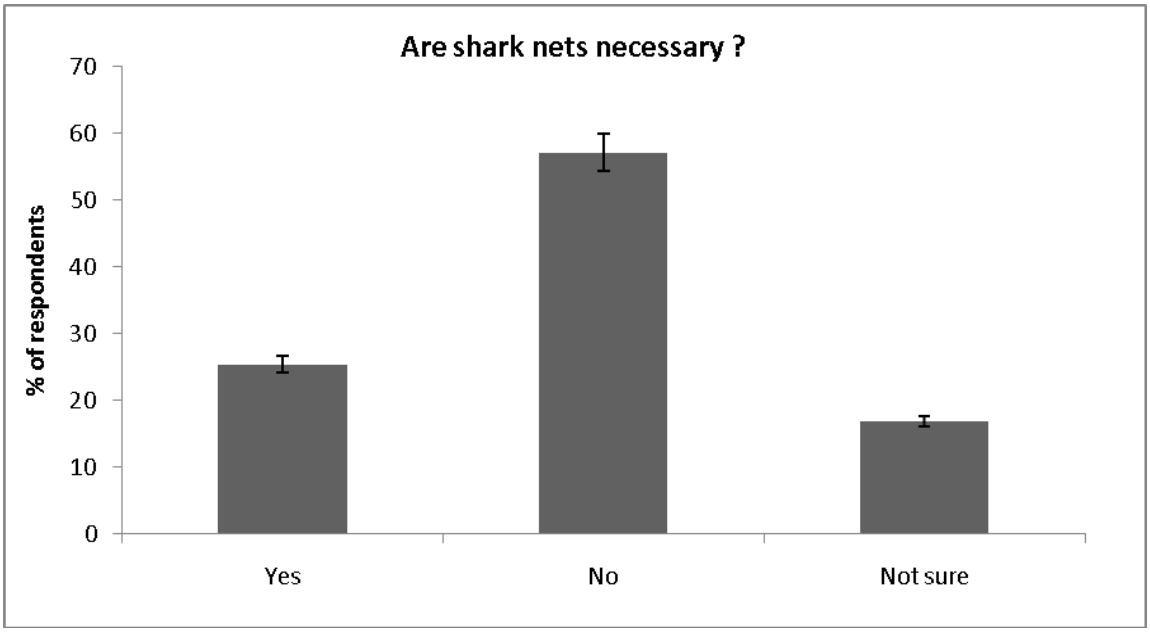

Figure 6 Histogram showing percentage of respondents who think shark nets are necessary

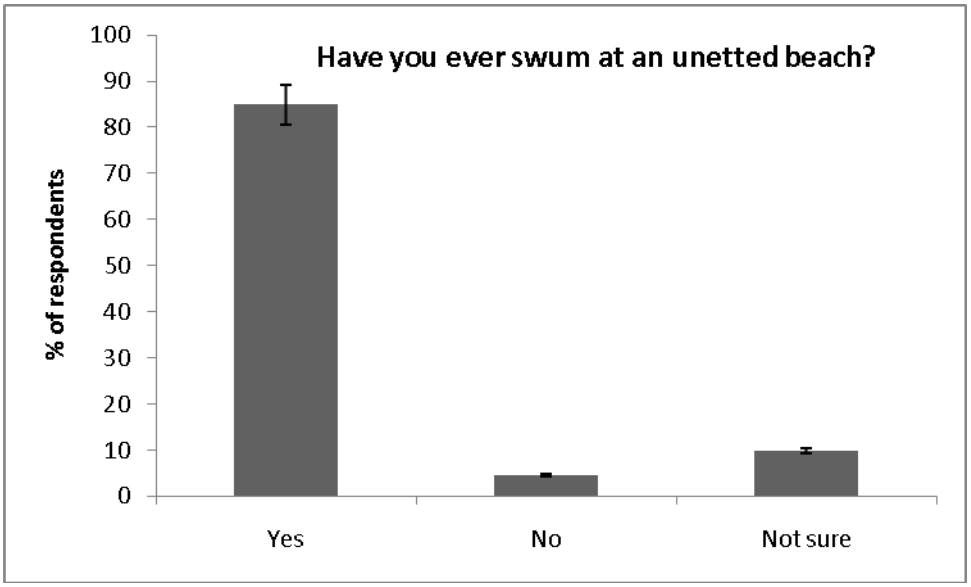

Figure 7 Histogram showing percentage of respondents who have ever swum at an unetted beach

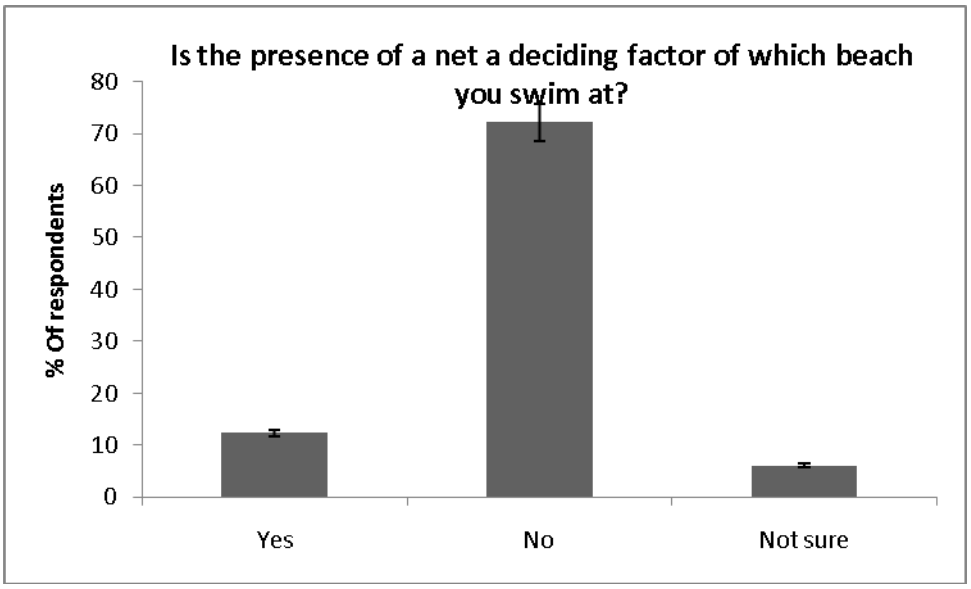

Figure 8 Histogram showing percentage of respondents who use shark nets as a deciding factor when choosing a beach to swim at

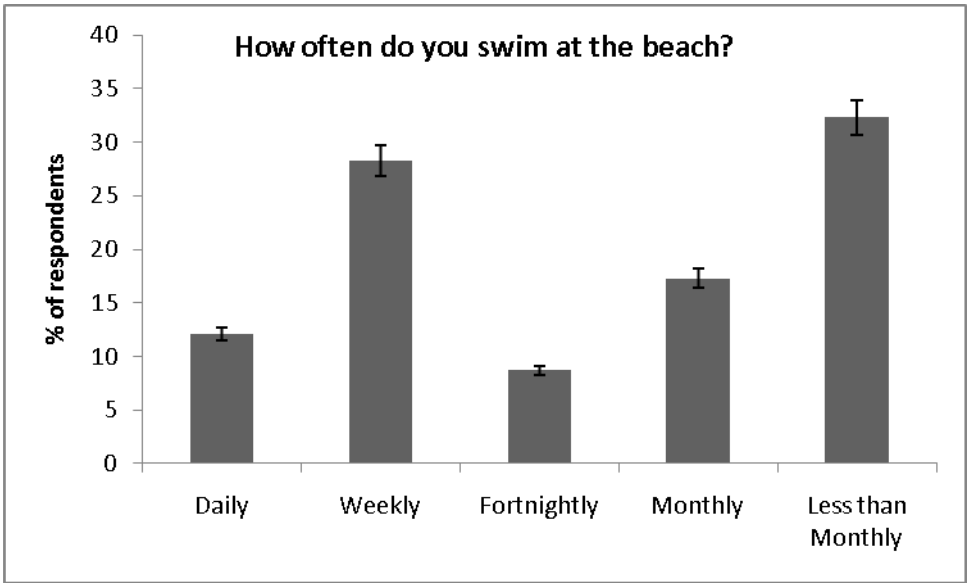

Figure 9 Histogram showing how often respondents swim at the beach

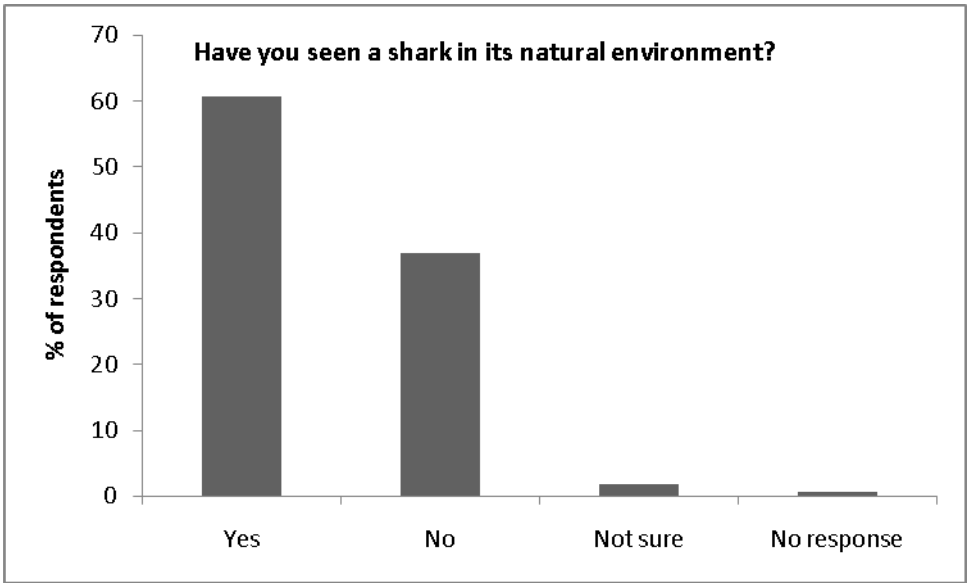

Figure 10 Histogram showing percentage of respondents who have seen a shark in its natural environment

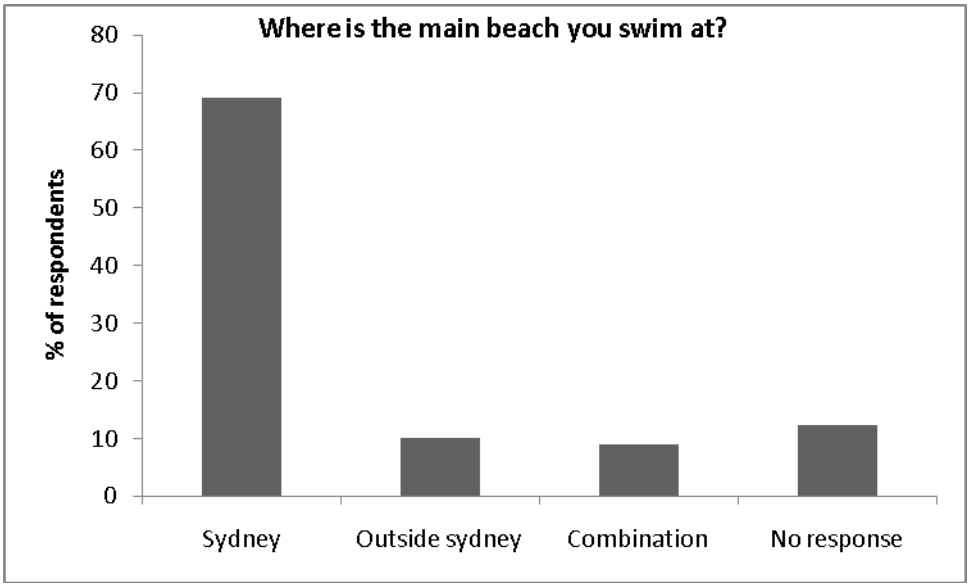

Figure 11 Histogram showing percentage of respondents who swim at which netted beaches

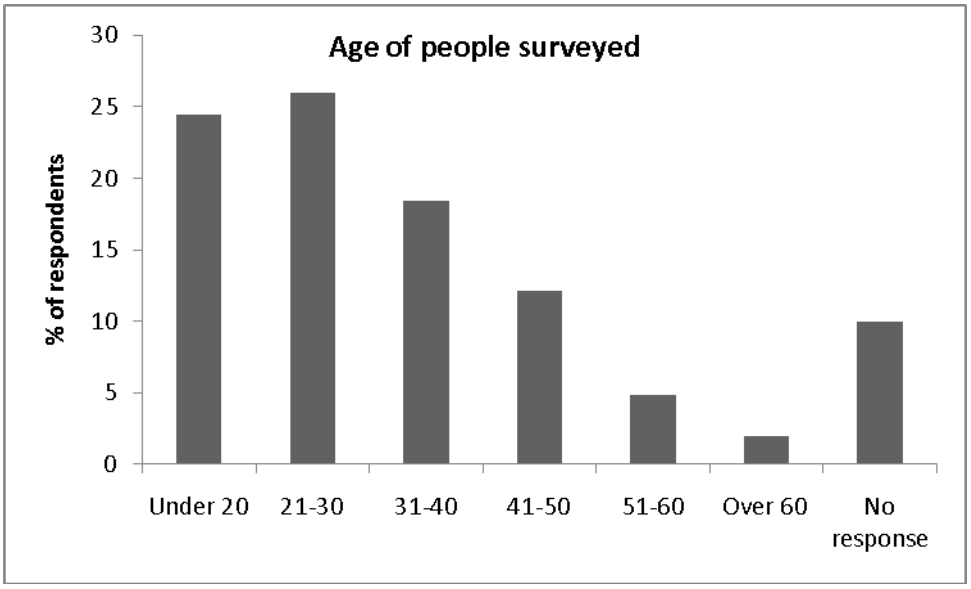

Figure 12 Histogram showing percentage of respondents and their ages

Statistical analysis from a One-Way ANOVA shows that Levene's test for homogeneity of variances was not violated for "Are shark nets a deciding factor for which beach you will swim at?" as 0.083>0.05, this can be seen in figure 13. The ANOVA in figure 14 shows there is a significant difference between answers as 0.00<0.05. Multiple comparisons show where the difference lies among the groups occurs. The only significant difference for are shark nets a deciding factor are between 'yes' and 'no answer' as 0.000<0.05 as seen in figure 15.

Although these questions violated Levene's test for homogeneity as their P<0.05, a significant difference was found amongst then from the ANOVA as 0.00<0.05 as seen in figure14

- Do the beaches you swim at have nets?
- Do they span headland to headland?
- Are nets in place all year round?
- How many non-target species are caught per target shark?
- Have you ever swum at an unnetted beach?
- Have you seen a shark in its natural environment?

Test of Homogeneity of Variances

	Levene Statistic	df1	df2	Sig.
NETDECIDEFACTOR	2.236	3	658	.083
HOWOFTENSWIM	3.516	3	658	.015
DOTHEYHAVENETS	103.121	3	658	.000
SPANDHEADLAND	3.984	3	658	.008
INPLACEALLYEAR	3.983	3	658	.008
NONTARGET	11.718	3	658	.000
SWUMUNETTED	651.830	3	658	.000
SEENASHARK	103.347	3	658	.000

Figure 13 Levene's test for homogeneity of variances is not violated only for "Are nets a deciding factor if you swim at a beach?"

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
NETDECIDEFACTOR	Between Groups	3433819.417	3	1144606.472	15.576	.000
	Within Groups	4.835E7	658	73486.196		
	Total	5.179E7	661			
HOWOFTENSWIM	Between Groups	32976.490	3	10992.163	.927	.427
	Within Groups	7804342.646	658	11860.703		
	Total	7837319.136	661			
DOTHEYHAVENETS	Between Groups	245246.279	3	81748.760	30.957	.000
	Within Groups	1737575.057	658	2640.692		
	Total	1982821.335	661			
SPANDHEADLAND	Between Groups	740979.362	3	246993.121	3.136	.025
	Within Groups	5.182E7	658	78755.879		
	Total	5.256E7	661			
INPLACEALLYEAR	Between Groups	741070.609	3	247023.536	3.136	.025
	Within Groups	5.183E7	658	78770.236		
	Total	5.257E7	661			
NONTARGET	Between Groups	2166802.633	3	722267.544	27.883	.000
	Within Groups	1.704E7	658	25903.629		
	Total	1.921E7	661			
SWUMUNETTED	Between Groups	2225912.629	3	741970.876	653.270	.000
	Within Groups	747343.481	658	1135.780		
	Total	2973256.110	661			
SEENASHARK	Between Groups	2216884.814	3	738961.605	279.445	.000
	Within Groups	1740009.893	658	2644.392		
	Total	3956894.707	661			

Figure 14 ANOVA showing significant difference amongst groups, where all questions have significant differences except "How often do you swim at the beach?" However, they all violated Levene's Test except for "Are nets a deciding factor if you swim at a beach?"

Multiple Comparisons

Multiple Comparisons

Dependent Variable		(I) ARETHEYNECESSARY	(J) ARETHEYNECESSARY	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
NETDECIDEFACTOR	Tukey HSD	1.00	2.00	28.06187	25.04387	.677	-36.4413	92.5651
			3.00	18.52226	33.08035	.944	-66.6798	103.7243
			999.00	-897.55882*	137.12702	.000	-1250.7443	-544.3734
		2.00	1.00	-28.06187	25.04387	.677	-92.5651	36.4413
			3.00	-9.53961	29.27390	.988	-84.9377	65.8585
			999.00	-925.62069*	136.25884	.000	-1276.5701	-574.6713
		3.00	1.00	-18.52226	33.08035	.944	-103.7243	66.6798
			2.00	9.53961	29.27390	.988	-65.8585	84.9377
			999.00	-916.08108*	137.96227	.000	-1271.4178	-560.7444
		999.00	1.00	897.55882*	137.12702	.000	544.3734	1250.7443
			2.00	925.62069*	136.25884	.000	574.6713	1276.5701
			3.00	916.08108*	137.96227	.000	560.7444	1271.4178
HOWOFTENSWIM	Tukey HSD	1.00	2.00	4.16759	10.06129	.976	-21.7464	30.0815
			3.00	-15.26534	13.28992	.659	-49.4950	18.9643
			999.00	11.94412	55.09033	.996	-129.9470	153.8352
		2.00	1.00	-4.16759	10.06129	.976	-30.0815	21.7464
			3.00	-19.43293	11.76069	.350	-49.7239	10.8580
			999.00	7.77653	54.74154	.999	-133.2162	148.7693
		3.00	1.00	15.26534	13.28992	.659	-18.9643	49.4950
			2.00	19.43293	11.76069	.350	-10.8580	49.7239
			999.00	27.20946	55.42589	.961	-115.5459	169.9648
		999.00	1.00	-11.94412	55.09033	.996	-153.8352	129.9470
			2.00	-7.77653	54.74154	.999	-148.7693	133.2162
			3.00	-27.20946	55.42589	.961	-169.9648	115.5459
DOTHEYHAVENETS	Tukey HSD	1.00	2.00	-2.67260	4.74742	.943	-14.9001	9.5549
			3.00	-.18659	6.27084	1.000	-16.3378	15.9646
			999.00	-249.37353*	25.99435	.000	-316.3248	-182.4223
		2.00	1.00	2.67260	4.74742	.943	-9.5549	14.9001

			3.00	2.48601	5.54928	.970	-11.8068	16.7788
			999.00	-246.70093*	25.82978	.000	-313.2283	-180.1735
		3.00	1.00	.18659	6.27084	1.000	-15.9646	16.3378
			2.00	-2.48601	5.54928	.970	-16.7788	11.8068
			999.00	-249.18694*	26.15268	.000	-316.5460	-181.8279
		999.00	1.00	249.37353*	25.99435	.000	182.4223	316.3248
			2.00	246.70093*	25.82978	.000	180.1735	313.2283
			3.00	249.18694*	26.15268	.000	181.8279	316.5460
SPANDHEADLAND	Tukey HSD	1.00	2.00	17.19089	25.92627	.911	-49.5850	83.9668
			3.00	-5.05501	34.24591	.999	-93.2590	83.1490
			999.00	-404.56176*	141.95858	.023	-770.1914	-38.9321
		2.00	1.00	-17.19089	25.92627	.911	-83.9668	49.5850
			3.00	-22.24590	30.30535	.883	-100.3006	55.8088
			999.00	-421.75265*	141.05981	.015	-785.0674	-58.4379
		3.00	1.00	5.05501	34.24591	.999	-83.1490	93.2590
			2.00	22.24590	30.30535	.883	-55.8088	100.3006
			999.00	-399.50676*	142.82325	.027	-767.3635	-31.6500
		999.00	1.00	404.56176*	141.95858	.023	38.9321	770.1914
			2.00	421.75265*	141.05981	.015	58.4379	785.0674
			3.00	399.50676*	142.82325	.027	31.6500	767.3635
INPLACEALLYEAR	Tukey HSD	1.00	2.00	17.15397	25.92863	.911	-49.6280	83.9360
			3.00	-5.07080	34.24903	.999	-93.2829	83.1413
			999.00	-404.66765*	141.97152	.023	-770.3306	-39.0046
		2.00	1.00	-17.15397	25.92863	.911	-83.9360	49.6280
			3.00	-22.22477	30.30811	.884	-100.2866	55.8370
			999.00	-421.82162*	141.07267	.015	-785.1695	-58.4737
		3.00	1.00	5.07080	34.24903	.999	-83.1413	93.2829
			2.00	22.22477	30.30811	.884	-55.8370	100.2866
			999.00	-399.59685*	142.83627	.027	-767.4871	-31.7066
		999.00	1.00	404.66765*	141.97152	.023	39.0046	770.3306
			2.00	421.82162*	141.07267	.015	58.4737	785.1695
			3.00	399.59685*	142.83627	.027	31.7066	767.4871
NONTARGET	Tukey HSD	1.00	2.00	28.80774	14.86890	.213	-9.4887	67.1042
			3.00	28.77075	19.64027	.459	-21.8149	79.3564

			999.00	-698.84412*	81.41426	.000	-908.5353	-489.1529
		2.00	1.00	-28.80774	14.86890	.213	-67.1042	9.4887
			3.00	-.03699	17.38033	1.000	-44.8019	44.7279
			999.00	-727.65186*	80.89881	.000	-936.0155	-519.2882
		3.00	1.00	-28.77075	19.64027	.459	-79.3564	21.8149
			2.00	.03699	17.38033	1.000	-44.7279	44.8019
			999.00	-727.61486*	81.91015	.000	-938.5833	-516.6464
		999.00	1.00	698.84412*	81.41426	.000	489.1529	908.5353
			2.00	727.65186*	80.89881	.000	519.2882	936.0155
			3.00	727.61486*	81.91015	.000	516.6464	938.5833
SWUMUNETTED	Tukey HSD	1.00	2.00	.23231	3.11348	1.000	-7.7868	8.2514
			3.00	-.01129	4.11258	1.000	-10.6037	10.5811
			999.00	-748.10588*	17.04776	.000	-792.0142	-704.1975
		2.00	1.00	-.23231	3.11348	1.000	-8.2514	7.7868
			3.00	-.24360	3.63936	1.000	-9.6172	9.1300
			999.00	-748.33820*	16.93983	.000	-791.9686	-704.7078
		3.00	1.00	.01129	4.11258	1.000	-10.5811	10.6037
			2.00	.24360	3.63936	1.000	-9.1300	9.6172
			999.00	-748.09459*	17.15160	.000	-792.2704	-703.9188
		999.00	1.00	748.10588*	17.04776	.000	704.1975	792.0142
			2.00	748.33820*	16.93983	.000	704.7078	791.9686
			3.00	748.09459*	17.15160	.000	703.9188	792.2704
SEENASHARK	Tukey HSD	1.00	2.00	-2.30716	4.75074	.962	-14.5432	9.9289
			3.00	-.01261	6.27524	1.000	-16.1752	16.1499
			999.00	-747.90000*	26.01256	.000	-814.8982	-680.9018
		2.00	1.00	2.30716	4.75074	.962	-9.9289	14.5432
			3.00	2.29455	5.55317	.976	-12.0082	16.5973
			999.00	-745.59284*	25.84787	.000	-812.1668	-679.0189
		3.00	1.00	.01261	6.27524	1.000	-16.1499	16.1752
			2.00	-2.29455	5.55317	.976	-16.5973	12.0082
			999.00	-747.88739*	26.17100	.000	-815.2936	-680.4811
		999.00	1.00	747.90000*	26.01256	.000	680.9018	814.8982
			2.00	745.59284*	25.84787	.000	679.0189	812.1668
			3.00	747.88739*	26.17100	.000	680.4811	815.2936

*. The mean difference is significant at the 0.05 level.

Figure 15 Tukey's Multiple comparisons table showing there is only a difference between no response and yes, no and maybe for Are nets a deciding factor for which beach you choose to swim at, as this was the only question which did not violate Levene's Test.

Discussion

As this is the first time since 1972 the SMP has been reviewed by the NSW DPI and open to public review, previous studies have focused on environmental issues rather than community awareness in regards to the SMP. Results obtained from this survey show that the majority of respondents did not know how the SMP operates to protect them from target sharks, which fulfils a component of the hypothesis. The results also indicate the respondents know that a consequence of the SMP is bycatch, however, their answers grossly underestimated how many non-target animals are caught for every one target shark. This finding fulfils the last part of the hypothesis. It was surprising to discover only 25% of respondents think shark nets are necessary and a further 16.9% are unsure if they are. These finding indicate the hypothesis that >50% of respondents will be in favour of the SMP is incorrect and therefore rejected.

Although the majority of respondents do not know how the SMP offers to protect them, 57% of respondents think shark nets are unnecessary, so they have some understanding there is not a complete physical barrier between the beach and the sharks. Perhaps this finding was due to the fact that 49.1% of respondents are at the beach daily, weekly or fortnightly and are also under the age of forty. People who are constantly in the water at the beach swimming, surfing or snorkelling are more familiar with the shark's environment. This familiarity may lead to a better understanding of how sharks interact with humans.

Many respondents who thought shark nets are necessary did not know how they operate to protect swimmers. The most astounding piece of information the public did not know about was the rotational basis of the SMP, where only nine to thirteen days of a calendar month a beach is netted. It was also important to make recent respondents aware of the previous shark attacks of 2008/2009 summer, where a surfer was attacked at Bondi, which had two nets in place that day.

It is quite possible the SMP provides a false sense of security for people, but is this placebo worth the lives of so many marine animals for our own peace of mind. A community awareness program needs to be devised to make the public aware they are entering the sharks environment when they go for a swim, just as they would be entering a lion's territory on safari in Africa. There needs to be a community education program devised to

make the public aware of what the SMP offers to protect them, and the consequence of installing shark nets on other marine animals. After all it costs the tax payers approximately $750 000 each year to deploy and move the nets, so an education and feedback program would be beneficial to improving the SMP (Rechtorik, C and SACF 2007).

Improvements to the SMP could include the following where the days which beaches have the SMP in place, and the rotational cycle should be made available to the public. To decrease bycatch, the NSW DPI should deploy nets later in November as there have been no fatal shark attacks in September and October. This would also benefit the Whale migration south at this time of year (Rechtorik, C and SACF 2007). When nets are in place pingers should be attached to all nets to deter marine animals from entering the vicinity of the nets. Pingers work by emitting an electronic pulse which many marine animals such as sharks and turtles can pick up (Rechtorik, C and SACF 2007). There should be increased monitoring of the nets when in place at beaches, to help save entangled animals. Allowing information when beaches are netted available to the public could assist community involvement with monitoring the nets themselves, after all they are in place for their protection. The increased use of aerial patrols during summer is no doubt a useful method to spot sharks and also herd them away from beaches (Rechtorik, C and SACF 2009).

The findings from this study are promising as the majority of people surveyed think shark nets are unnecessary. This study could be greatly improved by continuing the surveys over the 2009/10 summer, as more respondents are required to gain a better understanding of community awareness of the SMP. Statistical analysis could be improved by using a Welch and Brown-Forsythe test for the questions which violated Levene's Test of homogeneity of variances.

References

GBR MPA (2008). Australian Government Great Barrier Reef Marine Park Authority. (08). *Marine Turtles Species Description.* Available: http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/natural_values/marine_turtles/marine_turtle_species_descriptions. Last accessed 20/11/09.

Green, M, Ganassin, C and Reid, D.D. (2009). *Report into the NSW Shark Meshing (Bather protection) Program.* Available: http://www.dpi.nsw.gov.au/fisheries/info/meshing. Last accessed 20/11009

Rechtorik, C and SACF (2007). Understanding Beach Safety practices Pamphlet. Funded by EnviroFund.

Rechtorik, C. and SACF (2009). *Shark nets-What do you know?.* Available: http://www.sacf.org.au/projects/36-current-projects-sydney-aquarium-conservation-fund/3-shark-nets-sydney. Last accessed 20/11/09.