



Contents lists available at ScienceDirect

Ocean & Coastal Management

journal homepage: www.elsevier.com/locate/ocecoaman

Fish tales: Combating fake science in popular media

Andrew David Thaler^{a,*}, David Shiffman^b^a Blackbeard Biologic, Hayes, VA, USA^b RJ Dunlap Marine Conservation Program; University of Miami, Miami, FL, USA

ARTICLE INFO

Article history:
Available online xxx

Keywords:
Social media
Twitter
Megalodon
Mermaids
Pseudoscience

ABSTRACT

What role should scientist play in correcting bad science, fake science, and pseudoscience presented in popular media? Here, we present a case study based on fake documentaries and discuss effective social media strategies for scientists who want to engage with the public on issues of bad science, pseudoscience, and fake science. We identify two tracks that scientists can use to maximize the broad dissemination of corrective and educational content: that of an audience builder or an expert resource. Finally, we suggests that scientists familiarize themselves with common sources of misinformation within their field, so that they can be better able to respond quickly when factually inaccurate content begins to spread.

© 2015 Published by Elsevier Ltd.

1. Introduction

“A lie can travel halfway around the world while the truth is still putting on its shoes.”

~Almost certainly not Mark Twain.

“Falsehood will fly, as it were, on the wings of the wind, and carry its tales to every corner of the earth; whilst truth lags behind; her steps, though sure, are slow and solemn, and she has neither vigour nor activity enough to pursue and overtake her enemy.”

~Thomas Francklin, Sermons on Various Subjects, 1787

In an era of mass media propagation, the potential to disseminate scientific discoveries to a curious and literate public is unprecedented. Scientist and science advocates have the ability to bypass gatekeepers of traditional media to grow and nurture their own audiences (Thaler et al., 2012). This presents a powerful pathway for conservation scientists to reach critical stakeholders and increase attention on key environmental and conservation issues (Parsons et al., 2014). This also provides a means to increase attention for less popular conservation issues, including both regional issues and impacts that are not generally tailored for mass appeal (i.e. ocean acidification: Upwell, 2015).

The potential reach of these attention-driving tools for conservation outreach is tempered by the ability for bad science, pseudoscience, and fake science to spread widely through the general public (here we define “bad science” as unsound conclusions drawn from valid premises; “pseudoscience” as sound conclusions drawn from invalid premises; and “fake science” as unsound conclusions drawn from invalid premises). Unfettered by the limitations of accuracy and rigor, these stories can, as Francklin would say, “fly, as it were, on the wings of the wind”. Bad science, pseudoscience, and fake science can often spread so effectively that, even when corrected, as in the case in the now-retracted Lancet paper which sparked the modern anti-vaccination movement (Eggertson, 2010; Rao and Andrade, 2011), the false information will remain within the unchecked pool of common knowledge (Starbird et al., 2014). Bad science can even spread through poorly-assessed best practices, as in the case of the Gulf of Mexico oil spill, where the chemical dispersant Corexit was used for mitigation and remediation, despite known environmental hazards (Almeda et al., 2014; Zheng et al., 2014).

As practicing scientists find themselves more frequently participating in public discussions through social media and other platforms of digital dissemination, we must address a central question: What role, if any, should professional scientists play in challenging misinformation in the popular media? Tied to this question are three more pragmatic concerns:

1. How can scientists effectively engage with popular media?
2. What tools are available to scientists who want to reach a broad audience?

* Corresponding author.

E-mail address: andrewdavidthaler@gmail.com (A.D. Thaler).

3. How can scientists measure both quantitative and qualitative success in online science campaigning?

Here, we present a case study where conservation scientists implemented a strategic campaign through social media to directly address fake science in popular media. Rather than providing an exhaustive critique of how scientist and science communicators can use social media platforms, we instead highlight specific tactics that yield effective, measurable results. For a broader look at how to survive and thrive in the digital ecosystems, we recommend [Thaler et al. \(2012\)](#) and [Bik and Goldstein \(2013\)](#).

2. Mermaids and megalodons: the rise and fall of the fake discovery documentary

In May, 2012, Animal Planet, a Discovery Communications property, released *Mermaids: The Body Found*. The fictitious documentary, which presents the case that mermaids are not only real, but that there is an active government conspiracy to hide their existence, aired with a minimal post-credit disclaimer and was preceded by heavy promotional material suggesting that the program evidence-based. To project credibility, *Mermaids* featured actual government organizations, particularly the United States' National Oceanic and Atmospheric Administration (NOAA), implicating real scientists in a fake conspiracy. NOAA experienced a backlash from this production and issued a statement distancing itself from the show ([NOAA, 2012](#)). Several NOAA scientists reported being verbally accosted as a result of their perceived complicity in the “mermaid conspiracy” (personal communications to Shiffman and Thaler).

Mermaids: The Body Found launched a new generation of fake documentaries, produced with the trappings of educational programming, including high production value, stunning visuals, and compelling narration. Since then, Discovery Communications' networks have aired a follow-up to the initial fake mermaid documentary, which went on to become Animal Planet's highest grossing show ([ABC News, 2013](#)), as well as two that promote the claim that the extinct *Carcharocles megalodon* ([Pimiento and Clements, 2014](#)) is extant and predating on humans. These fake documentaries followed a very particular style, weaving real science, natural history, and current events with fabricated images, CGI video, and interviews with actors playing experts, witnesses, and government officials. In each case, the fake documentaries created conflict by inserting real government agencies into the narrative as antagonists, and implicated working scientists in fictional conspiracies.

Shows like this can have real, tangible effects on science and science outreach ([Myrick and Evans, 2014](#)). NOAA is the lead government agency tasked with preparing for and educating the public about climate change ([NOAA, 2013](#)). By sowing distrust about the motives and methods of this organization through misleading works of fiction, the producers of *Mermaids* and other shows undermined NOAA's ability to address real, pressing issues. Climate change already suffers from an organized and concerted denial industry ([Dunlap and McCright, 2011](#)) and this additional insult further erodes the public's confidence in government scientists.

The reaction from the scientific community was mixed, with some science communicators capitalizing on the interest in mermaids to educate a new audience about real ocean issues ([Shiffman, 2013](#)) while others set to work ensuring that people were made aware of the fabricated premises of these shows ([Switek, 2012](#)). Others tapped into the increased public interest to boost ocean science literacy ([Steingass, 2013](#)). It is important to note that, though the earliest responses to these fake documentaries were haphazard, latter articles did not appear *de novo*, but rather built

upon the experience of a diverse group of ocean science communicators that coordinated and evaluated the success of each component of an overarching campaign. After two years of experience addressing these programs, we have developed an effective model of rapid debunking followed by deeper educational content that capitalizes on the increased public interest in ocean issues following the airing of a fake documentary.

Beginning with Mermaids: The Body Found, we published articles that debunked the central premises of these shows while directing our audience to disclaimers and other material that highlighted the shows' fictitious content. Initially, these articles came out within days of first airing ([Thaler, 2013b](#)), but, increasingly, fact-checking articles could be released during, and occasionally before, the show aired ([Shiffman, 2014a](#)). By using search-engine-optimized headlines that anticipate audience queries (i.e. *Mermaids: the Body Found is a fake documentary* captures search term queries for anyone looking for combinations of “mermaids”, “fake”, “documentary”, and/or “the body found”), we maximized search volume directed to our content. This technique, combined with a policy of posting as close to the air date and time as possible, resulted in our articles yielding top Google search results and holding a prominent position on the first page of results for years after airing. Maintaining strong, consistent search engine rankings is essential, as these programs are frequently re-aired in both the US and international markets.

These posts consistently hold top positions among all articles on Southern Fried Science, a popular marine science and conservation website. *Mermaids: The New Evidence is a fake documentary* has received over a quarter-million unique visitors over its lifetime, while *Megalodon: The New Evidence is a fake documentary* has a smaller share, with only 40,000 unique visitors over its lifetime. This is due in part to a concerted effort via Twitter, Facebook, and other social media platforms to disavow and debunk the show prior to airing, as it coincided with a major, multi-institutional effort coordinated by Upwell, a non-profit organization that monitors and shapes the online ocean conversation, to provide science-based information during Shark Week 2014 ([Upwell, 2014b](#)).

The tide began to shift during Shark Week 2014. Discovery Communications premiered their flagship summer event, Shark Week, with a program entitled *Shark of Darkness: Wrath of Submarine*. Like the previous *Mermaids* and *Megalodon* shows, *Shark of Darkness* was a fictitious production that used the tropes of classic nature documentaries. Unlike the previous two series, many viewers felt that *Shark of Darkness* stepped far over the line by capitalizing on a real maritime tragedy (up to, and including, using actors to portray actual victims of a passenger ferry sinking) to bolster the narrative that a rogue great white shark was attacking ships. The South Africa National Sea Rescue Institute, who participated in the real at-sea rescue and was featured without consultation in the program, had to publicly distance themselves from Discovery in the aftermath of the show's airing ([NSRI, 2014](#)).

We were ready for *Shark of Darkness*. Our tactical response highlights the precise role that practicing scientists can and should play in shaping the online discussion, honed over years of refining our strategy. As the show aired, we reached out to our professional colleagues, particularly Michelle Jewell, a behavioral zoologist whose graduate work focused on the geographic areas featured in *Shark of Darkness*. Before the premier of *Shark of Darkness* ended, we commissioned and published *Shark of Darkness: Wrath of Submarine is a fake documentary*, a systematic breakdown of the factual errors and misrepresentations featured throughout the show ([Jewell, 2014](#)). Within hours of publication, this article had accrued nearly half-a-million unique visitors. As of February 2, 2015, the article *Shark of Darkness: Wrath of Submarine is a fake documentary* holds the top Google search result for “shark of darkness”,

displacing even Discovery Communications' own promotional material.

It is worth noting that, while our number of unique visitors is exceptionally high for an ocean science audience, they represent a small fraction of those watching Discovery Communications programming. By producing compelling, factual, and corrective content early, we not only maximize our audience, but increase the likelihood that mainstream media sources will pick up our articles and incorporate them into secondary coverage. In our experience, there is a window of two days or less after airtime when large media outlets will consider reporting on a television program newsworthy. The longer it takes to release corrective content, the less likely it will spread.

Shark of Darkness marked a dramatic shift in the public's response to Discovery's, and, in particular, Shark Week's programming. For several years, Shark Week was the single largest event in the online shark conversation. Each year, Upwell charted the growth of the Shark Week conversation. For the first time since they began tracking, social mentions related to Shark Week fell dramatically (Fig. 1; Upwell, 2014a), with an increasingly negative sentiment (Levine, 2014). Overall, Shark Week lost almost 9 million viewers from 2013 to 2014 (Wilcox, 2014).

Complementary to these specific responses to major broadcast events, we also conducted in-depth analyses of Discovery Communications programming, resulting in a series of articles highlighting some of the less dramatic, but equally damaging misrepresentations of the state of science and conservation (Thaler, 2013a; Shiffman, 2014b), while continuing to monitor the online conversation and drive attention towards out correctional content. This resulted in a consistent baseline of skepticism regarding these programs and served to maintain a pool of active participants that continued to address these misrepresentations.

3. Measuring success

There are a few metrics of success that can provide active social media campaigners with an understanding of the effectiveness of their outreach efforts. The volume of a conversation on Twitter can be measured by several third-party services. Unique visitors to a blog post serves as a quantitative gauge of the degree of public interest. Placement in Google search results is more qualitative, but is an effective indicator of what content the public is using to inform their decision making. We entered into the multiyear campaign with the goal of making fake documentaries presented as factual natural history programming less economically viable as a stand-in for educational programming. To that end, decrease in

Shark Week lost nearly half its online conversation

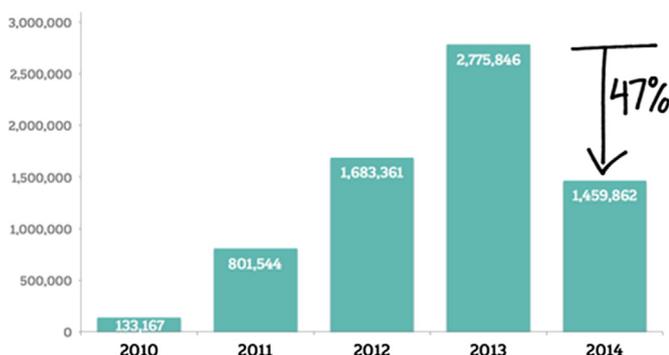


Fig. 1. Online mention volume for Upwell's 2010, 2011, 2012, 2013 and 2014 'Shark Week All' keyword groups. Used with permission.

viewership and increase in negative sentiment served as the best metrics of success for this campaign. In early 2015, citing the backlash against these programs, the new CEO of Discovery Communications announced that their new programming would not include fake documentaries (de Moraes, 2015).

In conducting these campaigns, we have identified two strategic tracks that scientists who wish to address the promulgation of bad science, pseudoscience, and fake science through popular media can utilize to further public education in their chosen fields.

4. Track 1: the audience builder

One of the obvious conclusions of this work is that in order for science and conservation messaging to successfully disseminate through social media, there needs to be active scientists with prominent, mature audiences. This approach, though often regarded as the gold standard for measuring long-term social media success, is neither effective for everyone nor often the best pathway for most practicing scientists. Generally, scientists on social media develop a niche audience specific to their discipline, resulting in smaller, though more engaged following.

Developing a large, active, and sustaining (that is, one that continues to grow linearly) social media audience represents a considerable investment in time and resources. Success in audience building can have tremendous payoff in terms of public outreach and broader impacts, but it may come at a cost to other aspects of a scientist's career. Scientists interested in pursuing this track should consult Thaler et al. (2012) and Bik and Goldstein (2013) for strategies to establish and grow your audience.

5. Track 2: the expert resource

Ensuring that experts in their field are not only aware of potentially problematic popular media, but have access to tools to broadly disseminate correctional media is as important as audience building. Perhaps the dominant reason that the above case study was successful is that Shiffman is both an audience builder and an expert resource, which enabled him to respond quickly to misinformation and capitalize on the initial increase in public interest. This highlights one of greatest strengths that practicing scientists can bring to the media landscape: they already have the background knowledge necessary to rapidly and thoroughly respond to misinformation as the story is breaking, effectively increasing the speed of those slow and solemn steps towards the truth. As in the case with *Shark of Darkness*, it is not necessary for the expert to have nurtured their own massive online audience; they only need to know who the key audience builders are and either direct those individuals towards the best content or produce content that can be shared broadly.

6. Conclusion

When audience builders and expert resources collaborate to create compelling, sharable content that directly addresses misinformation, be it in the form of fake nature documentaries, viral news stories of dubious merit, or pop culture pseudoscience, they can effectively harness the enhanced public attention to disseminate their knowledge effectively through social media. Scientists, particularly those working in fields where they commonly encounter bad science, pseudoscience, and fake science, should maintain a reasonable cultural awareness of the current zeitgeist and be prepared to reach out to key audience builders when the tide of misinformation needs to be stemmed.

Looking back over almost three years of social media campaigning against a particular popular media phenomenon, we see a

clearly defined role for the practicing scientist to engage with the proliferation of bad science, pseudoscience, and fake science: it is to ensure that the best available knowledge reaches the largest possible audience. There are many strategies and tactics that one can adopt to achieve these goals, and we have highlighted one case study here. Scientists can work to develop their own audience, if that is a pathway that appeals to them, but, more critically, scientists should be aware of the bad science, pseudoscience, and fake science that affect their field. These phenomena could be as benign as a fake documentary about mermaids, as dangerous as the growing anti-vaccination movement, or as destructive as the stance within the oil and gas industry that the use of chemical dispersal agents at the source of a major oil well blowout can be an effective mitigation and remediation strategy (Almeda et al., 2014; Zheng et al., 2014). By understanding what kinds of misinformation can spread rapidly through popular media and knowing who the lay audience builders are with relation to their field, the practicing scientist can position themselves to reach out to key influencers and maximize the dissemination of expert content.

Acknowledgments

We thank Dr. Amy Freitag for early review of this manuscript and Upwell or granting permission to use their figure. Funding was provided to DSS through the RJ Dunlap Marine Conservation Program, the International Women's Fishing Association, the Florida Outdoor Writers Association, and the Society for Conservation Biology Marine Section. Funding was provided to ADT through the contributions of his Patreon supporters.

References

- ABC News, 2013. "Mermaids" Documentary Stirs Big Ratings for Animal Planet. ABC News. Available at: <http://abcnews.go.com/blogs/entertainment/2013/05/mermaids-mocumentary-stirs-big-ratings-for-animal-planet/> (accessed 06.02.15).
- Almeda, R., et al., 2014. Dispersant Corexit 9500A and chemically dispersed crude oil decreases the growth rates of meroplanktonic barnacle nauplii (*Amphibalanus improvisus*) and tornaria larvae (Schizocardium sp.). *Mar. Environ. Res.* 99, 212–217.
- Bik, H.M., Goldstein, M.C., 2013. An introduction to social media for scientists. *PLOS Biol.* 11 (4), e1001535.
- Dunlap, R., McCright, A., 2011. Organized climate change denial. In: Dryzek, John S., Norgaard, Richard B., Schlosberg, David (Eds.), *The Oxford Handbook of Climate Change and Society*. Oxford University Press, Oxford, pp. 144–160.
- Eggertson, L., 2010. Lancet retracts 12-year-old article linking autism to MMR vaccines. *Can. Med. Assoc. J.* 182 (4), E199–E200.
- Jewell, M., 2014. Shark of Darkness: Wrath of Submarine is a Fake Documentary. Southern Fried Science. Available at: <http://www.southernfriedscience.com/?p=17533> (accessed 06.02.15).
- Levine, S., 2014. Shark Week Puts up Impressive Numbers Despite Backlash. Sysomos. Available at: <http://blog.sysomos.com/2014/08/19/shark-week/> (accessed 06.02.15).
- de Moraes, L., 2015. Fake Stuff Out at Discovery Channel, Promises New Chief Rich Ross. Deadline. Available at: <http://deadline.com/2015/01/discovery-channel-new-chief-rich-ross-fake-documentaries-tca-1201344279/> (accessed 06.02.15).
- Myrick, J.G., Evans, S.D., 2014. Do PSAs take a bite out of shark Week? the effects of juxtaposing environmental messages with violent images of shark attacks. *Sci. Commun.* 36 (5), 544–569.
- NOAA, 2013. National Oceanic and Atmospheric Administration – Climate Resources. US Department of Commerce. Available at: <http://www.noaa.gov/climate.html> (accessed 06.02.15).
- NOAA, 2012. No Evidence of Aquatic Humanoids Has Ever Been Found. US Department of Commerce. Available at: <http://oceanservice.noaa.gov/facts/mermaids.html> (accessed 06.02.15).
- NSRI, 2014. Shark of Darkness, Fake Documentary. National Sea Rescue Institute. Available at: <http://www.nsri.org.za/2014/08/shark-of-darkness-fake-documentary/> (accessed 06.02.15).
- Parsons, E.C.M., et al., 2014. How twitter literacy can benefit conservation scientists. *Conserv. Biol.* 28 (0), 299–301.
- Pimiento, C., Clements, C.F., 2014. When did *Carcharocles megalodon* become extinct? A new analysis of the fossil record. *PLOS One* 9 (10), e111086.
- Rao, T.S.S., Andrade, C., 2011. The MMR vaccine and autism: sensation, refutation, retraction, and fraud. *Indian J. Psychiatry* 53 (2), 95–96.
- Shiffman, D., 2014a. Megalodon: the New Evidence is a Fake Documentary. Southern Fried Science. Available at: <http://www.southernfriedscience.com/?p=17392> (accessed 06.02.15).
- Shiffman, D., 2013. Mermaids Aren't Real: Animal Planet's Fake Documentaries Misrepresent Ocean Life. Slate. Available at: http://www.slate.com/articles/health_and_science/science/2013/05/mermaids_aren_t_real_animal_planet_s_fake_documentaries_misrepresent_ocean.html (accessed 06.02.15).
- Shiffman, D., 2014b. Shark Week Lied to Scientists to Get Them to Appear in "documentaries." io9. Available at: <http://io9.com/shark-week-lied-to-scientists-to-get-them-to-appear-in-1619280737> (accessed 06.02.15).
- Starbird, K., et al., 2014. Rumors, false flags, and digital vigilantes: misinformation on twitter after the 2013 Boston Marathon bombing. In: iConference 2014 Proceedings, p. 9. Available at: http://faculty.washington.edu/kstarbi/Starbird_iConference2014-final.pdf (accessed 06.02.15).
- Steingass, S., 2013. Fishful thinking: five reasons why mermaids can't physically exist. Deep Sea News. Available at: <http://deepseanews.com/2013/10/fishful-thinking-five-reasons-why-mermaids-cant-physically-exist/> (accessed 06.02.15).
- Switek, B., 2012. Mermaids embodies the rotting carcass of science TV. Wired. Available at: <http://www.wired.com/2012/05/mermaids-embodies-the-rotting-carcass-of-science-tv/> (accessed 06.02.15).
- Thaler, A., et al., 2012. Digital environmentalism: tools and strategies for the evolving online ecosystem. In: Gallagher, D. (Ed.), *Environmental Leadership: a Reference Handbook*. SAGE Publications, p. 1032.
- Thaler, A.D., 2013a. It's not About the Mermaids: Animal Planet's Track Record of Fabricated Reality. Southern Fried Science. Available at: <http://www.southernfriedscience.com/?p=15173> (accessed 06.02.15).
- Thaler, A.D., 2013b. Mermaids: the New Evidence is a Fake Documentary. Southern Fried Science. Available at: <http://www.southernfriedscience.com/?p=14946> (accessed 06.02.15).
- Upwell, 2015. Ocean Acidification: the State of the Online Conversation. Upwell, p. 51. Available at: <http://bit.ly/acidificationSOTC>.
- Upwell, 2014a. Shark week 2014: not Moar shark? upwell. Available at: <http://www.upwell.us/shark-week-2014-not-moar-shark> (accessed 06.02.15).
- Upwell, 2014b. The Official Upwell Toolkit for Saving Sharks during Shark Week 2014. Upwell. Available at: <http://www.upwell.us/official-upwell-toolkit-saving-sharks-during-shark-week-2014> (accessed 06.02.15).
- Wilcox, C., 2014. Shark week loses nine million viewers, but discovery says "everyone is absolutely thrilled." Discover. Available at: <http://blogs.discovermagazine.com/science-sushi/2014/08/21/shark-week-loses-nine-million-viewers-discovery-says-everyone-absolutely-thrilled/#.VNUBxj3F98E> (accessed 06.02.15).
- Zheng, M., et al., 2014. Evaluation of differential cytotoxic effects of the oil spill dispersant Corexit 9500. *Life Sci.* 95 (2), 108–117. Available at: <http://www.sciencedirect.com/science/article/pii/S00242320153007571> (accessed 06.02.15).