



# Australian and U.S. News Media Portrayal of Sharks and Their Conservation

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**Abstract:** Investigation of the social framing of human-shark interactions may provide useful strategies for integrating social, biological, and ecological knowledge into national and international policy discussions about shark conservation. One way to investigate social opinion and forces related to sharks and their conservation is through the media's coverage of sharks. We conducted a content analysis of 300 shark-related articles published in 20 major Australian and U.S. newspapers from 2000 to 2010. Shark attacks were the emphasis of over half the articles analyzed, and shark conservation was the primary topic of 11% of articles. Significantly more Australian articles than U.S. articles treated shark attacks ( $\chi^2 = 3.862$ ; Australian 58% vs. U.S. 47%) and shark conservation issues ( $\chi^2 = 6.856$ ; Australian 15% vs. U.S. 11%) as the primary article topic and used politicians as the primary risk messenger (i.e., primary person or authority sourced in the article) ( $\chi^2 = 7.493$ ; Australian 8% vs. U.S. 1%). However, significantly more U.S. articles than Australian articles discussed sharks as entertainment (e.g., subjects in movies, books, and television;  $\chi^2 = 15.130$ ; U.S. 6% vs. Australian 1%) and used scientists as the primary risk messenger ( $\chi^2 = 5.333$ ; U.S. 25% vs. Australian 15%). Despite evidence that many shark species are at risk of extinction, we found that most media coverage emphasized the risks sharks pose to people. To the extent that media reflects social opinion, our results highlight problems for shark conservation. We suggest that conservation professionals purposefully and frequently engage with the media to highlight the rarity of shark attacks, discuss preventative measures water users can take to reduce their vulnerability to shark encounters, and discuss conservation issues related to local and threatened species of sharks. When integrated with biological and ecological data, social-science data may help generate a more comprehensive perspective and inform conservation practice.

**Keywords:** content analysis, human dimensions, news media, risk messengers, risk perceptions

Descripción de Tiburones y su Conservación por Medios Informativos Australianos y Norteamericanos

**Resumen:** La investigación del marco social de las interacciones humanos-tiburones puede proporcionar estrategias útiles para la integración de conocimiento social, biológico y ecológico en las discusiones de políticas nacionales e internacionales para la conservación de tiburones. Una manera de investigar la opinión y fuerzas sociales relacionadas con tiburones y su conservación es a través de la cobertura de los medios sobre tiburones. Realizamos un análisis de contenido de 300 artículos relacionados con tiburones publicados de 2000 a 2010 en 20 periódicos australianos y norteamericanos. Los ataques de tiburones fueron el énfasis de más de la mitad de los artículos analizados, y la conservación de tiburones fue el tema primario de 11% de los artículos. Significativamente más artículos australianos que norteamericanos trataron los ataques de tiburón ( $\chi^2 = 3.862$ ; australianos 58% vs. norteamericanos 47%) y temas de conservación de tiburón ( $\chi^2 = 6.856$ ; australianos 15% vs. norteamericanos 11%) como el tema principal del artículo y utilizaron a políticos como el principal mensajero de riesgo (i.e., persona o autoridad primaria fuente del artículo) ( $\chi^2 = 7.493$ ; norteamericanos 8% vs. australianos 1%). Sin embargo, significativamente más artículos norteamericanos que australianos discutieron a los tiburones como entretenimiento (e.g., sujetos en películas, libros y televisión;  $\chi^2 = 15.130$ ; norteamericanos 6% vs. australianos 1%) y usaron a científicos como el principal mensajero de riesgo ( $\chi^2 = 5.333$ ; norteamericanos 25% vs. australianos 15%). No obstante la evidencia de muchas

*especies de tiburón están en riesgo de extinción, encontramos que la mayoría de la cobertura de los medios enfatizó los riesgos que representan los tiburones para humanos. En el sentido en que los medios reflejan la opinión social, nuestros resultados resaltan los problemas para la conservación de tiburones. Sugerimos que profesionales de la conservación se comprometan con los medios, con determinación y frecuencia, para resaltar la rareza de los ataques de tiburones, discutir medidas preventivas que los usuarios pueden tomar para reducir su vulnerabilidad a encuentros con tiburones y discutir temas de conservación relacionados con especies de tiburones locales y amenazadas. Datos de la ciencia social, incorporados a datos biológicos y ecológicos, pueden ayudar a generar una perspectiva integral y proporcionar información a la práctica de la conservación.*

**Palabras Clave:** Análisis de contenido, dimensiones humanas, medios informativos, mensajeros de riesgo, percepciones de riesgo

## Introduction

Declines in the abundance of marine species are having negative effects on marine systems and processes (e.g., trophic downgrading [Estes et al. 2011]) and are affecting the ability of oceans to provide ecosystem services (Worm et al. 2006). Many species of sharks are of particular conservation concern due to their role as apex predators (Myers et al. 2007). Worldwide human pressures on chondrichthians are associated with systematic population declines and many likely collapses (Jacques 2010). Sharks are threatened by commercial fishing (Bonfil 1994), finning (i.e., harvesting of sharks for their fins) (Clarke et al. 2006), pollution (Gelsleichter et al. 2005), habitat loss and degradation (Jennings et al. 2008), and climate change (Chin et al. 2010). Sharks are especially vulnerable to these threats due to their life-history traits (i.e., slow growth rates, late age of maturity, long gestation periods, and low reproductive output) (Musick 1999). Like many apex predators, sharks suffer from a negative public image (Driscoll 1995; Woods 2000; Thompson & Mintzes 2002) in part because they can threaten human safety (Philpott 2002). Negative perceptions about sharks and shark-attack risks have been identified as one of the greatest barriers to shark conservation efforts (Ferguson 2006).

Scientists, conservation organizations, politicians, and even fishers have expressed concerns about threats to global shark populations for years (Lynch et al. 2010). Yet, shark conservation is just starting to become a global policy priority and be attended to by social scientists (Jacques 2010). For example, in November 2005 the Convention for Migratory Species (CMS) Parties adopted a recommendation on migratory sharks that urged range states to strengthen protection for these species and called for the development of a global conservation agreement. The 2010 Conference of the Parties for the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) also featured substantial dialogue about shark conservation.

Similarly, 2011 witnessed a significant global shift in shark conservation actions as evidenced by bans on the practice of shark finning (e.g., Taiwan), bans on the sale

of shark fins all together (e.g., in California [U.S.A.] and Toronto [Canada]), and a boom in new shark sanctuaries (e.g., in the Bahamas, Honduras, Chile, and the Marshall Islands). These efforts are conservation milestones; however, challenges remain in developing, implementing, and enforcing policies that protect sharks (and other migratory marine species) outside of demarcated political boundaries (Nevins et al. 2009).

Enacting conservation policies that reduce risks to sharks requires coordinated international cooperation and collaboration among many countries and dedicated attention by social scientists (Jacques 2010). In addition to the need for countries to share, understand, and integrate biophysical knowledge about sharks (e.g., diet, migration, population) into national and international policy discussions, conservation professionals must also seek cross-cultural insights on the many different people, cultures, and histories that are affected by such policies. Quantifying the social forces of and on marine systems is essential for understanding and mitigating changes to marine systems (Jacques 2010). Discovery about the social framing of shark conservation may provide important answers and possibly new solutions. Mass-media studies (i.e., the formal subdiscipline dedicated to quantifying and qualifying media effects on society and vice versa) offers one mechanism with which to investigate social opinion and forces related to sharks and their conservation (Jacques 2010).

Media studies have long recognized the ability of mass media to reflect popular views (Katz & Lazarsfeld 1955; Jensen 2003; Gans 2004) and to influence social attitudes about outcomes of wildlife and conservation policy (Wolch et al. 1997; Muter et al. 2009; Jacobson et al. 2012). News and entertainment media are widely credited for perpetuating negative portrayals of sharks and for amplifying public fear through newspaper stories and documentaries with sensationalistic headlines and imagery (Philpott 2002; Peschak 2006). However, the content and context of news media coverage about sharks, needed to empirically assess this claim, has been neither adequately described nor quantified. Researchers have investigated the portrayal of sharks in documentaries (Ferguson 2006), shark-diving websites (Gore et al.

2011), and diving magazines (Whatmough et al. 2011). Boissonneault et al. (2005) assessed how the portrayal of gray nurse sharks in Australian newspapers changed from 1969 to 2003. Although results of these studies provide useful insights into the portrayal of sharks in various media outlets, their limitations (e.g., time frame of articles assessed, species considered, media outlets and reach) narrow the types of cross-cultural insights that can be transferred to, but are needed for, global shark conservation.

We sought to describe the content and context of shark-related media coverage in high-profile news media in Australia and the United States over the last decade (2000–2010). Australia and the United States are 2 of the most influential countries in global shark conservation policy and were among the first countries to draft and implement a National Plan of Action for Conservation and Management of Sharks (NMFS 2001; DAFF 2004). More documented human-shark interactions occur in these countries than in any other (ISAF 2011), and together they comprise a disproportionately large segment of the global media market for shark stories. Because shark attacks are newsworthy (Peschak 2006), it makes sense to study the media in the countries that have the most documented shark attacks.

Specifically, we wanted to identify the primary topics, frames (i.e., how information about sharks and their conservation is presented), and messengers of media coverage of sharks in Australia and the United States. We also wanted to identify trends in that coverage over the last decade and to compare and contrast Australian and U.S. coverage. Collectively, this information may assist conservation biologists in understanding how the news media has portrayed sharks and shark conservation issues over the last decade. This knowledge may also help them predict public perceptions of risk (Elliot 2003) related to sharks and to identify opportunities for the global conservation community to more effectively engage with diverse stakeholders (Pelstring et al. 1997) and the media (Gore et al. 2005) for the benefit of shark conservation.

## Methods

Content analysis is an objective and systematic method (Kerlinger 2000; Wimmer & Dominick 2003) for examining the content of information in documents (e.g., newspapers, magazines, radio and television transcripts) and is often used to better understand media and its effects on the public. The method is commonly applied in the conservation arena due to its ability to provide historical insight on complex management issues (Wolch et al. 1997; Muter et al. 2009; Houston et al. 2010).

**Table 1.** Shark-related articles published and assessed from Australian and U.S. newspapers from 2000 to 2010.

<i>Publication</i>	<i>No. published</i>	<i>No. assessed (%)</i>
Australian newspapers (totals)	2398	150
<i>Advertiser (Sunday Mail)</i>	613	36 (24)
<i>The Age</i>	95	6 (4)
<i>The Australian</i>	213	13 (9)
<i>Canberra Times</i>	55	3 (2)
<i>Courier Mail (Sunday Mail)</i>	449	27 (18)
<i>Herald Sun</i>	313	20 (13)
<i>Mercury (Sunday Tasmanian)</i>	190	12 (8)
<i>Northern Territory News</i>	162	10 (7)
<i>Sydney Morning Herald</i>	188	12 (8)
<i>West Australian</i>	175	11 (7)
U.S. newspapers	944	150
<i>Daily News</i>	71	11 (7)
<i>Houston Chronicle</i>	175	28 (19)
<i>New York Times</i>	103	16 (11)
<i>Oregonian</i>	27	4 (3)
<i>Philadelphia Inquirer</i>	44	7 (5)
<i>San Diego Union Tribune</i>	189	30 (20)
<i>San Francisco Chronicle</i>	81	13 (9)
<i>St. Petersburg Times</i>	130	21 (14)
<i>USA Today</i>	50	8 (5)
<i>Washington Post</i>	74	12 (8)
Total	3342	300

We used LexisNexis, an electronic search engine, in April 2010 to identify shark-related articles published in major newspapers in Australia and the United States (10 from each country) from 1 January 2000 through 31 December 2009 (Table 1). We defined major publications as those ranked by the Audit Bureau of Circulation to be in the top 30 newspapers by daily circulation in their country. We purposively selected publications to ensure our sample was geographically distributed across and representative of the 2 countries and to ensure the publication was electronically available over the entire sampling period. We limited our search to articles that contained the keyword *shark* in both the title and body of the article. This strategy helped identify articles that were primarily about sharks (i.e., Chondrichthyes).

We reviewed all articles identified through the search and excluded nonrelevant articles (e.g., articles referring to, for example, sports teams). After sorting, 3342 articles fit our search criteria (2398 from Australia and 944 from the United States). We recorded the date and publication of each article and randomly selected 150 articles from each country ( $n = 300$ ) with a random-number generator in proportion to their distribution across publications (e.g., 24% of the 2398 [ $n = 613$ ] Australian articles we identified were published in the *Advertiser*, so 24% of the 150 [ $n = 36$ ] articles in our final Australian sample were taken from the *Advertiser* [Table 1]) for further analyses (Riffe et al. 2005).

On the basis of our research objectives, we developed a codebook and protocol (Supporting Information). We

trained 2 teams of coders (2 people on each team)—one in the United States and one in Australia. Teams trained together on 2 sets of 10 dummy articles (i.e., relevant articles not included in the sample) until simple percent agreement among coders was  $\geq 90\%$  for most items (Muter et al. 2009). Each article was coded by both team members; a third coder was used when needed to settle discrepancies between team members and to increase reliability (Wimmer & Dominick 2003).

Coders examined each article for 83 variables organized into 7 content categories: general article information (e.g., date, publication, topic, shark species mentioned), natural-history information (e.g., physical traits, physiology, behavior), risks from sharks (e.g., attacks on humans, beach closures), risks to sharks (e.g., overexploitation, illegal trade, negative public image), risk perceptions and estimates, shark tourism, and news format (i.e., episodic or thematic coverage).

We used Cohen's kappa (Cohen 1960, 1968) to measure agreement between the 2 coders (Capozzoli et al. 1999). Kappa values  $>0.7$  represent a strong level of agreement above chance (Lombard et al. 2002). We retained for analyses only variables with a kappa  $>0.7$ . We computed kappa values with PASWStatistics 18 software (SPSS 2010) for each variable across all 300 articles.

We obtained data on shark attacks in Australia and the United States from 1 January 2000 to 31 December 2009 from the International Shark Attack File (ISAF 2011) and the Australian Shark Attack File (ASAF 2010; Table 2).

We used logistic regression to identify trends in coverage over time. We used chi-square analyses to test for differences between Australian and U.S. coverage. We assessed correlations among variables (i.e., primary article topic, frame, and messengers). Linear regression was used to compare number of attacks with frequency of shark-related coverage.

## Results

### Description of the Content

We analyzed 300 articles across 20 publications (Table 1). News coverage about sharks was most frequent from December through March in Australia and from June through September in the United States (i.e., summer months when more people are in the water). White sharks (*Carcharodon carcharias*,  $n = 75$ ), bull sharks (*Carcharhinus leucas*,  $n = 32$ ), and tiger sharks (*Galeocerdo cuvier*,  $n = 31$ ) were among the species most frequently cited in the coverage (Table 2).

Shark attacks were the emphasis of more than half the articles analyzed ( $n = 157$ , 52%); conservation concerns were the primary topic of 32 articles (11%). Other article topics included sharks as attractions in zoos and aquariums ( $n = 27$ , 9%), shark biology or ecology ( $n = 22$ ,

7%), sharks as entertainment ( $n = 18$ , 6%), recreational shark fishing ( $n = 12$ , 4%), shark-diving tourism ( $n = 5$ , 2%), other recreational diving ( $n = 4$ , 1%), nondiving-related businesses ( $n = 4$ , 1%), and shark conservation professionals or biologists ( $n = 3$ , 1%) (Table 3).

More than half the articles ( $n = 176$ , 59%) emphasized negative effects of sharks (e.g., human injuries or deaths, closed beaches). Fewer articles emphasized positive effects of sharks (e.g., human-health insights, sharks as aquarium attractions;  $n = 58$ , 19%), negative effects on sharks (e.g., shark finning, pollution, ineffective policies for shark conservation;  $n = 50$ , 17%), and positive effects on sharks (e.g., successful conservation interventions, education campaigns;  $n = 11$ , 4%). Five articles (2%), all of which were in Australian newspapers, were classified as having multiple foci (i.e., more than one frame) (Table 3).

### Shark-Related Risks

We identified 4 types of risks from sharks and 14 types of risks to sharks in the articles (Table 4). Forty-four percent of the articles mentioned elevated public risk perceptions or fear of sharks ( $n = 133$ ). Other risks from sharks identified were shark-related human injuries ( $n = 98$ , 33%), shark-related human fatalities ( $n = 92$ , 31%), and changes in recreation, such as beach closures, due to the presence of sharks ( $n = 50$ , 17%).

Of the 14 different risks to sharks mentioned in the sample articles (Table 4), physical injury to sharks (e.g., from boats) was discussed most frequently ( $n = 49$ , 16%). Other risks to sharks discussed were overfishing ( $n = 36$ , 12%), trophy fishing ( $n = 25$ , 8%), negative public image ( $n = 21$ , 7%), shark finning ( $n = 21$ , 7%), commercial fisheries ( $n = 16$ , 5%), sharks as bycatch ( $n = 11$ , 4%), illegal trade in shark parts ( $n = 8$ , 3%), altered behavior of sharks ( $n = 7$ , 2%), beach meshing (i.e., nets designed to reduce human-shark encounters near beaches) ( $n = 6$ , 2%), pollution ( $n = 5$ , 2%), culling ( $n = 4$ , 1%), shark tourism ( $n = 3$ , 1%), and coastal development ( $n = 1$ ,  $<1\%$ ).

### Comparison of Australian and U.S. Articles

Significantly more Australian articles than U.S. articles treated shark attacks ( $\chi^2 = 3.862$ ; Australian 87 [58%] vs. U.S. 70, [47%]) and shark conservation issues ( $\chi^2 = 6.856$ ; Australian 23 [15%] vs. U.S. 9 [11%]) as the primary article topic. However, significantly more U.S. articles than Australian articles highlighted sharks as entertainment ( $\chi^2 = 15.130$ ; U.S. 17 [6%] vs. Australian 1 [1%]) (Table 3). More U.S. articles than Australian articles used a primary frame highlighting positive effects of sharks ( $\chi^2 = 12.311$ ; U.S. 41 [27%] vs. Australian 17 [11%]) (Table 3). Articles published in the United States discussed shark-related risk perceptions

**Table 2.** Shark species described in Australian and U.S. newspapers and frequency with which species were implicated in shark attacks on humans from 2000 to 2010.

Common name	Scientific name	No. of articles			No. of attacks <sup>a</sup>		
		total	Australia	U.S.	total	Australia	U.S.
White shark	<i>Carcharodon carcharias</i>	75	45	30	80	51	29
Unidentified		63	37	26	363	8	355
Bull shark	<i>Carcharhinus leucas</i>	32	15	17	34	14	20
Tiger shark	<i>Galeocerdo cuvier</i>	31	17	14	26	6	20
Whaler spp.	<i>Carcharhinus</i> spp.	18	18	0	35	35	0
Hammerhead spp.	<i>Sphyrna</i> spp.	14	4	10	5	1	4
Blacktip shark	<i>Carcharhinus limbatus</i>	13	0	13	15	0	15
Mako shark	<i>Isurus</i> spp.	8	3	5	3	1	2
Blue shark	<i>Prionace glauca</i>	8	3	5	0	0	0
Whale shark	<i>Rhincodon typus</i>	6	2	4	0	0	0
Thresher spp.	<i>Alopias</i> spp.	6	1	5	1	0	1
Lemon shark	<i>Negaprion</i> spp.	5	1	4	4	0	4
Sandbar shark	<i>Carcharhinus plumbeus</i>	5	1	4	3	0	3
Nurse shark	<i>Ginglymostomidae</i> spp.	4	0	4	14	0	14
Wobbegong spp.	<i>Orectolobidae</i> spp.	4	2	2	33	33	0
Sharpnose spp.	<i>Rhizoprionodon</i> spp.	4	0	4	0	0	0
Gray nurse shark	<i>Carcharias Taurus</i>	3	3	0	4	1	3
Leopard shark	<i>Triakis semifasciata</i>	3	0	3	0	0	0
Reef shark	<i>Carcharhinus</i> spp.	3	0	3	1	0	1
Sand shark	<i>Carcharias taurus</i> <sup>b</sup>	3	0	3	1	0	1
Whitetip shark	<i>Carcharhinus longimanus</i> or <i>Triaenodon obsesus</i>	2	0	2	1	0	1
Blacktip reef shark	<i>Carcharhinus melanopterus</i>	2	1	1	1	1	0
Whitetip reef shark	<i>Triaenodon obesus</i>	2	2	0	1	1	0
Zebra shark	<i>Stegostoma fasciatum</i>	2	0	2	0	0	0
Basking shark	<i>Cetorhinus maximus</i>	2	1	1	0	0	0
School shark	<i>Mustelus antarcticus</i>	2	2	0	0	0	0
Gummy shark	<i>Galeorhinus galeus</i>	2	2	0	0	0	0
Sevengill shark	<i>Hexanchidae</i> spp.	2	1	1	0	0	0
Carribbean reef shark	<i>Carcharhinus perezi</i>	1	0	1	0	0	0
Finetooth shark	<i>Carcharhinus isodon</i>	1	0	1	0	0	0
Deep sea shark	Various	1	1	0	0	0	0
Brown shark	<i>Carcharhinus plumbeus</i> <sup>b</sup>	1	0	1	0	0	0
Goblin shark	<i>Mitsukurina owstoni</i>	1	1	0	0	0	0
Galapagos shark	<i>Carcharhinus galapagensis</i>	1	1	0	0	0	0
Glyphis shark	<i>Glyphis</i> spp.	1	1	0	0	0	0
Lamnoid shark	<i>Lamnidae</i> spp.	1	0	1	0	0	0
Angel shark	<i>Squatina</i> spp.	0	0	0	1	0	1
Cookie cutter	<i>Isistius brasiliensis</i>	1	0	1	1	0	1
Gray reef shark	<i>Carcharhinus amblyrhynchos</i>	0	0	0	2	1	1
Spinner shark	<i>Carcharhinus brevipinna</i>	1	0	1	3	0	3
Blind shark	<i>Brachaelurus colcloughi</i>	0	0	0	1	1	0
Silvertip shark	<i>Carcharhinus albimarginatus</i>	0	0	0	1	1	0

<sup>a</sup>International Shark Attack File (ISAF 2011).

<sup>b</sup>Most likely scientific name but uncertain.

( $\chi^2 = 12.135$ ; U.S. 81 [54%] vs. Australian 52 [35%]) and shark-related human injuries ( $\chi^2 = 3.880$ ; U.S. 57 [38%] vs. 41 [27%]) (Table 5) significantly more than Australian articles.

As the total number of shark attacks (i.e., sum of fatal and nonfatal attacks) increased per quarter (i.e., 3-month period), the total number of articles increased in both Australia ( $r = 0.328$ ,  $p < 0.05$ ) and the United States ( $r = 0.506$ ,  $p < 0.01$ ). The total number of shark attacks per quarter and the number of articles in which the primary topic was a shark attack were positively correlated for

both Australia ( $r = 0.553$ ,  $p < 0.001$ ) and the U.S. articles ( $r = 0.435$ ,  $p < 0.01$ ).

### Trends

There was a significant decline over time in U.S. articles that mentioned shark attacks (odds ratio [OR] = 0.801,  $p < 0.001$ ) and an increase in U.S. articles discussing recreational shark fishing (OR = 1.341,  $p < 0.05$ ). Articles emphasizing positive effects of sharks increased significantly over time in the United States

**Table 3.** Frequencies and results of chi-square analyses of primary article topic, frame (positive or negative focus), and messenger for Australian and U.S. newspaper coverage of sharks from 2000 to 2010.

Variable	All		U.S.		Australia		$\chi^2$	p
	f	%	f	%	f	%		
<i>Primary article topic</i>								
shark attacks on people	157	52.3	70	46.7	87	58.0	3.862	0.049
sharks as attractions in zoos	27	9.0	14	9.3	13	8.7	0.000	1.000
shark-diving tourism	5	1.7	4	2.7	1	0.7	1.831	0.176
shark biology or ecology	22	7.3	11	7.3	11	7.3	0.000	1.000
shark fishing (sport)	12	4.0	7	4.7	5	3.3	0.347	0.556
shark conservation issues	32	10.7	9	6.0	23	15.3	6.856	0.009
shark biologist, conservationist	3	1.0	2	1.3	1	0.7	0.337	0.562
sharks as entertainment	18	6.0	17	11.3	1	0.7	15.130	0.000
other diving and recreation	4	1.3	3	2.0	1	0.7	1.014	0.314
nondiving tourism	4	1.3	2	1.3	2	1.3	0.000	1.000
other	16	5.3	11	7.3	5	3.3	2.377	0.123
<i>Primary article frame</i>								
negative effects of sharks	176	58.7	86	57.3	90	60.0	0.220	0.639
negative effect on sharks	50	16.7	19	12.7	31	20.7	3.456	0.063
positive effects of sharks	58	19.3	41	27.3	17	11.3	12.311	0.000
positive effects on sharks	11	3.7	4	2.7	7	4.7	0.849	0.357
multiple foci	5	1.7	0	0.0	5	3.3	5.085	0.024
<i>Primary messenger</i>								
author of article	27	9.0	16	10.7	11	7.3	1.018	0.313
scientist	61	20.3	38	25.3	23	15.3	5.333	0.021
fishers	11	3.7	4	2.7	7	4.7	0.849	0.357
conservation organization	20	6.7	14	9.3	6	4.0	3.429	0.064
shark-attack victim or victim's family	31	10.3	14	9.3	17	11.3	0.324	0.569
general public	19	6.3	7	4.7	12	8.0	1.405	0.236
tourism	15	5.0	8	5.3	7	4.7	0.000	1.000
politicians	14	4.7	2	1.3	12	8.0	7.493	0.006
nonscientist government officials	21	7.0	9	6.0	12	8.0	0.461	0.497
retailers	4	1.3	1	0.7	3	2.0	1.014	0.314
multiple messengers	32	10.7	12	8.0	20	13.3	2.239	0.135
other	9	3.0	6	4.0	3	2.0	0.146	0.702

(OR = 1.216,  $p < 0.01$ ) and decreased significantly in Australia (OR = 0.819,  $p < 0.05$ ). There was a significant decrease in U.S. articles with a primary frame emphasizing negative effects of sharks (OR = 0.807,  $p < 0.001$ ), whereas Australian coverage emphasizing positive effects of sharks increased over time (OR = 1.623,  $p < 0.05$ ).

There was a significant decrease over time in U.S. articles discussing shark-related effects on recreation (OR = 0.847,  $p < 0.05$ ). More U.S. articles than Australian articles discussed a negative public image ( $\chi^2 = 6.196$ ; U.S. 16 [11%] vs. Australian 5 [3%]) and bycatch ( $\chi^2 = 4.624$ ; U.S. 9 [2%] vs. Australian 2 [1%]) as threats to sharks, whereas significantly more Australian articles than U.S. articles discussed illegal trade in shark parts ( $\chi^2 = 4.623$ ; Australia 7 [5%] vs. U.S. 1 [1%]).

### Messengers

Scientists served as the primary messengers in both Australian and U.S. articles ( $n = 61$ , 20%). Other primary messengers included victims of shark attacks or their families ( $n = 31$ , 10%), the article author ( $n = 27$ , 9%),

nonscientist government officials ( $n = 21$ , 7%), conservation organizations ( $n = 20$ , 7%), members of the general public ( $n = 19$ , 6%), tourism interests ( $n = 15$ , 5%), politicians ( $n = 14$ , 5%), and fishers ( $n = 11$ , 4%) (Table 3).

More U.S. articles used a scientist as the primary messenger than Australian articles ( $\chi^2 = 5.333$ ; U.S. 38 [25%] vs. Australian 23 [15%]). Significantly more Australian articles than U.S. articles had a politician as the primary messenger ( $\chi^2 = 7.493$ ; Australian 12 [8%] vs. U.S. 2 [1%]) (Table 3).

Articles with scientists and fishers as the primary messengers were positively correlated with stories on shark biology ( $\phi = 0.307$ ,  $p < 0.001$ ) and shark fishing ( $\phi = 0.413$ ,  $p < 0.001$ ), respectively. Articles with someone from the tourism industry as the primary messenger were positively correlated with the topic of shark diving ( $\phi = 0.218$ ,  $p < 0.001$ ), whereas retailers as messengers were positively correlated with stories on shark diving-related business ( $\phi = 0.747$ ,  $p < 0.001$ ). Articles with politicians as the primary messenger were positively correlated with stories on shark conservation ( $\phi = 0.282$ ,  $p < 0.001$ ) (Table 5).

**Table 4.** Frequencies and chi-square analyses of risks to and from sharks discussed in Australian and U.S. newspaper coverage about sharks from 2000 to 2010.

Variable	All		U.S.		Australia		$\chi^2$	p
	f	%	f	%	f	%		
<i>Risks from sharks</i>								
perception of risk	133	44.3	81	54.0	52	34.7	12.135	0.000
shark-related human injury	98	32.7	57	38.0	41	27.3	3.880	0.049
shark-related human fatality	92	30.7	43	28.7	49	32.7	0.564	0.453
change in recreation	50	16.7	28	18.7	22	14.7	0.864	0.353
<i>Risks to sharks</i>								
physical injury to sharks	49	16.3	23	15.3	26	17.3	0.220	0.639
overfishing, overexploitation	36	12.0	22	14.7	14	9.3	2.020	0.155
trophy fishing	25	8.3	16	10.7	9	6.0	2.138	0.144
negative public image	21	7.0	16	10.7	5	3.3	6.196	0.013
finning <sup>a</sup>	21	7.0	10	6.7	11	7.3	0.051	0.821
commercial fisheries	16	5.3	9	6.0	7	4.7	0.264	0.607
bycatch	11	3.7	9	6.0	2	1.3	4.624	0.032
illegal trade in shark parts	8	2.7	1	0.7	7	4.7	4.623	0.032
altered shark behavior	7	2.3	5	3.3	2	1.3	1.316	0.251
beach meshing <sup>a</sup>	6	2.0	1	0.7	5	3.3	2.721	0.099
oceanic, coastal pollution	5	1.7	4	2.7	1	0.7	1.831	0.176
shark culling	4	1.3	1	0.7	3	2.0	1.014	0.314
shark tourism	3	1.0	3	2.0	0	0.0	3.030	0.082
coastal development	1	0.3	1	0.7	0	0.0	1.003	0.317

<sup>a</sup>Shark finning is the harvesting of sharks for the primary purpose of obtaining their fins. Beach meshing is a net, or system of nets, designed to reduce human-shark encounters near beaches.

Stories highlighting negative effects of sharks were negatively correlated with scientists ( $\phi = -0.173$ ,  $p < 0.01$ ) and conservation organizations ( $\phi = -0.237$ ,  $p < 0.001$ ) as messengers, but positively correlated with shark-attack victims ( $\phi = 0.285$ ,  $p < 0.001$ ) and nonscientist government officials ( $\phi = 0.151$ ,  $p < 0.01$ ) as messengers. Conservation organizations ( $\phi = 0.167$ ,  $p < 0.01$ ) and attack victims ( $\phi = -0.152$ ,  $p < 0.01$ ) as messengers were also correlated with stories emphasizing negative effects on sharks. Nonscientist government officials ( $\phi = -0.134$ ,  $p < 0.05$ ), shark-attack victim ( $\phi = -0.166$ ,  $p < 0.01$ ), and scientist ( $\phi = 0.135$ ,  $p < 0.05$ ) messengers

were correlated with stories with a frame that showed positive effects of sharks. Only politician messengers were correlated with stories highlighting positive effects of sharks ( $\phi = 0.377$ ,  $p < 0.001$ ). Fisher messengers were correlated only with stories with multiple foci ( $\phi = 0.252$ ,  $p < 0.001$ ) (Table 5).

## Discussion

Despite substantive evidence that many shark species are at risk (Dulvy et al. 2008), our inquiry indicates that

**Table 5.** Correlations ( $\phi$ ) between primary article messenger and article frame in Australian and U.S. newspaper coverage about sharks from 2000 to 2010.

Messenger	Negative effects of sharks	Negative effects on sharks	Positive effects of sharks	Positive effects on sharks	Multiple foci
Unknown	-0.117*	-0.051	0.216***	-0.016	-0.047
Author	0.051	0.016	-0.036	-0.061	-0.041
Scientist	-0.173**	0.089	0.135**	-0.009	0.000
Fisher	-0.052	0.056	-0.051	-0.038	0.252***
Conservation organization	-0.237***	0.167**	0.106	0.090	-0.035
Shark attack victim	0.285***	-0.152**	-0.166**	-0.066	-0.044
General public	0.107	-0.043	-0.093	0.022	-0.034
Tourism	0.089	-0.057	-0.028	-0.043	-0.029
Politician	-0.103	0.028	-0.068	0.377***	-0.029
Nonscientist government official	0.151**	-0.018	-0.134*	-0.054	-0.036
Retailer	0.039	-0.052	0.017	-0.023	-0.015
Multiple	0.071	-0.010	-0.032	-0.067	-0.045
Other	-0.050	-0.010	-0.020	-0.030	0.325***

Significance: \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

most news coverage in both Australia and the United States continues to emphasize risks from sharks rather than the reverse. Shark attacks were reported at least 5 times more than conservation concerns or any other shark-related topic. We also noted a significant positive correlation between the number of shark attacks and the number of shark-related articles per quarter (i.e., 3-month period). Wildlife-related media coverage often highlights low-incidence, high-consequence events such as human injuries and mortalities (Corbett 1995; Gore et al. 2005). We also found that local shark events received international coverage. We found several instances in our sample of a shark attack occurring in one location (e.g., South Africa) and making headlines in a different part of the world (e.g., Australia, United States). This means the world is watching how local people respond to shark-related events. To the extent that media affects people's attitudes toward wildlife, conservation professionals around the world can be aware of the effect of international media coverage on local attitudes about shark conservation.

White sharks, bull sharks, and tiger sharks—the 3 species most commonly implicated in attacks on humans—were among the species most frequently cited in both Australian and U.S. articles. However, species of greater conservation concern (e.g., gray nurse sharks [*Carcharias taurus*] listed as critically endangered in New South Wales by the International Union for Conservation of Nature [IUCN]) did not receive as much coverage. Out of the 68 species of elasmobranch (sharks, rays, and skates) currently considered globally endangered or critically endangered by the IUCN (2011), the spartooth shark (*Glyphis* spp.) and hammerhead shark (*Sphyrna* spp.) groups were the only elasmobranch mentioned in the 300 articles we analyzed. These species of threatened sharks were cited 19 times in the articles, whereas white sharks, tiger sharks, and bull sharks were cited 171 times. These numbers highlight the disproportion of framing between species of conservation concern and species potentially dangerous to humans (Table 2). Conservation professionals in other countries may recognize that their local media engage in similar practices and respond accordingly (e.g., changing media focus to species of conservation need by purposefully engaging the media in conservation stories related to local and threatened species).

Our results provide insight into the current media environment and identify opportunities for the conservation community to more effectively engage the media for the benefit of shark conservation. Given that most news coverage tends to be episodic (i.e., case-study oriented) rather than thematic (i.e., big-picture synthesis of issues) (Iyengar 1991), perhaps shark attacks simply fit the episodic template better than conservation issues that may require more in-depth background and explanation.

Physical injury to sharks was the most frequently cited risk to sharks in both countries—even though overfishing, finning, and illegal trade are all statistically greater threats to shark populations (Jacques 2010). Perhaps instances of physical injury to individual sharks fits the episodic template better than more substantial threats that affect hundreds of thousands of sharks. This may indicate that thematically framed stories are better at facilitating conservation action. Hart (2011), for example, found that framing polar bears as victims of climate change was more effective at motivating policy support than episodic framing. On the other hand, conservation professionals may also consider reframing the way they communicate about shark conservation (i.e., risks to sharks) to the media.

There is a large body of a research that discusses the benefits of using identifiable victims in risk communication campaigns (e.g., Slovic 2007). Small and Loewenstein (2003), for example, found that showcasing an individual victim was more effective at generating donations for a cause than using multiple victims or statistics. These approaches have yet to be tested or evaluated for motivating conservation action for sharks and would need to be explored cross-culturally. Social framing of sharks as either victims or perpetrators may lead to assumptions about policy prescriptions (e.g., help the victim, persecute the perpetrator) (Muter et al. 2009). If sharks continue to be framed primarily as perpetrators of risk, policy responses will likely remain unfavorable to shark conservation.

Despite finding that the majority of articles highlighted risks from sharks, we identified some small changes in shark-related coverage over time. We found a small, but significant decrease in articles that discussed negative effects of sharks and an increase in articles that discussed positive effect of sharks. Portrayal of the shark tourism industry seemed to become more positive as the number of articles discussing the negative effects to humans and to sharks from tourism decreased. This positive portrayal could also have been due, in part, to the increasing acceptance of wildlife tourism targeting sharks and its beneficial role in shark conservation and awareness. These results are consistent with those from other media and attitudinal studies. For example, Boissonneault et al. (2005) found that articles about gray nurse sharks have increased since 2001. This finding implies an increasing interest among the general public in learning about the plight of the gray nurse sharks. On the basis of a study of 53 years of *SportDiving* magazine, Whatmough et al. (2011) suggest an increase in conservation awareness as attitudes portrayed in the magazine shifted from “adventure-seeking hunters” to “nature-appreciating observers.” Positive changes in attitudes toward sharks have been documented recently among recreational fishers (Lynch et al. 2010). Given these recent findings, one may question whether newspaper articles accurately reflect society's values toward sharks and shark conservation.

Assessment of human attitudes, beliefs, and behaviors related to sharks would provide some much-needed insight into media effects on public attitudes toward sharks and their conservation (Gore et al. 2011; Simpfendorfer et al. 2011). Furthermore, continued monitoring of shark-related newspaper articles may signal changes in attitude and belief patterns (Houston et al. 2010).

Although we could not determine whether messengers in the articles examined sought out the media to share their message or were sought by the media, there were several noteworthy findings regarding messengers. First, politicians were used as primary messengers in Australian significantly more than in the United States. Politician messengers were also positively correlated with stories discussing positive effects of sharks (e.g., successful conservation efforts). In contrast, conservation groups were correlated with articles highlighting negative effects on sharks (which is presumably what they often are created for); however, they were not correlated with stories about shark conservation. This suggests conservation groups are either not being sought out by the media in regards to shark conservation issues or are not being as efficient as they could be at communicating conservation concerns to the media. Either way, this is an issue that could be investigated empirically and addressed through conservation action. Purposeful media training for conservationists (e.g., Jacobson 2009) would help them advance conservation actions.

Finally, we found that shark attack victims are not only being used as messengers about shark attacks (i.e., negative effects of sharks), but they are also being used as messengers for shark conservation. This suggests that victims of shark attacks are not always resentful toward sharks and understand the risks of being attacked while in the water. This finding also demonstrates that shark-attack stories, although often negatively framed toward sharks, can be crafted to inform and educate readers about shark conservation. From a communication perspective, news stories on attacks can highlight the rarity of attacks, discuss preventative measures to take to reduce vulnerability to attacks, and discuss conservation issues. Frequent reminders about the rarity of shark attacks may reinforce, rather than amplify, existing risk perceptions (Gore et al. 2005). Furthermore, proactive communication coupled with messages on ways to reduce the risk of negative encounters with sharks (e.g., identifying times of day or year when shark activity is more prevalent) may help curb negative attitudes toward sharks.

Human pressures on sharks have increased dramatically over time. Ecological investigations into declines in shark populations predate conservation efforts; systematic social scientific inquiry is only now beginning to contribute to decision making in the regimes within which such science makes a difference (Jacques 2010). Through analysis of Australian and U.S. media, our find-

ings contribute to a growing knowledge base and offer empirical evidence that risks from, rather than to, sharks have and continue to dominate news coverage in large media markets. To the extent that media reflects social opinion (Houston et al. 2010), this is problematic for successful shark conservation. Although we offer some media-based solutions for working to overcome some challenges to shark conservation, we agree with Jacques (2010) that such insights alone will not save sharks. However, when integrated with biological and ecological research, social science research may help generate a more comprehensive perspective and effectively inform conservation practice.

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## Supporting Information

The coding protocol for this study (Appendix S1) is available online. The authors are solely responsible for the content and functionality of these materials. Queries (other than absence of the material) should be directed to the corresponding author.

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