

1 **Title: Sharks, Lies, and Videotape: A content analysis of 32 years of Shark Week**
2 **documentaries**

3

4 **Short title:** A content analysis of 32 years of Shark Week

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26 **Abstract:**

27

28 Despite evidence of their importance to marine ecosystems, at least 25% of all chondrichthyan
29 species are estimated or assessed as threatened with extinction. In addition to the logistical
30 difficulties of effectively conserving wide-ranging marine species, shark conservation is believed
31 to have been hindered in the past by public perceptions of sharks as dangerous to humans. Shark
32 Week is a high-profile, international programming event that has potentially enormous influence
33 on public perceptions of sharks, shark research, shark researchers, and shark conservation.
34 However, Shark Week has received regular criticism for poor factual accuracy, fearmongering,
35 bias, and inaccurate representations of science and scientists. This research analyzes the content
36 and titles of Shark Week episodes across its entire 32 years of programming to determine if there
37 are trends in species covered, research techniques featured, expert identity, conservation
38 messaging, type of programming, and portrayal of sharks. We analyzed titles from 272 episodes
39 (100%) of Shark Week programming and the content of all available (201; 73.9%) episodes. Our
40 data demonstrate that the majority of episodes are not focused on shark bites, although such
41 shows are common and many Shark Week programs frame sharks around fear, risk, and
42 adrenaline. While anecdotal descriptions of disproportionate attention to particular charismatic
43 species (e.g. great whites, bull sharks, and tiger sharks) are accurate and supported by data, 79
44 shark species have been featured briefly at least once. Shark Week's depictions of research and
45 of scientists are biased towards a small set of (typically visual and expensive) research
46 methodologies and (mostly white, mostly male) scientists, including presentation of many white
47 male non-scientists as experts. While sharks are more often portrayed negatively than positively,
48 limited conservation messaging does appear in 53% of episodes analyzed. Results suggest that
49 as a whole, while Shark Week is likely contributing to the collective perception of sharks as
50 monsters, even relatively small alterations to programming decisions could substantially improve
51 the presentation of sharks and shark science and conservation issues.

52

53 **Introduction**

54

55 Shark species can make important contributions to the resilience, structure, and function of
56 marine ecosystems (1,2). The loss of shark populations has the potential to influence prey
57 abundance, diversity, behavior, and genetics, although the nature and extent of that influence
58 varies based on ecological context (reviewed in Ferretti et al. 2010). At least 24 percent of all
59 chondrichthyan species (sharks, rays, skates, and chimeras) are assessed as or estimated to
60 be Threatened with extinction (3-5), primarily due to overfishing (6,7). Conservation of shark
61 populations is challenging given life history characteristics including slow growth, late age at
62 maturity, and relatively low fecundity (8). Management is further complicated by the reality that
63 shark fisheries globally are often under-managed, enforcement resources are typically limited,
64 many species are highly mobile through multiple management jurisdictions, and sharks can
65 represent an important food source, especially in subsistence fishing communities (3).

66

67 In addition to the biological, ecological, and practical difficulties of effectively conserving sharks,
68 shark conservation is believed to have been hindered in the past by public perceptions of sharks
69 as dangerous to humans (9), including portrayals suggesting that they are evil or vicious (10).

70 One of the primary ways that the public (defined here as people who are not shark scientists,
71 marine scientists, or aquarists) obtains their knowledge about sharks is through the media,
72 including news stories, social media, and television programs (11,12). Although negative
73 images of sharks predate the modern era, with sharks featured as villains in many famous
74 works of art and literature (e.g. Copley's *Watson and the Shark* (1778) or Hemingway's *The Old*
75 *Man and The Sea* (1952)), the movie *Jaws* (1975) marked a shift towards modern presentations
76 of sharks with a visceral visual immediacy. These negative portrayals have been reinforced over
77 decades by media reporting focused overwhelmingly on shark bite incidents and by "attack"

78 focused movies and television programs (10,13-15). This media landscape contributes to a
79 collective public conceptualization of sharks as bad, dangerous man-eaters (16,17).
80
81 Public perceptions of sharks may affect shark conservation efforts directly or indirectly, by
82 altering public attitudes or by shaping public knowledge and support for particular policies
83 (9,18). In addition to a primary focus on covering shark bites (14), reporting on sharks in
84 newspapers focuses attention on particular threats to sharks and disproportionately discusses a
85 relatively small number of charismatic species, regardless of conservation status--potentially
86 leading to failures to direct attention to the most serious conservation challenges or most
87 threatened species (19). In a participatory democracy, conservation policy change often
88 requires public support, and fame is likely to have both costs and benefits in terms of
89 conservation attention and support (18,20).
90
91 Shark Week, an annual event from Discovery Communications, has played a large role in
92 shaping public perceptions of sharks since 1988. Shark Week is the highest-profile coverage of
93 marine biology or ocean conservation on American television, and represents the greatest
94 temporary increase over baseline in Americans paying attention to any ocean science topic
95 (21,22). In 2020, over 21 million viewers tuned in and 37% of those viewers did not watch the
96 Discovery Channel in the month prior to Shark Week (23). Social media mentions occur in the
97 hundreds of thousands each year during Shark Week, as do notable spikes in Wikipedia
98 searches about sharks (21). Therefore, this long-running programming event has potentially
99 enormous influence on public perceptions of sharks, shark research, shark researchers, and
100 shark conservation; it may be the only time that many people think about these topics at all
101 during a typical year.
102

103 Shark Week has received regular criticism for poor factual accuracy, fearmongering, bias, and
104 inaccurate representations of science and scientists (e.g. (24-27)). Multiple scientific experts
105 have reported that their words were selectively edited to make it appear that they were
106 responding to questions they were not asked, or that they found the way they were presented in
107 Shark Week programs profoundly professionally embarrassing (28,29). In 2010, in response to
108 criticism, Discovery Communications agreed to reduce entertainment programming during
109 Shark Week and present more scientifically-oriented episodes, though many of these more
110 scientific programs continued to depict sharks negatively (30).

111
112 Fictional programming from Shark Week has also generated scientific criticism, with shows like
113 *Megalodon: The Monster Shark Lives* (2013), *Megalodon: The New Evidence* (2014), and *Shark*
114 *of Darkness: Wrath of Submarine* (2014), presenting fictional storylines featuring CGI and actors
115 pretending to be scientists and government officials, without clear communication to the viewer
116 that these programs are not factual (e.g. (31,32)). According to a post-show social media poll
117 following *Megalodon: The Monster Shark Lives*, 79% of respondents reported believing that
118 *Otodous megalodon* was still alive (31), despite the fact that all scientific evidence suggests that
119 *O. megalodon* went extinct over 2 million years ago (33,34). These types of programs not only
120 present inaccurate information in ways that may reduce trust in science and scientists (e.g. (35),
121 but through their depiction of scientific and government collusion to hide the truth, join broader
122 sociological trends towards belief in conspiracy theories, which can undermine confidence in
123 previously undisputed facts and limit the potential for social consensus-building around a wide
124 range of important issues (36).

125
126 Defenses of Shark Week have typically fallen into two primary categories: firstly, that the most
127 problematic elements of Shark Week are also essentially harmless (e.g., that no-one expects
128 Shark Week to offer accurate information or believes what they see there (Shiffman, pers.

129 obsv.)). Not-yet-published data suggests that this is not the case, and that the public generally
130 perceives Shark Week as an accurate source of information about sharks (Wester et al. pers.
131 comm.). It is well established that reality television and info- or edu-tainment programming can
132 have real-world effects on public understanding of issues. Evidence suggests that exposure to
133 pseudoscientific television programming predicts pseudoscientific beliefs (e.g. (37,38), and that
134 regular exposure to reality TV featuring the paranormal predicts endorsement of paranormal
135 beliefs (39). Sixty-eight percent of pregnant women reported watching reality television shows
136 about pregnancy and birth, and 72% of those women who were pregnant for the first time said
137 that reality television could help them understand what it was like to give birth, although these
138 shows disproportionately focus on medically- and technologically-assisted birth, present birth as
139 dangerous, and frame women's bodies as incapable (40,41). Reality TV filming locations have
140 been reported to have substantial effects on tourist destination choice and demand for particular
141 locations (42). Television viewing shapes adolescent's beliefs about the risks of alcohol
142 consumption and their intention to drink (43). The power of media has become especially
143 apparent this past year during the COVID-19 pandemic, as 2020 was marked by the
144 propagation of medical disinformation and conspiracy theories across social media, with an
145 estimated 30% of the U.K. and U.S. populations subscribing to COVID scientific conspiracy
146 narratives (44). These and many other similar examples refute arguments that Shark Week
147 programming can have no meaningful real-world impact on sharks, shark science, or shark
148 conservation.

149
150 Secondly, defenders of current programming have argued that alternatives do not exist (e.g.,
151 that it is impossible to include more diverse representations of shark scientists because
152 available shark scientists are all white men (27) or that audience demand will not allow for more
153 conservation or science-focused programs (45)). These arguments are undermined by the
154 existence of organizations like Minorities in Shark Science (MISS;(46)) which to date has over

155 300 members that identify as women of color (Graham, pers. comm.), and the popularity of
156 factual, documentary television nature programming like that found on the BBC (as opposed to
157 the more “hybrid” programming combining factual and non-fiction or fictional genres (47) often
158 seen on Shark Week). While viewership for the Blue Planet II series was notably lower in the
159 U.S. than in the U.K., each episode had approximately 3 million viewers (48).

160

161 Shark Week represents a significant opportunity for public engagement with shark science and
162 conservation for a large and enthusiastic audience. Between 2014 and 2017, the Twitter
163 discourse regarding sharks shifted from negative or slightly negative to slightly positive or
164 positive during Shark Week air dates compared to non-Shark Week parts of the year (49) .

165 Documentary programming can shape public opinion about conservation-relevant issues,
166 particularly in concert with other reinforcing information or events, sometimes resulting in pro-
167 environmental policy and management changes (50). With adjustments to some choices about
168 programming, Discovery Communications could substantially improve their messaging about
169 science, sharks, and shark conservation and increase representation of diverse scientists on
170 television.

171

172 The goal of this research was to quantify some of the reported trends in Shark Week
173 programming, analyze the content and titles of Shark Week episodes to determine if there are
174 trends in species covered, research techniques featured, expert identity, conservation
175 messaging, type of programming, and portrayal of sharks. This quantitative analysis of the key
176 features of Shark Week’s 30+ year run will provide better data from which to discuss current
177 practices and recommend improvements.

178

179 **Methods**

180

181 *Title Analysis*

182 Titles from all Shark Week episodes from 1988 to 2020 were collected from two online sources:
183 thetvdb.com (2021) and the Washington Post (1994) (N=272). Each title was subjectively
184 analyzed to determine whether it contained words evoking negative connotations or if the title
185 could be taken as negative within context. Individual title words were searched within the list of
186 Affective Norms for English Words (ANEW) (51). Title words that scored below the mean for
187 valence (ranging from pleasant to unpleasant) or above the mean for arousal (ranging from
188 calm to excited) were considered as eliciting a negative effect. These titles often included words
189 associated with violence (wrath, fury), fear (terror, fear, scream), death (deadly, death, killer),
190 danger (danger, dangerous), or attacks (shark attack, shark bite).

191
192 In addition to analyzing individual words within titles, whole titles were analyzed in context. This
193 allowed some titles that contained no negative words from the ANEW list to be categorized as
194 negative based upon the construction of the title, such as “Rogue Shark”, “Jaws Strikes Back”,
195 or “Lair of the Mega Shark”. Titles that contained the word “Jaws” were treated as negative
196 since the word was deliberately chosen based on its association with the eponymous movie.
197 Episodes from the “Air Jaws” series were not treated as negative unless other parts of the title
198 had a negative connotation, as this series already has a reputation for not being negative. The
199 list of titles was independently analyzed by a public relations professional in the same manner to
200 confirm our subjective analysis.

201
202 The total number of titles, and number of negative titles was counted for each year and the
203 proportion of negative titles was calculated. Each title was stripped of punctuation and
204 decomposed into individual words. Singular and plural words were grouped together (eg. Shark,
205 Sharks) and root words with various suffixes were also grouped together (eg. Kill, Killer, Killing).

206 The frequency of occurrence of words and word groups was sorted from most to least frequent
207 for all years combined. Lines of best fit were calculated in Excel®.

208

209 *Episode Analysis*

210 For the purpose of this study, obtainable episodes (N=201, 73.9% of all aired Shark Week
211 episodes; Supplement 1) of Discovery Shark Week® from 1988-2020 were watched by four
212 trained coders (LBW, BLM, JS, and DSS). Episodes which were analyzed were obtained from a
213 variety of online sources (i.e., Hulu®, Amazon Prime®, Discovery+®, YouTube®, Vimeo®),
214 library loans, and private holdings. Episodes from earlier years were watched on VHS tape.
215 Those which were not coded were not obtainable via any of the aforementioned platforms,
216 despite extensive online searches between 2019 and 2021.

217

218 A code book was developed by all coauthors, which is described in detail in Supplement 2. The
219 coding process included the following areas of interest: A) documentary title, B) documentary
220 year, C) production company, D) locations of filming, E) species of chondrichthyans (sharks,
221 rays, skates, chimeras) featured, F) featured experts/hosts of the show, G) general type of
222 documentary, H) research methods featured, I) purpose/goal of documentary, J)
223 accomplishment of goal/purpose, K) mention of shark conservation, L) mention of shark finning,
224 M) mention of shark meat, N) mention of ways to help sharks, O) negative portrayal of sharks,
225 P) positive portrayal of sharks, Q) portrayal of sharks other than negative or positive, R) mention
226 of specific misconceptions (e.g., “bull sharks are the only sharks that can enter freshwater” and
227 “sharks can smell a drop of blood from a mile away”), S) anything else about a given episode
228 that coders found noteworthy including space for coders to note variables that they were unsure
229 about. Most variables were binary (presence/absence), which minimized the chance of coding
230 error or coding agreement problems resulting from interpretation.

231

232 Prior to data collection, all coders completed analysis of the same three episodes to check for
233 intercoder reliability and assess whether the coding tool was working as intended. There were
234 no differences in quantitative coding or results. Coders filled out the same structured coding
235 form in Google Forms® for each episode, filling in applicable information throughout the
236 duration of the show. Each episode was coded by one coder. Only one coder (LBW) appeared
237 in an episode, which was assigned to a different coder. A single coder (DSS) acted as arbitrator
238 to minimize error resulting from coder uncertainty and to make decisions on any variables that
239 were coded unclearly.

240 .

241 *Hosts/Expert Analysis*

242 Not-yet-published data from a recent survey done by Wester et al. indicate that Shark Week is
243 perceived by the public as a reputable source of information on sharks and conservation
244 (Wester, pers. comm.). To better understand the sources of expert perspectives offered by
245 Shark Week, we assessed the academic research productivity of those identified onscreen as
246 “experts”, “scientists”, and “researchers” as a rough proxy for recognized scientific activity. We
247 used Google Scholar to determine the number of peer-reviewed publications (as of July 9,
248 2021) authored by each Shark Week expert/scientist. Because scientific journal publications are
249 not the only evidence of scientific expertise, we also counted authorship of peer-reviewed book
250 chapters and edited books, peer-reviewed abstracts from conferences, and government reports.
251 Popular press books and magazine articles were not included. We sorted expert scientific
252 productivity into bins based on number of publications (0, 1-5, 6-15, 16-25, 26-50, 50+
253 publications). Fictional experts were removed from the analysis (i.e. fictional scientist “Colin
254 Drake” from the megalodon episodes).

255

256 In order to assess the gender and racial diversity of non-fictional hosts/experts, we conducted
257 Google® searches for biographies, news articles, or social media profiles of each host/expert.

258 We successfully located sources for all 204 non-fictional hosts/experts. The pronouns used in
259 these sources were used to determine their gender, with the caveat that this allows us to speak
260 only to broad trends in gender representation on Shark Week, not to the individual gender
261 identities of particular experts. We recognize that people may be misgendered in sources that
262 they did not write themselves.

263
264 We assessed host/expert race based on how they would likely be perceived by U.S. audiences,
265 with the exception of the small number of hosts/experts who mention their race in public
266 biographies or platforms (i.e., on Twitter #BlackinMarineScience or #LatinxinSTEMWithout).
267 Because names are a poor predictor of racial identity, we did not consider names in this
268 analysis . Without drawing any conclusions about individual identities, this allowed us to develop
269 an approximate estimate of the proportion of hosts/experts who can be assessed as white or
270 white-passing.

271
272 *Species Analysis*
273 After all episodes in the study were coded, we collected the following additional information on
274 each shark species appearing in the episode: A) maximum recorded size (Castro, 2011), B)
275 IUCN Red List Status (iucnredlist.org), C) taxonomic order. All species appearing on screen and
276 also mentioned by name in narration were recorded, regardless of total screen time and
277 regardless of whether that species was discussed meaningfully during the episode, thus results
278 over-represent the coverage of less commonly featured species (e.g. a blacknose shark that
279 appeared for ten seconds in an episode largely about tiger sharks would yield the same results
280 as an episode that featured both blacknose and tiger sharks equally).

281
282 *Assessment of Scientists Attitudes toward Shark Week*

283 A survey of expert shark researcher’s perspectives on shark conservation policy (51) included
284 questions concerning perspectives on the role of media coverage in shaping public
285 understanding of sharks. These results were collected with the approval of the University of
286 Miami Human Subjects Research Office Institutional Review Board protocol 20130730, but have
287 not previously been published. In this survey, experts are defined as members of professional
288 scientific societies focusing on sharks and their relatives, including the American Elasmobranch
289 Society, the Oceania Chondrichthyan Society, and the European Elasmobranch Society.
290 Questions whose answers we report here are “How significant do you feel that public attitudes
291 towards sharks are in terms of shaping public policy?” and “In your opinion, does the
292 mainstream media accurately portray shark science and conservation issues?”

293

294 **Results & Discussion**

295

296 *Title Analysis & Programming Trends*

297 Between 1988 and 2020, there were 272 unique Shark Week program titles (Supplement 1).
298 For the first 15 years the number of original programs each year did not exceed seven. The
299 number of programs began to increase dramatically after 2010, with the greatest number of
300 unique programs (24) produced in 2018 and 2020 (Fig 1). Over half (51.8%) of all Shark Week
301 programming was produced in the past eight years (2013-2020). The increase in the number of
302 titles each year is best fit with an exponential function ($y = 2.290e^{0.0622x}$ where $x = \text{year } 1-33$, $r^2 =$
303 0.882). Overall, 59 titles (21.7%) used words with negative connotations, based on the ANEW.
304 Although the number of titles produced increased exponentially, the number of titles with
305 negative words each year ranged between zero and five and increased less dramatically (y
306 $= 1.204e^{0.039x}$ where $x = \text{year } 1-33$, $r^2 = 0.449$). When titles were analyzed within context, 42.6%
307 of all titles were categorized as negative. The number of negative titles increased proportionally

308 with the total number of titles as an exponential function ($y = 0.938e^{0.074x}$ where $x = \text{year } 1-33$, r^2
309 $= 0.850$).

310

311 *Fig 1. Trends in Shark Week episode titles. (A) Frequency of negative words used in episode*
312 *titles; (B) Percent of episodes with negative titles per year. Orange circles indicate episode titles*
313 *coded as negative based solely on the ANEW, blue squares indicate episode titles coded as*
314 *negative by authors based on context; (C) Number of episodes with negative titles per year.*
315 *Black circles indicate total number of episodes aired each year, orange circles indicate episode*
316 *titles coded as negative based solely on the ANEW, blue squares indicate episode titles coded*
317 *as negative by authors based on context.*

318

319 The proportion of titles that were assessed as having negative connotations ranged from 0-75%
320 in any given year (Fig 1). During the first five years of programming (1988-1992) only two titles
321 were considered negative. In total, six non-consecutive years, (1990, 1991, 1992, 1995, 1998,
322 2000), representing 18.2% of the time examined, had no negative titles. The last year in which
323 there were no negative titles was 2000. In contrast, at least half of the program titles each year
324 were considered negative for twelve years, which represents 36.4% of the time examined. The
325 years in which at least half of the program titles were negative were: 1997, 2001, 2002, 2007,
326 2010, 2011, 2013, 2014, 2016, 2016, 2018, and 2020. The greatest number of negative titles
327 was found in 2018 (14) and 2020 (12). These two years both produced the greatest number of
328 programs (24 each year) and combined they represent 17.6% of all Shark Week programming
329 since inception.

330 Title length ranged from one to eight words, with four word titles occurring most frequently. One
331 hundred seventy-three titles (64.6%) included the root word “shark”. While 99 of the titles

332 (36.4%) did not include the root word “shark”, many of these titles referred to a specific species,
333 such as “Great White Encounters” or, “Search for the Golden Hammerhead”. Sixteen titles
334 (5.9%) were merely descriptive and used the format, “Sharks of xxx”, where the xxx denotes a
335 location.

336 The 272 program titles were composed of 1047 total words. There were 354 unique words,
337 including root words plus their derivatives. The words “shark” and “sharks” occurred the most
338 frequently (161 occurrences) and accounted for 15.4% of all title words. This was followed by
339 the prepositions “of” (6.5%) and “the” (5.6%), then “jaws” (3.2%), “great” (2.8%), “white(s)”
340 (2.6%), and “attack(s)” (1.4%). “Attack(s)” was the most frequently occurring word that has a
341 negative connotation based on the ANEW list, and “jaws” was the most frequently occurring
342 word that has a negative connotation in context (Fig 2).

343

344 *Fig 2. Frequency of occurrence of title words. The word “Shark(s)” occurred 4.7 times more*
345 *frequently than the next most common word, “Jaws”, and was omitted from the word cloud.*
346 *Prepositions were also omitted, along with words that occurred only once. Words with a*
347 *negative connotation are depicted in red and font size reflects frequency of occurrence.*

348

349 The number of negative titles for Shark Week shows increased at a lower rate (for words from
350 the ANEW list) or at a similar rate (for titles taken in context) to the total number of titles. The
351 number of negative titles based on the ANEW list did not exceed five per year, despite a
352 dramatic increase in the total number of programs produced. For the first 15 years, all programs
353 with negative titles were derived from words within the ANEW list. However, more recently, the
354 number of negative titles in context has increased at a greater rate than the number of titles with
355 negative words from the ANEW list. This suggests that titles are being constructed to avoid

356 negative words, but are still depicting sharks in a sensationalized, potentially negative light
357 when taken in context.

358 Some words that have a negative connotation in isolation can be rendered neutral in context.
359 For example, an existing franchise entitled, “Naked and Afraid” produced episodes for Shark
360 Week in 2018 and 2020 with the title, “Naked and Afraid of Sharks”. In this case the franchise
361 title already included the word “afraid” so these titles were not included in the list of negative
362 titles. However, taken in isolation, the title “Naked and Afraid of Sharks” would be considered to
363 be a negative title. Similarly, the word “monster” is recognized as negative, but a program
364 entitled “Monster Garage: Shark Boat” used the word “monster” to describe a garage, not
365 sharks. In this case the title was not classified as negative. The word, “monster” can also refer
366 to something that is very large, so programs like, “Monster Mako”, can refer to a particularly
367 large mako shark. However, the word “monster” in this and similar titles was likely chosen to
368 elicit fear and titles which used words like “monster” to describe sharks themselves were
369 classified as negative despite some ambiguity around their meaning.

370 The word “Jaws” is unique in the context of Shark Week titles. Nearly all vertebrates possess
371 jaws, so the word is not considered negative in itself. However, the 1975 movie “Jaws” caused
372 people to associate the word with a killer shark. The word thus evokes a primal fear of being
373 attacked, bitten, or eaten. Titles that include the word “Jaws” take advantage of this association
374 by indirectly suggesting that the subject is dangerous or fear-inducing, without having to use
375 words that are explicitly negative. Therefore, titles that included the word “jaws”, other than “Air
376 Jaws”, were classified as negative within context.

377

378 There has been a recent trend to amalgamate “shark” with root words that have a negative
379 connotation. This creates chimeras such as Sharkzilla (2012), Sharkpocalypse (2013),
380 Sharkageddon (2014), Sharksanity (2014, 2015, 2016), and Sharkwrecked (2018, 2019). None

381 of these fabricated words would appear in the ANEW list so they were analyzed within context.

382 While the root words “apocalypse”, “armageddon”, and “shipwreck” are not included in the

383 ANEW list, the root word “insane” is listed and does have a negative connotation (52).

384

385 *Episode analysis*

386 General content

387

388 201 episodes were watched, coded, and scored, though not every variable was present in every

389 episode. A plurality of episodes were broadly categorized as being about “Research” (37%) or

390 “Natural History” (16%) (Fig 3). Our definition of research was very broad and essentially

391 included any attempt to obtain the answer to any question about shark biology or behavior via

392 observation or experimentation. Many of the episodes categorized as research include atypical

393 or unscientific methods, attempts to answer questions long considered resolved in the peer-

394 reviewed scientific literature, or experimental design that would likely not be considered

395 scientifically valid if presented in an academic journal or conference. Episodes that focused on

396 reenactments of sharks biting people (“Shark bites”) and episodes with no purpose beyond

397 people diving with sharks (“Diving with sharks”) each represented about 15% of all episodes.

398 Episodes about mythical/legendary sharks represented about 7% of all episodes. When

399 analyzed by year, we found no trends in programming; episodes have not become more or less

400 focused on science or shark bites over time (Fig 4). However, we note that “research” themed

401 programming was 25% or less in several years, including several consecutive years leading up

402 to the fictional megalodon episodes (2009-2012) and the most recent year analyzed in this

403 study (2020).

404

405 *Fig 3. Number and percent of episodes by documentary class.*

406

407 *Fig 4. Percent of episodes categorized by “Research” (orange line), “Shark Bites” (green line),*
408 *or “Swimming with Sharks” (blue line).*

409

410 A focus on shark bites, shark-related danger, and mythical, legendary, or fictional monster
411 sharks reflects, at least in part, the use of violence or fear as a marketing tool. Violent
412 programming is a market differentiator known to attract advertiser-desired demographics,
413 particularly 18-34 year old males (53). Hamilton (53) describes this tendency as an
414 economically rational and self-interested act by networks, despite creating negative externalities
415 for society that are not borne by the producers or programmers who are making decisions about
416 content. It is also possible that the creation of frustrated and vocal constituencies opposed to
417 inaccurate and fear-mongering programming, including opposition from scientists and
418 conservationists, is part of an overall marketing strategy in which critique drives further public
419 attention and viewership to even highly problematic content. Controversy and social media
420 discussion are strongly positively correlated with sales performance, although strong and
421 consistent negative word of mouth feedback may harm perceptions of a brand (54). This
422 argument is supported in the context of Shark Week in particular by O’Donnell’s observation
423 that the year that aired the fake megalodon documentary (2013) was also the year that
424 generated the greatest volume of Twitter discussion about Shark Week (49).

425

426 *Research Methods*

427

428 18.3% of Shark Week episodes featured no real research methods of any kind, which is the
429 most common “research” category (Fig 5). Among episodes that did include research methods,
430 methods featured tended to be simple, declarative and visual, such as satellite tagging large
431 charismatic animals. The most common methods were satellite telemetry tagging, acoustic
432 telemetry tagging, or use of high-tech camera equipment including drones, ROVs, BRUVs, or

433 ultra-high-speed cameras; when added together these techniques were featured in
434 approximately 40% of episodes. Some of this high-tech camera equipment is non-standard in
435 published scientific research and was used in these episodes to obtain high-quality imagery for
436 television, rather than scientific research purposes. While we note that examples of published
437 studies using high-tech camera equipment does exist (as reviewed in 55), the definition of
438 “research method” used here was inclusive of activities that would not meet the scientific
439 threshold for “research”.

440

441 *Fig 5. Number and percentage of occurrences of particular research methods in Shark Week*
442 *episodes.*

443

444 Research with high-tech equipment such as ROVs and satellite telemetry tagging is also
445 expensive, which translates into featuring well-funded and prominent (often white and male)
446 researchers. These research methodologies typically require more grant, donor, or personal
447 funding, which is easier to access for scientists with some degree of seniority and influence and
448 institutional support. Other methodologies producers consider less visually appealing may be
449 more likely to be performed by scientists working with limited resources, including early career
450 researchers, scientists at less wealthy institutions, or those from less wealthy countries, making
451 them less likely to be featured in Shark Week episodes. Compensation for Shark Week
452 appearances may also exacerbate these differences; scientists requesting industry-minimum
453 pay for their appearances can be passed over in favor of those who have more financial
454 resources and therefore may not need the additional funds (Jewell, pers.comm.). Appearing on
455 Shark Week programming can have positive benefits for researchers, including increased
456 visibility at home institutions and in the media, increased professional opportunities, and
457 additional research funds or resources (56). The research methods featured in Shark Week are
458 also notably distinct from the most common methods used in scientific investigations (57), which

459 are dominated by age and growth, life history, and reproductive biology work (although see (55)
460 for a review on the use of drones in shark research) While perhaps not as camera friendly, this
461 kind of work is vital to generate data for the sustainable management of shark species, and the
462 fact that commonly conducted, management-relevant science is rarely featured could impact
463 public understanding of the purpose, function, and social relevance of marine science and the
464 scientific process.

465

466 In addition to focusing on a very limited range of existing research techniques, television
467 programming often presents science and scientific discovery as reporting unquestionably true
468 facts rather than as generating knowledge through human-led iterative processes (58). A
469 significant disconnect has been found between scientists (who generally described science on
470 television as failing to reflect the practices and methods of science), and those working to
471 produce science programs for television, who believed reflecting uncertainty and methodological
472 processes in science television programs would undermine confidence in science, and
473 negatively affect ratings and audience interest (58). In general, media producers have reported
474 wanting to feature experts who are authoritative, confident, and willing to court controversy--all
475 characteristics which do not necessarily align with effectively conveying scientific knowledge or
476 nuance (59). These are also masculine-coded characteristics and women may receive
477 gendered hostility for displaying them or be more likely to be professionally penalized by senior
478 male colleagues for them, perhaps explaining why women experts are generally more hesitant
479 to appear on television than their male colleagues (59); for more discussion of misogyny in
480 shaping perceptions of female leadership and expertise, see (60,61).

481

482

483 *Featured experts*

484

485 Shark Week episodes often repeatedly rely on a subset of hosts/experts; 102 of the 229
486 hosts/experts were featured in more than one episode. Of those, 80 were featured 2-5 times, 13
487 were featured 6-10 times and nine were featured more than 10 times. Eight of the nine
488 host/experts were featured in between 10 and 19 episodes, with one person featured in 43
489 different episodes.

490

491 22.7% of the 204 people billed as an expert, scientist, or researcher by Shark Week have no
492 peer-reviewed publications (Fig 6). 14.4% of featured experts have between one and five
493 scientific publications, and although some of these individuals are early career researchers,
494 many are people who are not working professionally in science. For example, one
495 cinematographer is a coauthor on two scientific publications but is primarily not a scientist.
496 However, just over 41% of experts featured have more than 26 peer-reviewed publications.
497 Although the metric of publications is an imperfect measure of scientific and research
498 contributions, it does provide a general sense of whether someone is actively engaged in
499 publishable scientific research. However, publication metrics and credentials may not be central
500 to television representations of expertise. On U.S. talk shows, experts--particularly "intellectual
501 experts"---are subject to "levelling," or being treated in ways that present them as equivalently
502 knowledgeable as non-experts. They are often brought on late in an episode, featured alongside
503 non-experts, given little time to speak, frequently interrupted, and may be challenged or
504 disagreed with (62). In some sense Shark Week undertakes a similar leveling process, treating
505 activists, divers, camerapeople and others as having equivalent scientific expertise to
506 credentialed scientists. Of the nine most frequently featured host/experts, three have no peer-
507 reviewed publications, including the host with the most Shark Week episodes (43 episodes).
508 While there are multiple kinds of useful and relevant knowledge, it may be helpful for Shark
509 Week to more clearly distinguish between scientists and non-scientists (who may well possess
510 other forms of valuable expertise but should not be presented as scientific authorities). It is also

511 noteworthy that many of the most egregious and harmful factual errors or misrepresentations
512 highlighted in criticisms of Shark Week came from non-scientists who Shark Week presents as
513 experts.

514

515 *Fig 6. Frequency of number of scientific publications authored by Shark Week experts.*

516

517 Shark Week programming has previously been criticized for overwhelmingly featuring white
518 men as experts in their programming (27) and we were left with the same impression after
519 viewing 201 episodes. 93.9% of experts were perceived by coders as white or white-passing,
520 with only 6.1% of experts perceived as non-white. 24 out of 201 episodes included at least one
521 host/expert perceived by coders as non-white; only one episode included more than one
522 host/expert perceived as non-white. Based on our search, no experts used non-binary pronouns
523 or publicly mentioned being trans*. 78.6% of hosts/experts were associated with male pronouns
524 (an online biography for 2 hosts/experts was not readily available via Google search), whereas
525 the remaining hosts/experts (20.1%) were associated with female pronouns (Fig 7). 60 of the
526 201 episodes included at least one host/expert associated with female pronouns. Only 11
527 episodes included more than one host/expert associated with female pronouns; of these nine
528 aired between 2016 and 2018 and one each in 2003 and 2004. Of the 35 experts referred to as
529 “Dr.”, three were associated with female pronouns. We note that two of the male experts
530 referred to as “Dr.” do not have a Ph.D., D.V.M., or similar degree, and that some experts/hosts
531 known to have Ph.D.’s were not referred to as “Dr.” The nine hosts/experts who have been
532 featured in more than 10 episodes are all associated with male pronouns and were perceived as
533 white or white-passing. We note our results over-represent the coverage experts associated
534 with female pronouns and experts perceived by coders as non-white; if a female and/or non-
535 white-passing expert was featured on screen for one episode in an episode where the vast

536 majority of speaking was performed by male and/or white-passing experts, the episode was
537 counted as featuring a female expert.

538

539 *Fig 7: Percent of episodes including any appearance by an expert/host referred to by female*
540 *pronouns, by year. The red dashed line indicates 50% for a given year. Overall, 20.1% of*
541 *hosts/experts were associated with female pronouns.*

542

543 Women are underrepresented in science, filling approximately 26% of jobs, with
544 underrepresentation even more pronounced among women of color (63). STEM (science,
545 technology, engineering, and mathematics) fields in general and shark science in particular are
546 known to suffer from problems with misogyny, harassment, and discrimination (e.g., 56,64,65).
547 Counter-stereotyping and access to same-race and same-sex role models can play an
548 important role in making historically excluded groups feel a greater sense of belonging in
549 science, so availability of role models, including in media, is significant (66-68).

550

551 The selection methods for experts appearing on Shark Week have an important influence on
552 content. Experts may be selected for media appearances based on a prior existing relationship
553 with the producer or documentary team, or may be asked to vet or recommend other potential
554 experts being considered (e.g., 69). As people are most likely to have social networks structured
555 around homophily (i.e., primarily composed of people similar to themselves (70)); these
556 recruitment methods can perpetuate a lack of diversity among featured experts. Host/experts
557 are also found through production teams researching social media or published works, such as
558 research papers. This is more likely to favor established, senior researchers with a larger
559 publication record or a higher public profile. It could also result in people with a particularly
560 active social media presence being featured, whether or not they are scientific experts. The
561 limitations created by this recruitment process are not necessarily insurmountable; Shark

562 Week's chief competitor, National Geographic's "Shark Fest," has partnered with the non-profit
563 Minorities in Shark Sciences to improve diversity among their own hosts, while Shark Week has
564 made no such moves publically as of this writing.

565

566

567 *Featured Species*

568

569 Including species that weren't the focus of an episode but were briefly introduced by name on
570 screen, at least 79 extant (living) species of shark or species groups (e.g. "hammerhead",
571 "mako", "sevengill", "sixgill", "thresher", "wobbegong") were featured in at least one Shark Week
572 episode (Fig 8, Supplement 3). Additionally, eight extinct species and 13 species of extant non-
573 shark chondrichthyans were also featured (10 batoids (rays), 3 holocephalans (chimera and
574 ratfish)). 46 extant species were featured in more than one episode, 30 appeared in more than
575 five episodes, and 16 appeared in more than ten episodes. Across all episodes, an average of
576 4.9 species appeared. 39 episodes showed just one species, and 36 of these single-species
577 episodes featured only white sharks (*Carcharodon carcharias*).

578

579 *Fig 8: Species appearing in at least 5 Shark Week episodes. Hammerheads were most*
580 *commonly great hammerheads S. mokarran, though scalloped hammerheads S. lewini and*
581 *smooth hammerheads S. zygaena were sometimes mentioned. Conservation status reflects*
582 *that of great and scalloped hammerheads (Critically Endangered); smooth hammerheads are*
583 *currently assessed as Vulnerable. Mako sharks were almost always shortfin makos Isurus*
584 *oxyrinchus, but one longfin mako I. paucus was mentioned (both species are Endangered).*

585

586 Across the 201 coded episodes, the most common species featured were white sharks *C.*
587 *carcharias* (18.4% of all episodes), tiger sharks *Galeocerdo cuvier* (12.2% of all episodes), bull

588 sharks *Carcharhinus leucas* (9.6% of all episodes), and hammerhead sharks Sphyrnidae (8.4%
589 of all episodes) (Fig 8). Often the specific species of hammerhead was not mentioned, so all
590 hammerheads were grouped together for analysis; when species were specified, great
591 hammerheads *Sphyrna mokarran* were featured most often (62.3%) with the occasional
592 scalloped (21.7%) and smooth (2.9%) hammerheads (*S. lewini* and *S. zygaena*, respectively).

593
594 The species highlighted show some interesting contrasts with similar analyses of shark species
595 of interest in scientific publications (57) and popular press (19) coverage. While white sharks
596 appear in the top five featured species in Shark Week, scientific publications, and popular press
597 coverage, some of the most-studied species (bonnethead shark *Sphyrna tiburo*, sandbar shark
598 *Carcharhinus plumbeus*, and spiny dogfish *Squalus acanthias*) are rarely featured in any Shark
599 Week episodes (5, 7, and 1 episode, respectively) (Supplement 3). Similarly, some of the
600 species that received the most media attention in popular press articles (19) such as the
601 porbeagle *Lamna nasus* and basking shark *Cetorhinus maximus* were rarely featured in any
602 Shark Week episodes (2 and 4 episodes, respectively)(Supplement 3). As in other forms of
603 popular media, more highly threatened species were not more likely to be featured, with an
604 overall tendency to large, charismatic, well-known species.

605

606 *Featured localities*

607

608 Though dozens of countries were featured in at least one episode each, a handful of filming
609 locations dominated. The United States was the most common filming location (24.2% of all
610 episodes), followed by the Bahamas and South Africa with 15% each, and New Zealand,
611 Australia, and Mexico with approximately 10% each (Fig 9). Within the United States, 31.5% of
612 episodes took place in California, followed by Florida (26.7% of episodes), Hawaii (17.8% of
613 episodes), and Massachusetts (9.6% of episodes). At least one episode took place in nearly

614 every coastal state's waters (except for Delaware, and noting that most shows featured in
615 Georgia were filmed at the Georgia Aquarium). However, most states other than Florida,
616 California, Hawaii, and Massachusetts were not featured often, and some states were featured
617 only once.

618

619 *Fig 9. Shark Week filming locations. (A) Locations by country; (B) Locations within the United*
620 *States.*

621

622 This geographic focus on just a few countries (and on a relatively small number of locations
623 within those countries) in part reflects a focus on particular species and researchers, though
624 Shark Week episodes regularly feature experts who have no particular experience with a
625 location, but fly in to the location just for filming the episode. Although sharks are circumglobal,
626 familiar and logistically simple sites in which filmmakers have prior experience or existing
627 relationships may be favored for filming (71), potentially acting as a factor which contributes to
628 reducing the diversity of species, locations, narratives, and scientists featured. For example, two
629 of the top three filming localities have majority Black populations; 91% of the Bahamian
630 population is Black (72) and approximately 80% of the South African population is Black African
631 (73). Despite 30% of filming localities being located in these two countries, non-white experts
632 are rarely featured in Shark Week (this study; 27).

633

634 Messaging

635

636 174 (86.6%) of the coded episodes had a stated goal at the beginning of the episode. Of these
637 episodes, 64 (36.8%) did not address their stated goals during the course of the episode, and
638 110 (63.2%) claimed to have accomplished their stated goal. The stated goals varied from
639 specific research goals to answering general questions about shark behavior (see Supplement

640 2 for examples). If the goal of these episodes is to educate viewers, it is important that they
641 have a clearly stated purpose and that this purpose is addressed. The fact that this often did not
642 happen shows that many episodes serve no purpose beyond imagery of sharks.

643

644 148 (73.6%) of the coded episodes included some sort of fear-mongering language or negative
645 portrayal of sharks. These comments mostly focused on shark bites on humans (Table 1). On
646 the other hand, 127 (63.2%) of the episodes had at least one mention of sharks as awe-
647 inspiring, beautiful, misunderstood, or ecologically important (Table 2). Notably, this was often a
648 brief mention that played over the ending credits, while fear-mongering-type narrative often
649 occurred throughout the episode.

650

651

652 *Table 1: Representative example dialogue and narration showing sharks in a negative light.*

"Biologists know little of what makes these killing machines tick."
"The threat against humans from sharks has never been greater."
"Deadly maneaters lurking in the shadows."
"You can't outswim a shark, and you can't overpower it."
"Great white sharks can be absolute monsters."
"The New Jersey shore became a killing ground."
"Sharks are the stuff of nightmares."
"Sharks are mindless, monstrous killers."

“Sharks are stalking and killing us from the deep.”

“Great whites keep returning to California to terrorize people.”

“A missile armed with teeth, ready to fire.”

653

654

655 *Table 2: Representative example dialogue and narration showing sharks in a positive light.*

“The balance and health of the ocean depends on their survival.”

“A marine ecosystem is not healthy without top predators.”

“You cannot remove the top predators without affecting every link below.”

“Sharks are misunderstood animals.”

“Sharks are more valuable alive than dead.”

“Gentle giants”

“Great white sharks are one of the most awe-inspiring animals on the planet.”

“Sharks are clearly intelligent, not mindless killers.”

“Seeing a great white breach is one of the most spectacular things in nature.”

“What’s not to love?”

656

657 The language used to describe sharks does matter, as studies have shown that negatively
658 valenced words like “attack” can contribute to negative public sentiment towards sharks (49,74).

659 Public acceptance of predators is related to the frequency and intensity of interactions

660 (especially negative interactions) with humans, so support for shark conservation is likely to be
661 related to perceived frequency of bites or human injuries (i.e., “attacks”) (75). Media portrayal of
662 these issues has indeed been shown to play a role in public support for shark conservation (11).
663 Muter et al. (14) and Neff and Hueter (74) also found that news stories about sharks largely
664 focus on fear-mongering and exaggerated stories of sharks biting people rather than on shark
665 research or conservation. Exposure to violent Shark Week programming has been shown to
666 induce greater levels of fear of sharks (76), and fear correlates with support for policies, like
667 shark culls or beach netting, that are harmful to shark conservation (77).

668

669 One area in which Shark Week programming may be effective at reducing fear is through
670 episodes including neutral and positive interactions with sharks, which have been shown to
671 improve public perceptions (78). Episodes of Shark Week in the last several years typically
672 include at least one well-known celebrity interacting with sharks (e.g., Shaquille O'Neal, Will
673 Smith, Adam Devine, Ronda Rousey, Craig Ferguson). Celebrity actions, opinions, and
674 endorsements are known to influence the attitudes we adopt and the decisions we make (79),
675 and in conservation specifically, celebrity endorsement of a cause yields higher willingness-to-
676 engage amongst the public (80). However, it should be noted that Shark Week’s celebrity
677 episodes often feature unnecessary artificial danger or inappropriate interactions with animals
678 such as chasing, riding, or harassing them, which could undermine any positive messaging and
679 potentially endanger people’s safety (81).

680

681 In terms of specific threats to sharks and shark conservation, 28 episodes (13.9%) mentioned
682 shark finning or the shark fin trade, and eight (4.0%) mentioned that people eat shark meat.
683 However, Shark Week episodes are generally lacking in actionable educational content about
684 shark conservation. 107 episodes (53.2%) at least briefly mention something related to
685 conservation, often vague statements about shark population decline, the ecological importance

686 of sharks, or extinction risks. Just six episodes (3.0%) mentioned anything specific about shark
687 conservation policy or specific ways that Discovery’s audience could help; these statements
688 were mostly about individuals choosing to not eat shark fin soup or releasing sharks they catch.
689 There was no content encouraging viewers to speak to government officials about specific
690 ongoing policy discussions, advising them to avoid specific seafoods with shark bycatch,
691 requesting donations to nonprofits that have a track record of success, or incorporating any
692 other common advice given by experts to those who want to help conserve sharks. When
693 suggestions are provided during programming, many of them are not actionable in any way that
694 could actually be useful to shark conservation efforts, an enormous missed opportunity given
695 Shark Week’s massive audience and the general lack of public pro-sustainability engagement in
696 US shark fisheries discussions (82). Past attempts to leverage their audience included a 2014
697 social media ad with five ways that people could help sharks, which included “report shark
698 attacks” and “avoid shark fishing in marinas” as suggestions without explanation. The most
699 specific was “lobby for shark protection,” but no information was provided on who to lobby or
700 what to ask them to do. Exposing a large audience to vague platitudes is of questionable value
701 for conservation and may even undermine existing campaigns (82).

702

703

704 *Expert attitudes toward Shark Week*

705

706 A survey of expert shark scientists revealed broad concerns about the role of media
707 misinformation in general, and Shark Week specifically, in perpetuating misinformation about
708 shark research and conservation. 102 experts responded to the survey, but not everyone
709 responded to every question, and therefore the following percentages are relative to the number
710 of respondents that answered the particular question. Survey respondents generally believe that
711 public understanding of sharks is a significant factor influencing their conservation. 64% (N=49)

712 of respondents refer to public attitudes towards sharks as significant/important or very
713 significant/very important to shark conservation. Survey respondents reported being very
714 concerned about how sharks are portrayed in the media, a primary way that the public becomes
715 informed about environmental issues. 86% of responses to this question (N=74) reported
716 believing that mainstream media coverage of shark related issues is not factually accurate, and
717 while the question did not specifically ask about Shark Week, many respondents brought up
718 their concerns with sensationalist and inaccurate coverage included on Shark Week
719 unprompted (Table 3).

720

721 *Table 3: Selected responses to the survey question “In your opinion, does the mainstream*
722 *media accurately portray shark science and conservation issues” demonstrating survey*
723 *respondents’ concerns about how shark science and conservation issues are portrayed in the*
724 *media in general, and about Shark Week specifically.*

725

“They hardly ever portray any scientific and/or conservation issues.”
“Sharks will be portrayed as scary because that’s what sells.”
“Sensationalism abounds.”
“They sensationalize everything and do not accurately portray research.”
“Media attention is mainly and predominantly focused on shark attacks which are tiny compared to worldwide deaths due to other animals.”
“Shark Week is a disaster.”
“Shark Week is the worst.”

“Just look at the crap on the Discovery Channel.”

“Shark Week is the spawn of Satan.”

726

727

728 The disconnect between scientists and the producers of science-related programming may help
729 explain the lack of support for Shark Week among a significant portion of professional shark
730 scientists. In general, scientists report that much of what is called science on television is not
731 science but entertainment, while producers tended to define science programming much more
732 broadly and believe television represents science well (58). Scientists who do appear on
733 television emphasized the particular additional skill sets required, while the broader consensus
734 from the scientific community seems to be that scientists are “...better off doing science, but
735 letting the broadcasters do the science stories” (58, p. 129). This, however, presents obvious
736 challenges for programming such as Shark Week, where scientific inaccuracy is already a major
737 source of complaint and conflict--many scientists both want to see programming improved and
738 do not want to have to be involved in those improvements. This caution is understandable,
739 given recent fictional programming and the reality that some scientists have reported being
740 misled and misrepresented by Shark Week producers (29). However, it is unlikely that
741 programming will improve without the continued participation and engagement of scientists.

742

743 *Recommendations*

744

745 The scale of Shark Week’s platform to communicate with the public about sharks means that
746 even minor adjustments to programming could have a meaningful effect. Some of the simplest
747 improvements involve reducing harmful sensationalism (including perceptions of the
748 dangerousness of many activities), enhancing factual accuracy and raising editorial standards,

749 and clearly distinguishing between fact-based and fictional programming. Similarly, explicit
750 differentiation between credentialed scientific experts and non-scientist hosts would be helpful in
751 avoiding inadvertently legitimizing incorrect information.

752

753 In portrayals of science and scientists, it would be helpful to feature real science and more
754 realistic scientific methods (even if recreated or dramatized), a wider range of shark species,
755 and a more diverse range of scientists. These changes would likely help with factual accuracy
756 while also benefiting the diversification of shark science, recruitment in STEM, and public
757 recognition of the work of scientists from historically excluded groups.

758

759 In terms of the effects these changes might have on the public, some studies of students of
760 varying ages have shown that increasing knowledge about animals increases positive attitudes
761 towards those animals (83,84), including for sharks in particular (85). Television has the
762 potential to drive conservation action or intention--for example, an increase in internet searches
763 for conservation charities and sustainable practices were seen during and after the airing of
764 *Blue Planet II* episodes (86,87). This does not mean that providing the public with positive
765 representations of sharks, or accurate information about them, represents a solution to
766 conservation problems or will necessarily generate interest or concern about them in itself (88-
767 90). However, evidence suggests playing on existing negative stereotypes--even with an intent
768 to challenge them--can actually serve to reinforce them (e.g., 91). Best practices for improving
769 the public image of sharks include shifting away from negative stereotypes and providing
770 detailed information about how conservation problems connect to people's lives and what
771 actions they can take to help (78) .

772

773 The majority of Shark Week episodes do contain at least some educational content about
774 sharks (often vague or brief mentions), with most episodes falling into the (broad) categories of

775 Research or Natural History (Fig 3). Even episodes focused on bites or attacks can offer some
776 educational value when they include scientifically accurate information, though this is often
777 undermined by conflicting messages and sensationalism, as in programs which terrorize
778 viewers and then briefly mention shark conservation as the credits roll. While conservation
779 content may not be appropriate for every episode, providing actionable steps for viewers is
780 necessary in order for them to move from positive attitudes towards behavior that supports
781 shark conservation; viewers who are misinformed or under-informed about key issues related to
782 conservation are unlikely to support expert-backed policy solutions in useful ways (19). For
783 example, a small number of episodes correctly connected shark fishing for meat and fins to the
784 current population decline of sharks (3,7). However, no episodes linked these facts to specific
785 actions the audience could take to make a difference, and only six episodes included anything
786 arguably specific and detailed about conservation.

787

788 **Conclusion**

789

790 Shark Week has a complicated history over the course of its 30+ years, and has received
791 substantial criticism for scientific inaccuracy, while also unquestionably increasing the public
792 attention paid to sharks. This analysis attempted to quantitatively assess some of the trends and
793 practices seen in Shark Week programming that have been anecdotally discussed for decades.

794

795 Our analyses demonstrate that the majority of episodes are not focused on shark bites,
796 although such episodes are common and many titles and episodes are framed around fear, risk,
797 and adrenaline. Including tangential mentions, a surprising number and diversity of shark
798 species have been featured, although anecdotal descriptions of disproportionate attention to
799 particular large charismatic species are supported by our data. Shark Week's depictions of
800 research and of scientists are biased towards particular research methodologies and (mostly

801 white, mostly male) scientists, including non-scientists being presented as scientific experts
802 even as they share incorrect information. Results suggest that as a whole, Shark Week is likely
803 contributing to collective perceptions of sharks as monsters, and that even relatively small
804 alterations to programming decisions could substantially improve the presentation of sharks and
805 shark science and conservation issues.

806

807 This requires a complex balance of Shark Week's potentially competing goals to educate and
808 entertain audiences and contribute to conservation. If Shark Week does not retain viewers, any
809 efforts to improve programs' educational and conservation impact will not be meaningful. These
810 competing imperatives have been recognized since at least the 1940s with radio shows such as
811 *Great Moments in Science* and television's *The Nature of Things* (LaFollette 2008) successfully
812 combining entertainment and accurate educational content. Successful, scientifically accurate
813 programming featuring Don Herbert ("Mr. Wizard"), Carl Sagan, and Bill Nye, among others,
814 succeeded because hosts displayed excellent and entertaining communication skills (92,93).
815 Programming featuring stunning visuals and music such as *Blue Planet* and *Planet Earth*
816 effectively entices viewers with 'visual and aural pleasure' (*sensu* 94) while also delivering
817 accurate educational information.

818

819 Given its popularity and global viewership, Shark Week has the potential to generate interest in
820 both sharks and scientific careers among viewers. However, Shark Week fails to feature the full
821 range of shark research topics and methods and the diversity of people performing research on
822 sharks. Cultivating a positive attitude toward sharks through Shark Week has the potential to
823 drive enhanced support of shark and ocean conservation efforts. Currently, through a series of
824 unnecessary and harmful programming choices, Shark Week can be seen as a missed
825 opportunity to benefit sharks, shark science, and shark conservation.

826

827

828

829

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838

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- 1065
- 1066 **Supporting information**
- 1067 S1. Shark Week episodes by year. Blue column indicates whether the episode was included in
1068 the content analysis. Yellow columns indicate titles deemed negative using the ANEW, using
1069 context, and with the ANEW and context combined.
- 1070 S2. Coding guidelines for the content analysis of Shark Week episodes.
- 1071 S3. Chondrichthyan species featured in Shark Week episodes and number of episodes.

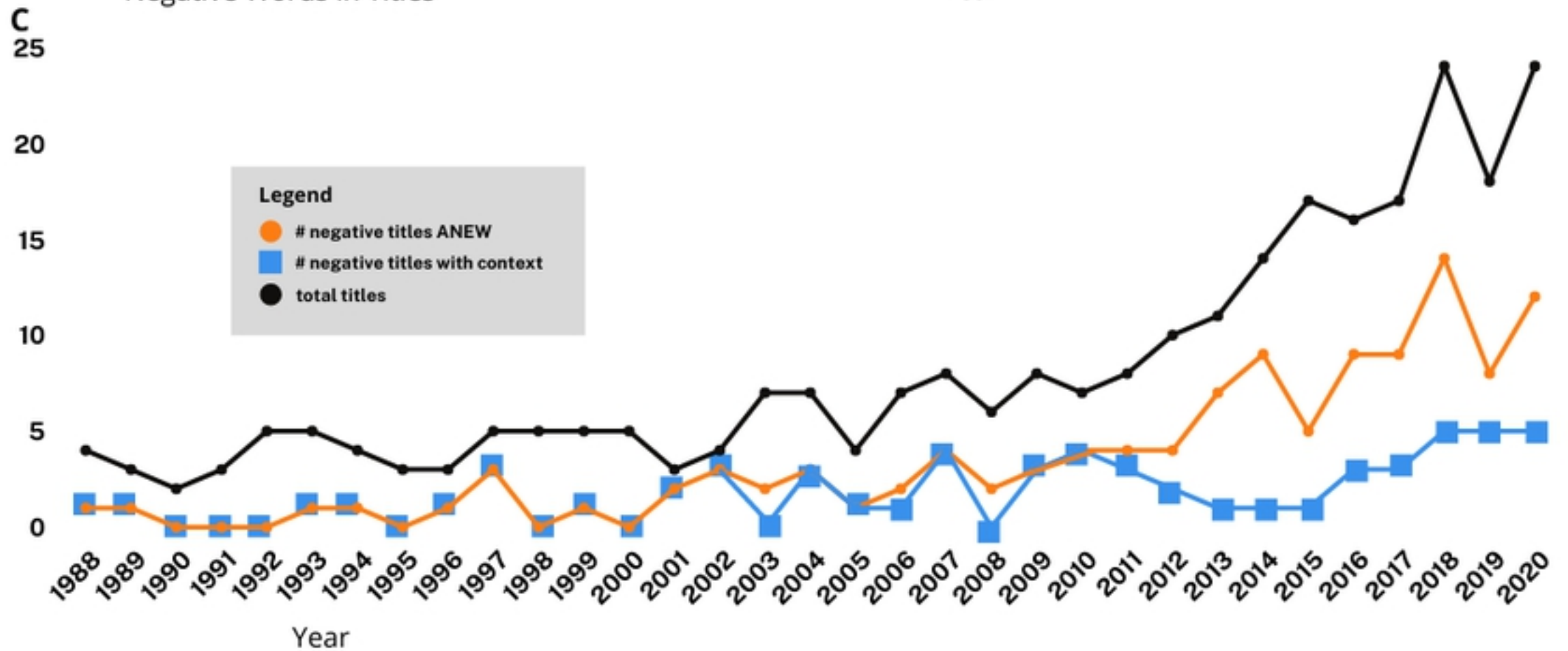
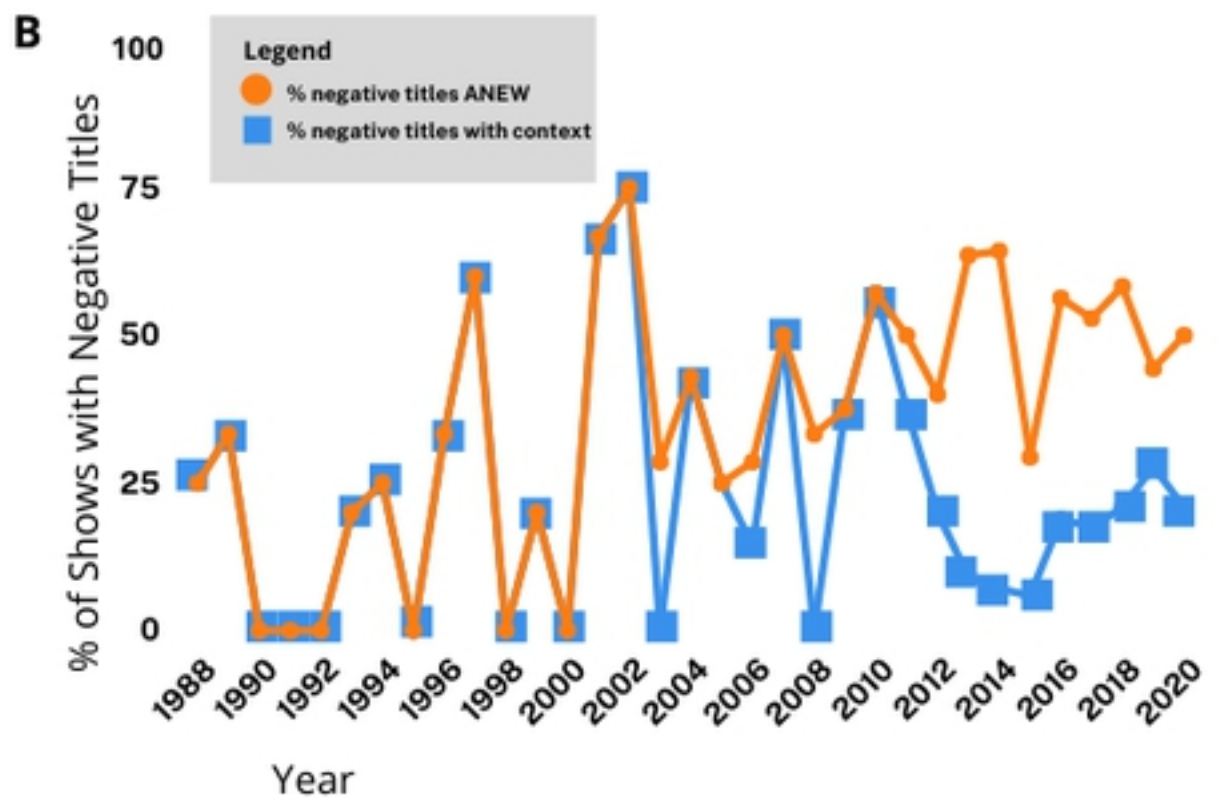
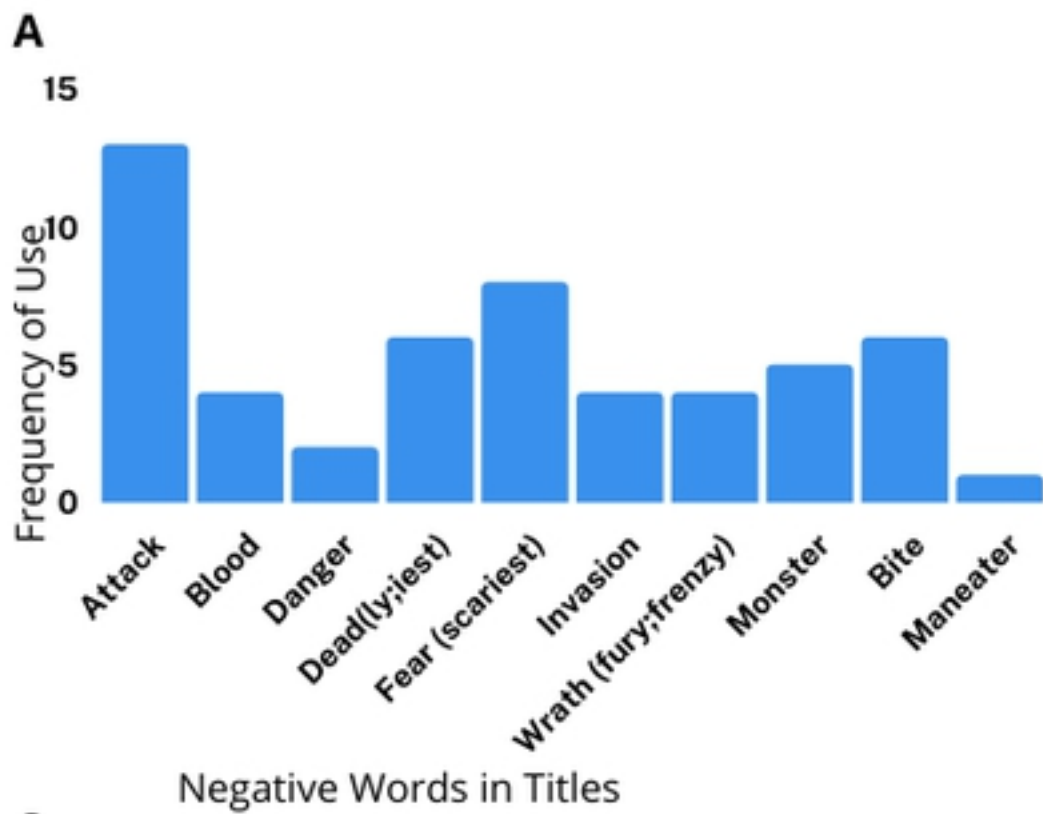


Figure 1



Figure 2

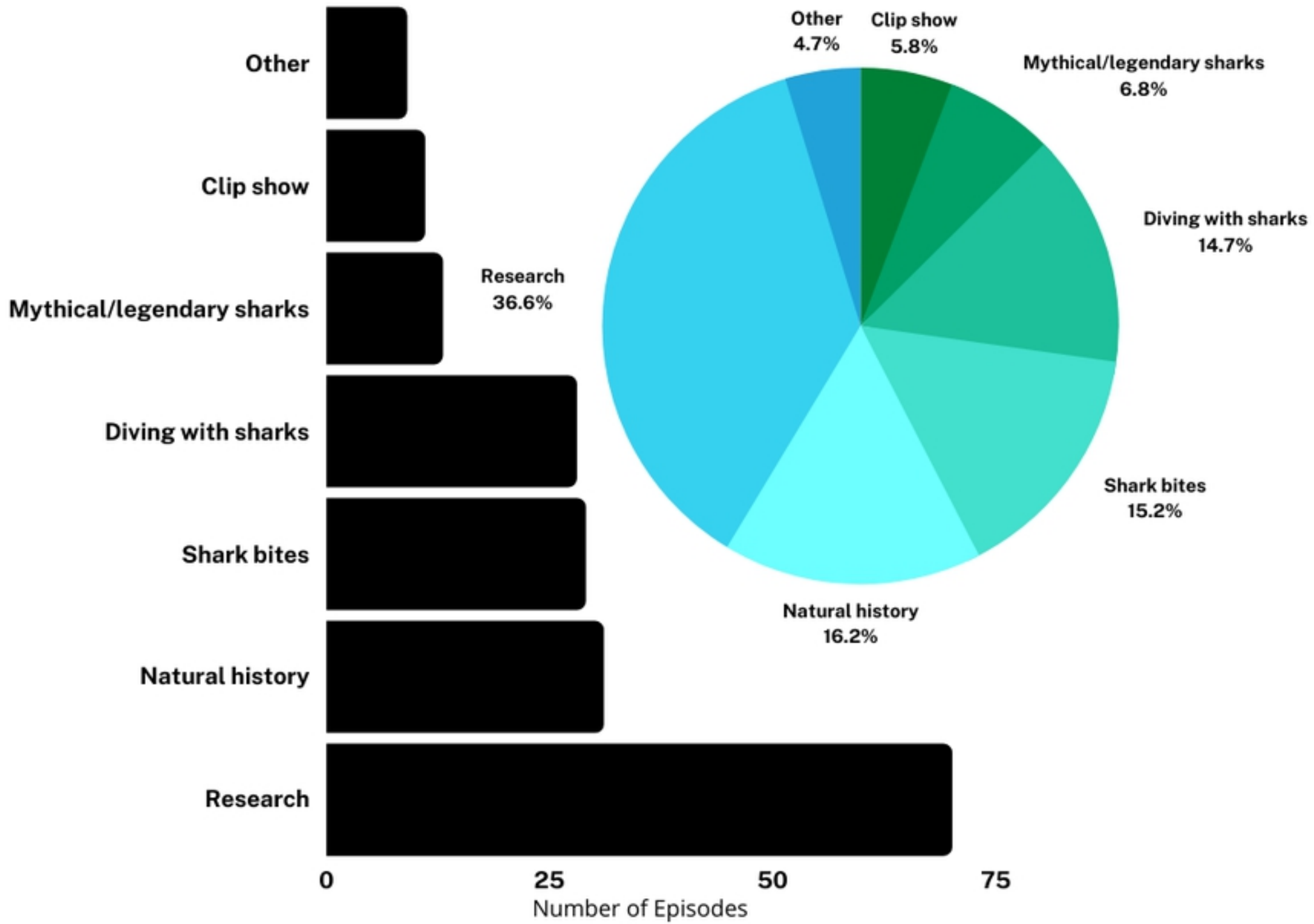


Figure 3

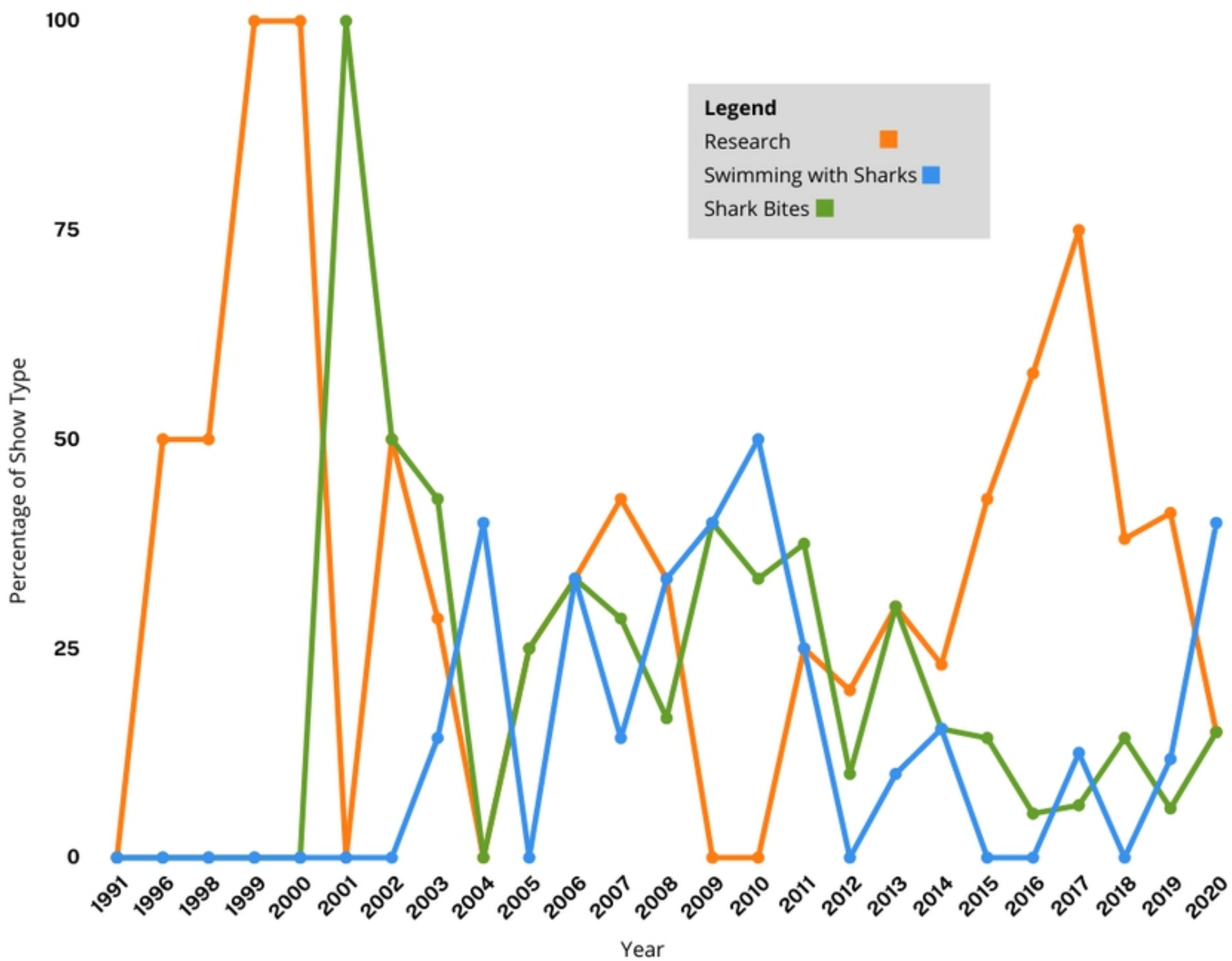


Figure 4

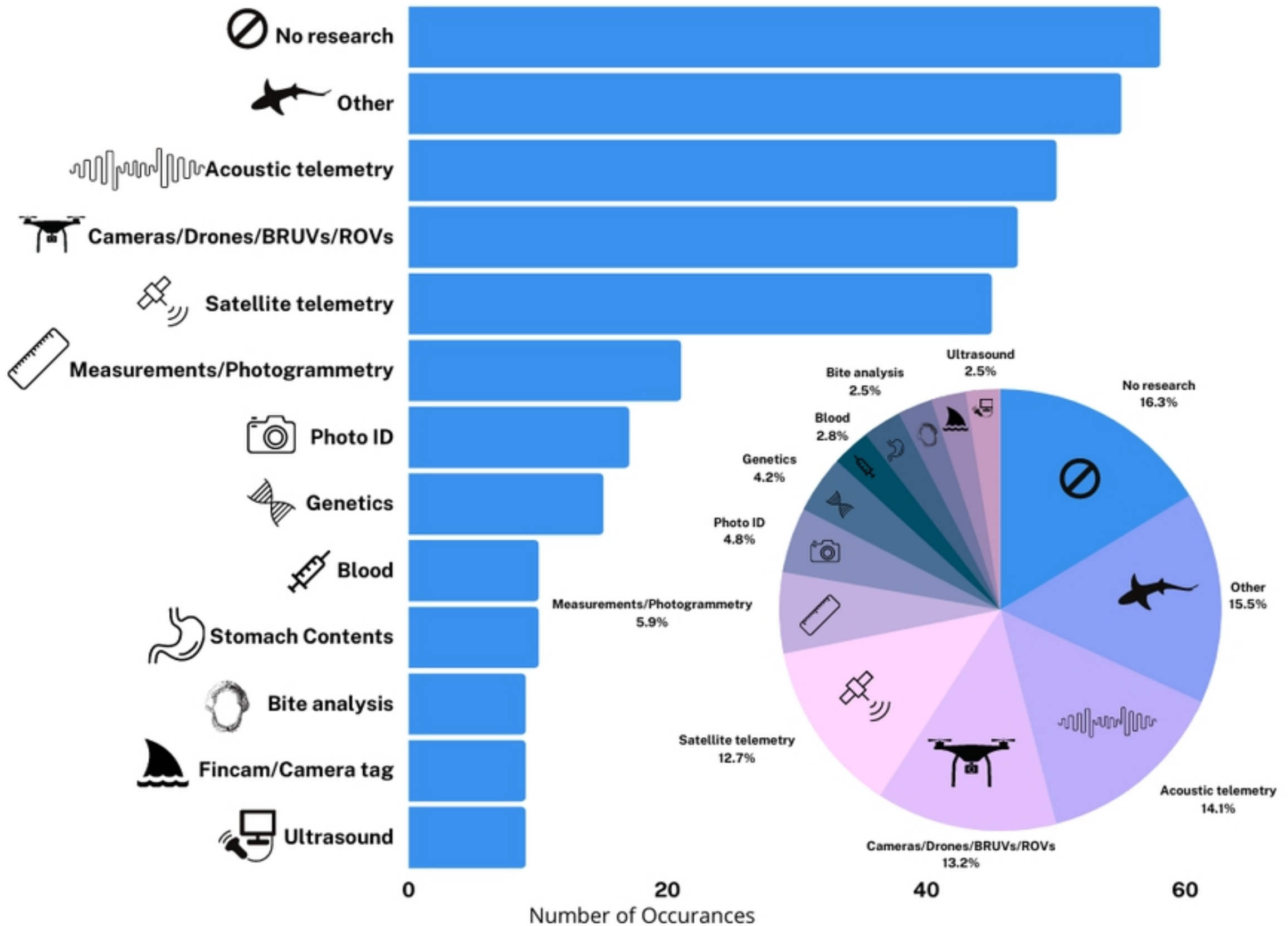


Figure 5

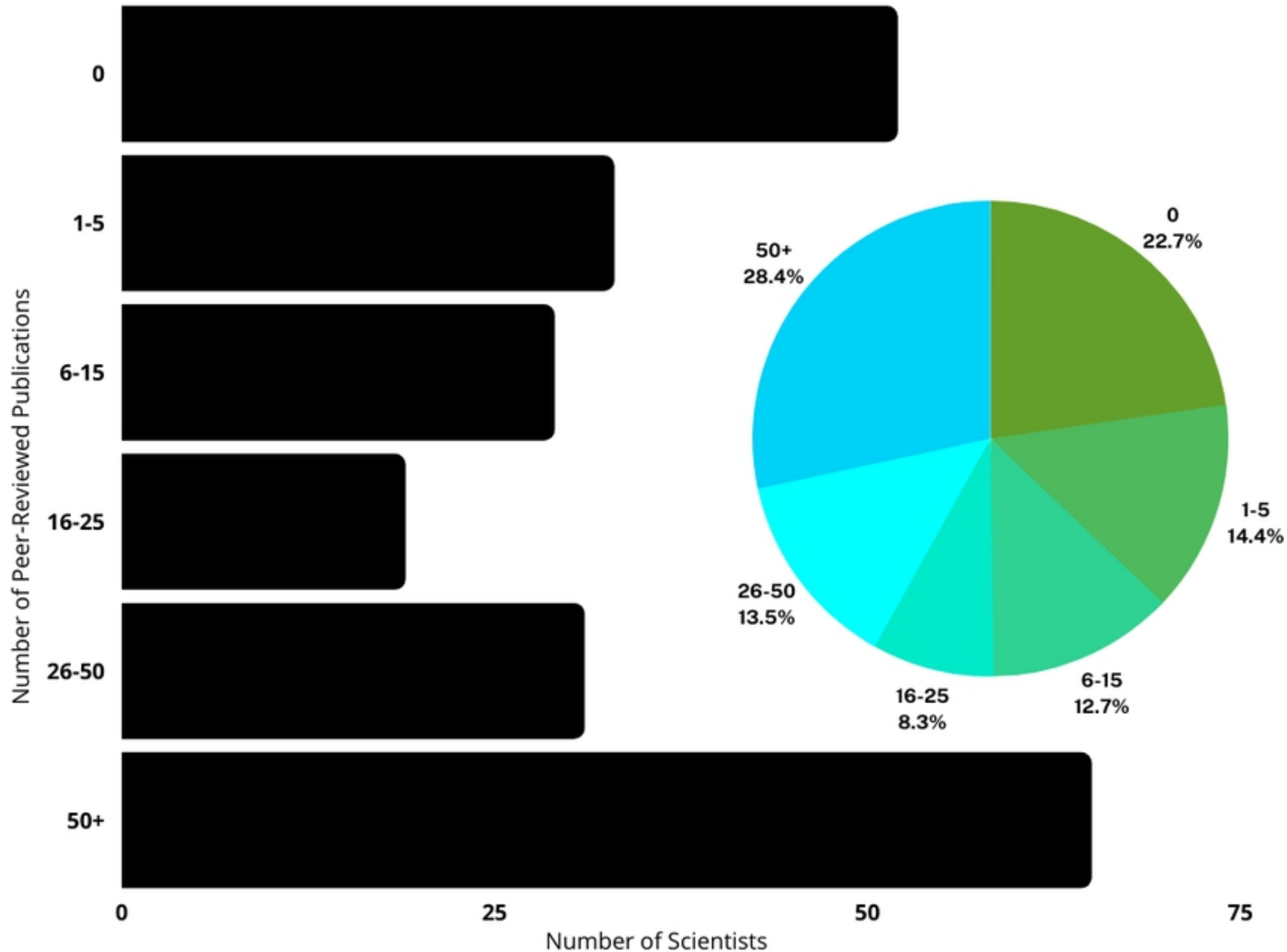


Figure 6

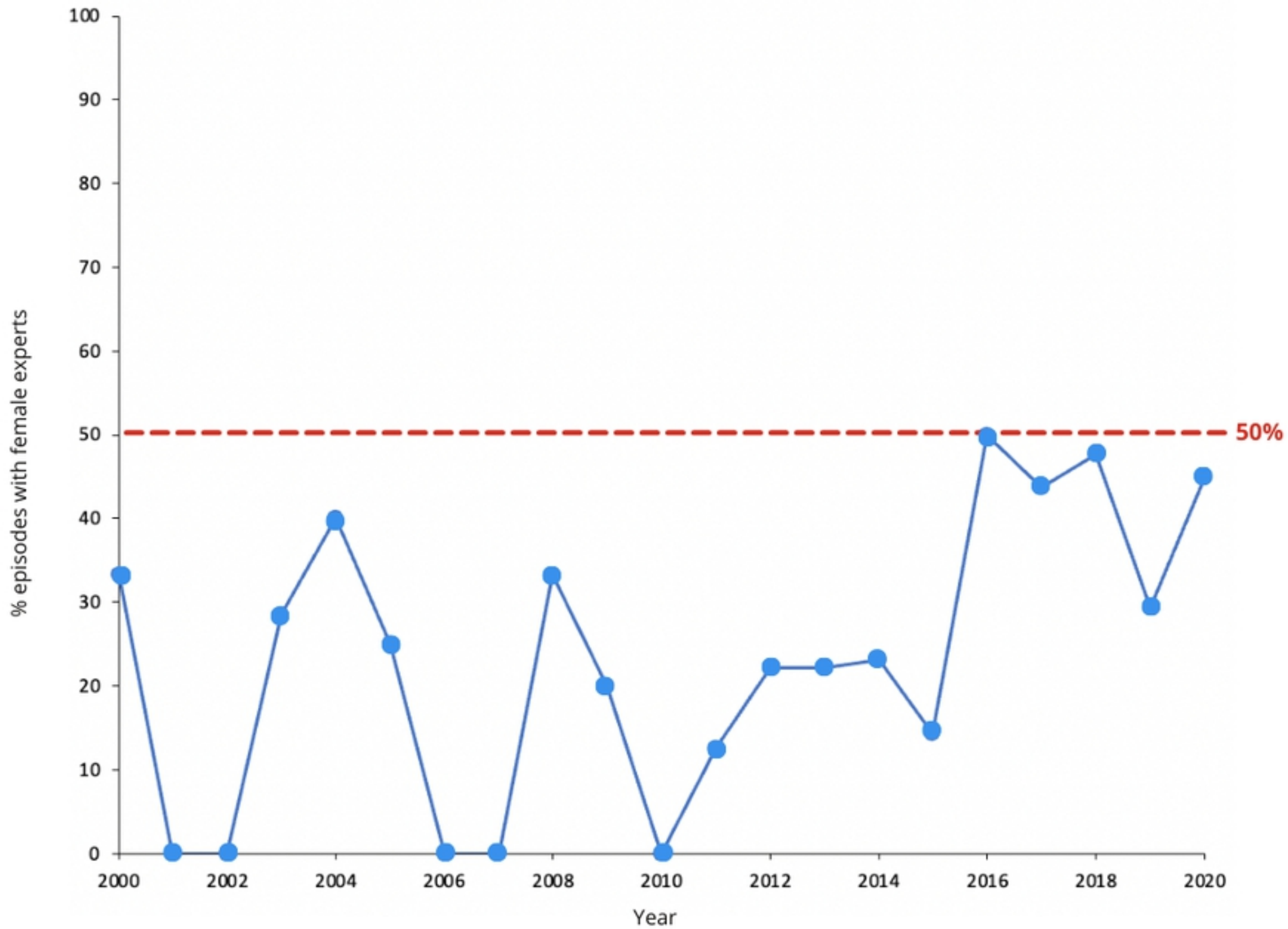


Figure 7

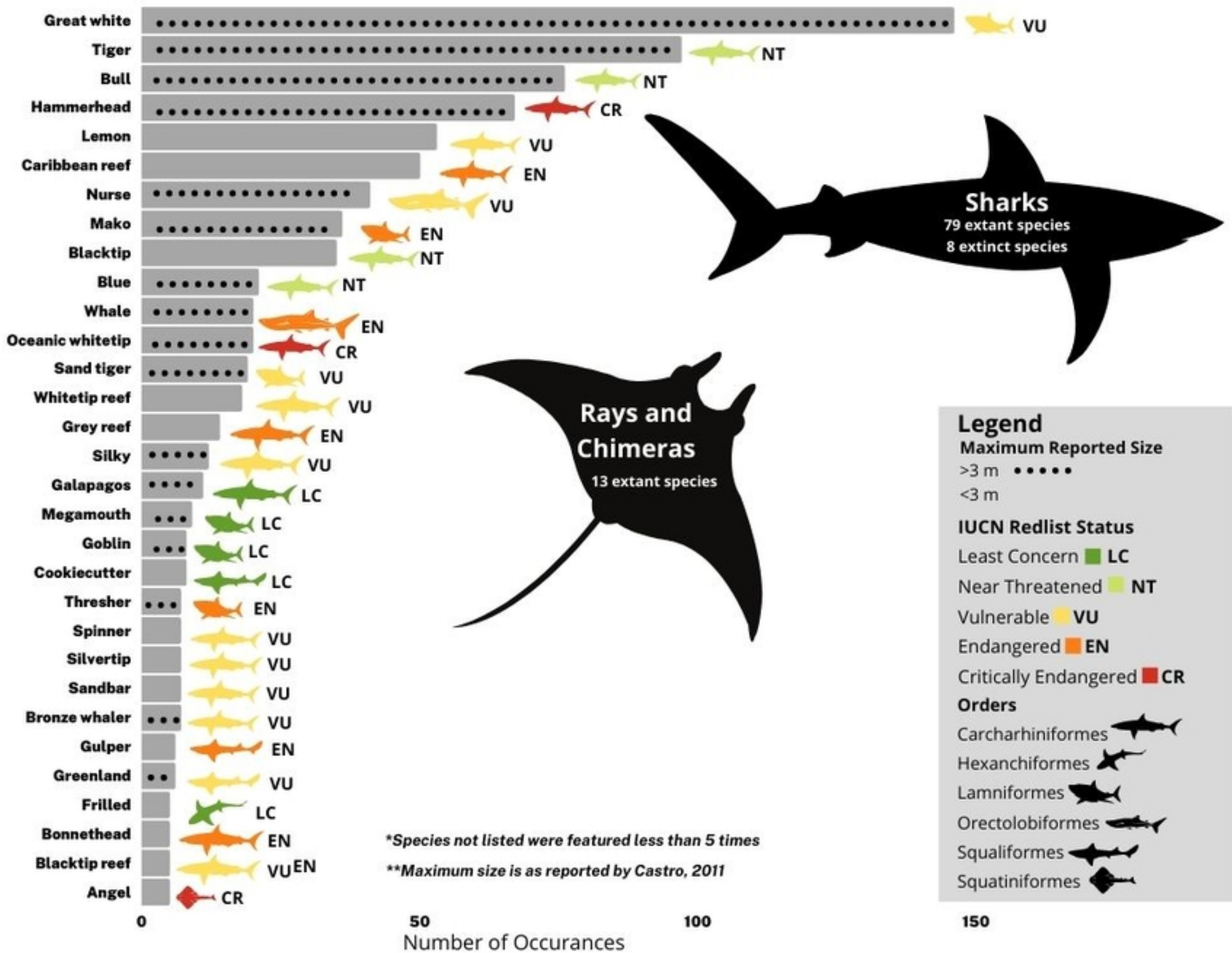


Figure 8

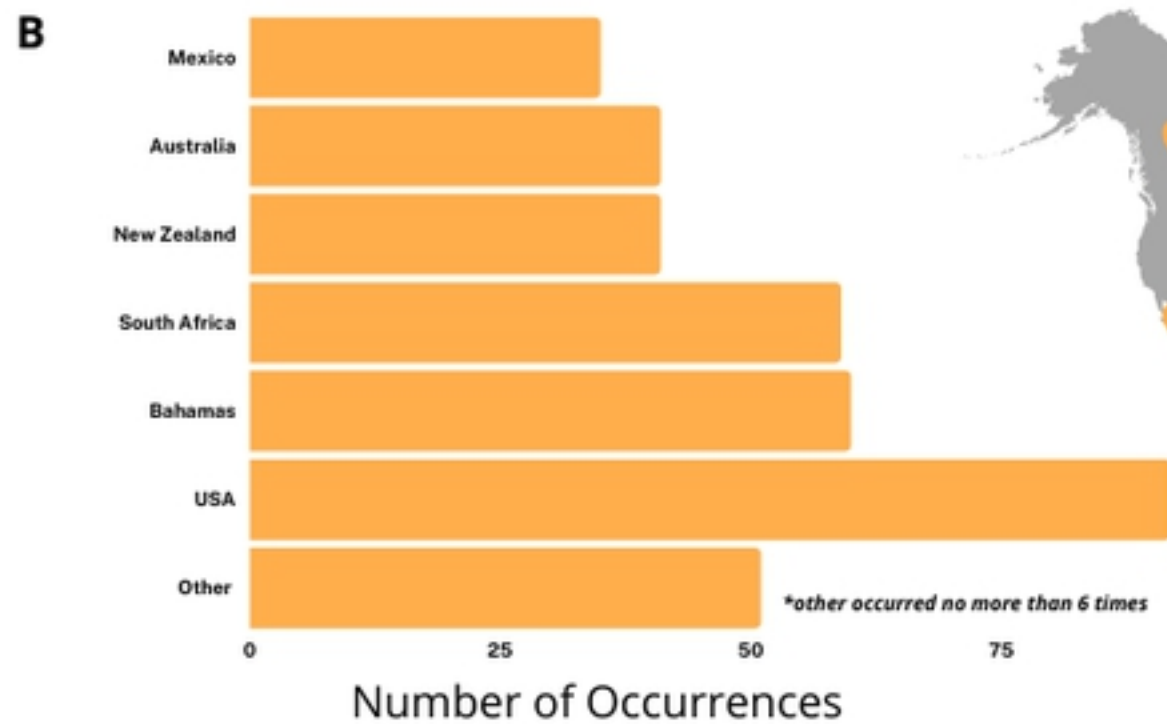
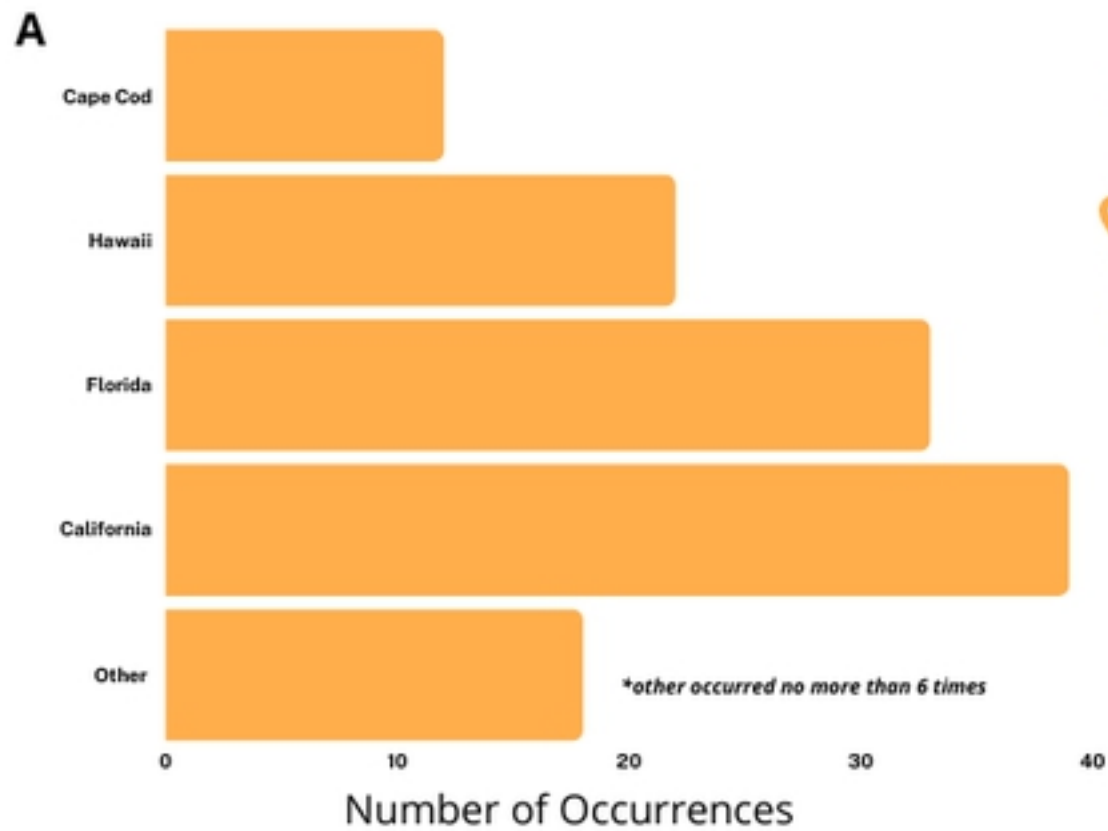


Figure 9