Public Perceptions of a Rip Current Hazard Education Program: 'Break the Grip of the Rip!'

Chris Houser[1], Sarah Trimble[2], Robert Brander[3], B. Chris Brewster[4], Greg Dusek[5] Deborah Jones[6], John Kuhn[5]

[1]Department of Earth and Environmental Sciences
University of Windsor
401 Sunset Avenue
Windsor, Ontario, Canada
N9B 3P4

[2]Department of Geography
Texas A&M University
810 O&M Building
College Station, Texas, USA
77843-3148

[3]School of Biological, Earth and Environmental Sciences
UNSW Sydney
Sydney, NSW 2052 Australia

[4]United States Lifesaving Association

[5]NOAA/National Ocean Service
Center for Operational Oceanographic Products and Services
1305 East West Highway, SSMC4 #6636
Silver Spring, MD 20910

[6]National Weather Service
Marine, Tropical, and Tsunami Services Branch

Abstract

Rip currents pose a major global beach hazard; estimates of annual rip current related deaths in the United States alone range from 35 to 100 per year. Despite increased social research into beach-goer experience, little is known about levels of rip current knowledge within the general population. This study describes results of an online survey to determine the extent of rip current knowledge across the United States, with the aim of improving and enhancing existing beach safety education material. Results suggest that the US-based "Break the Grip of the Rip"® campaign has been successful in educating the public about rip current safety directly or indirectly, with the majority of respondents able to provide an accurate description of how to escape a rip current. However, the success of the campaign is limited by discrepancies between personal observations at the beach and rip forecasts that are broadcasted for a large area and time. It was the infrequent beach user that identified the largest discrepancies between the forecast and their observations. Since infrequent beach users also do not seek out lifeguards or take the same precautions as frequent beach users, it is argued that they are also at greatest risk of being caught in a dangerous situation. Results of this study suggest a need for the national campaign to provide greater focus on locally specific and verified rip forecasts and signage in coordination with lifeguards, but not at the expense of the successful national awareness program.

KEYWORDS: Rip Current, Beach Safety, Survey, Perceived Risk

1 Introduction

Rip currents (often called "rips" or "rip tides") are strong, narrow seaward flows driven by alongshore variations in wave set-up landward of the breaker zone. Due to their dependence on wave breaking, rips can develop in any beach environment in oceanic, sea and lacustrine environments. Castelle et al. (2016) classify rips as: 1) boundary rips that develop along both natural and engineered structures including headlands, groins and piers, 2) bathymetric rips that develop in response to the variability of the nearshore morphology and 3) hydrodynamic rips that are spatial and temporally variable and develop in the absence of morphological variations or a lateral boundary. The type of rip that develops on a beach depends on the local wave climate and geology. For example, rips in the Great Lakes tend to be associated with natural headlands or the presence of large groins or harbor jetties, while rips in Florida and Texas tend to be bathymetrically controlled and associated with a transverse bar and rip nearshore morphology (Houser et al. 2013). Rips also vary regionally based on the driving forces, with rips on the Great Lakes typically associated with moderate to strong winds, while on the West Coast of the United States the rips are often associated with large swell events independent of the wind.

Rips are capable of carrying unsuspecting bathers significant distances away from the shoreline with speeds reaching over 2 m s^{-1}. As a consequence, rips are considered a major public health problem in the USA, Australia, Costa Rica, and many other countries (Klein et al., 2003; Hartmann, 2006; Sabet and Barani, 2011; Woodward et al., 2013; Arun Kumar and Prasad, 2014). Rip currents in these countries are considered a major public health problem (Short and Hogan 1994; Sherker et al., 2008; Morgan et al. 2009; Arozarena et al., 2015). In Australia, rip currents are believed to be responsible for approximately 13,000 beach rescues per year (SLSA, 2016) and an average of 21 confirmed deaths per year (Brighton et al., 2013), which exceeds

84 fatalities caused by most other natural hazards (Brander et al., 2013). While it has been estimated

85 that 30–40 individuals drown each year in rip current related incidents in the United States

86 (Gensini and Ashley 2010), Lushine (1991) suggested that rips may account for up to 150 fatal

87 drownings per year and the United States Lifesaving Association (USLA) estimate this number

88 to be over 100 per year. USLA's National Lifesaving Statistics Report (2012) indicates that over

89 82% of surf beach rescues in the US are rip current related and they therefore surmise that 82%

90 of all fatal drownings at beaches are associated with rip currents.

91   Beach users' vulnerability to drowning in a rip current depends on a combination of

92 nearshore hydrodynamic and bathymetric conditions, personal and group behaviors, and the

93 beach safety and rip current knowledge of the individual (e.g. Houser et al., 2011; Brander et al.,

94 2011; Caldwell et al., 2013; Houser et al., 2016). Morgan et al. (2009) identified that lacking rip

95 current knowledge was associated with rip current drownings, as was gender, age, alcohol

96 consumption, and overconfidence in swimming ability. Recent evidence suggests that while most

97 beach users are aware of rip currents and the hazard they pose, they are not able to identify a rip

98 current (Sherker et al., 2010; Caldwell et al., 2012; Brannstrom et al., 2014). More than 80% of

99 beach users surveyed in Florida and Texas failed to identify rip currents in photographs, usually

100 by incorrectly identifying areas of breaking waves as the most hazardous swimming conditions

101 (Brannstrom et al., 2014). This is consistent with results of Sherker et al. (2010) who argued that

102 most beach users are unable to identify a rip current and that "beachgoers clearly need to know

103 what a rip looks like to actively avoid swimming in it" (pg. 1787). Given sufficient information,

104 it is possible for beach users to identify a rip current with confidence (Hatfield et al., 2012).

105 However, the ability to identify a rip current or to recognize posted warnings about the rip

106 current danger is not a guarantee that a beach user will be safe, particularly because many will

107   still choose to swim in unsafe and unpatrolled sections of the beach, away from the presence of

108   lifeguards, for social or behavioral reasons or because of lack of awareness and/or complacency

109   (Drozdzewski et al. 2012; 2014; Williamson et al. 2012; Houser et al., 2016). Recent evidence

110   suggests that beach access management can inadvertently steer unsuspecting beach users towards

111   rip-prone areas, increasing the chances of a drowning occurring on that beach (see Barrett and

112   Houser, 2012; Houser et al., 2015; Trimble and Houser, 2017).

113   Informing the public about the rip current hazard has become a national priority in

114   several countries including the United States (e.g. Ashley and Black, 2008; Brannstrom et al.,

115   2013), Australia (e.g. Sherker et al., 2008; Brighton et al., 2013), United Kingdom (e.g.

116   Woodward et al., 2013), and Costa Rica (Aronzarena et al., 2015). The United States has

117   arguably the longest running cooperative and coordinated public rip current education program

118   operating across various organizational and political levels (Carey and Rogers, 2005). A Rip

119   Current Task Force was convened in 2003 by the National Oceanic Atmospheric Administration

120   (NOAA) and United States Lifesaving Association (USLA) to establish consistent rip current

121   education efforts and improve data sharing about rip current rescue data across the United States.

122   Subsequently, with the assistance of the National Weather Service (NWS) and Sea Grant, a

123   national "Break the Grip of the Rip!" ® education campaign was initiated in 2004. The "Break

124   the Grip of the Rip!" ® campaign aimed to educate the public about the rip current hazard by

125   providing information about what rip currents are, why they are dangerous, how to identify them,

126   what to do if caught in one, and how to help someone else if they are caught in a rip current.

127   Aspects of this information have been disseminated through various means such as the NWS Rip

128   Current Safety webpage (http://www.ripcurrents.noaa.gov/), brochures, beach signs, videos,

129   newspaper articles, and public service announcements on television.

130   While this campaign was the first of its kind globally, it was also particularly challenging

131   given that the United States has four very different coastlines (West Coast, East Coast, Gulf

132   Coast, Great Lakes) that differ in terms of wave climate and beach systems, and a large inland

133   non-coastal population who may only visit any of these coastlines infrequently. Results from

134   Brannstrom et al. (2015) suggest that while most beach users in Texas were not familiar with the

135   campaign itself, many were familiar with a key message of the campaign on "what to do" when

136   caught in a rip current. This suggests that the campaign may have been successful in educating

137   beach users and reducing the number of drownings, but this hypothesis has never been formally

138   tested.

139   The core visual image used in many of these interventions was a simple diagrammatic

140   illustration of an idealized rip current from an oblique aerial perspective (Fig. 1). In this image,

141   the rip current is characterized by relatively calm white water surrounded by more intensive

142   wave breaking adjacent to the rip and close to the shoreline. An image template was created that

143   could be accessed online and in hardcopy and duplicated freely to be posted along boardwalks,

144   beachfronts and public beach access points throughout the United States. The image has also

145   been more recently adopted in other countries such as Thailand, Costa Rica, Mexico, South

146   Korea, and Japan. While the NOAA-USLA sign was not intended to teach the general population

147   to identify a rip, the prominent image of a rip current on the sign and attempts to post the sign on

148   beaches indicate that its function and visual argument constitute an invitation to beach users to

149   use the information to identify rip currents (Brannstrom et al., 2015).

150   Due to this conflict between its' theoretical and practical use, the NOAA-USLA rip

151   current sign has proven to be mostly successful in regard to educating beachgoers on "what to

152   do" (e.g. swim parallel to the beach) when caught in a rip current, but has not been particularly

153 successful in improving beach users' ability to identify rip currents from the perspective of

154 standing or sitting on the beach (Brannstrom et al., 2015). Consistent with results of Matthews et

155 al. (2014), only a small percentage of beach users (<50%) recalled observing rip current warning

156 signs on beaches in Florida and Texas (Caldwell et al., 2012; Brannstrom et al., 2014) despite

157 their wide spread occurrence at beach access points. However, it is important to note that despite

158 observing and understanding a warning sign, it is well established that some people will not take

159 the appropriate actions to prepare for or avoid the hazard (Sietgrest and Gutscher, 2006; Karanci

160 et al., 2005; Hall and Slothower, 2009; Johannesdottir and Gisladottir, 2010).

161   In a separate initiative, the NWS has endeavored to develop a public rip current

162 forecasting system, although the methodology varies among Weather Forecast Offices (WFO).

163 Some WFOs issue surf zone forecasts that include a 3-tiered (low, moderate, high) rip current

164 outlook communicated to the public during television and radio news broadcasts (Carey and

165 Rogers, 2005) and social media platforms. Some WFOs work with local lifeguards to update

166 their outlooks based on real-time observations. However, as discussed in NOAA (2015), these

167 forecasts are not necessarily communicated or disseminated in a consistent manner throughout

168 all regions and therefore, are not communicated seamlessly. The lack of consistency in

169 forecasting is complicated by rip development being dependent on how the incident wave field

170 interacts with the pre-existing nearshore morphology, which is difficult to predict without local

171 knowledge on how it evolves over a range of spatial and temporal scales.

172   Since perception of the rip hazard depends in part on trust in experts and authorities, and

173 trust in the protective measures they employ (Njome et al., 2010; Heitz et al., 2009; Terpstra,

174 2009, 2011; Barnes, 2002), inaccuracies in the forecast or a discrepancy between the forecast and

175 what is observed at a specific beach at a specific time can erode confidence in the forecast

176 (Siegrist and Cvetkovich, 2000; Espluga et al., 2009). Lack of confidence in forecasts could

177 potentially condition beach users to downplay the hazard warning on future visits (Hall and

178 Slothower, 2009; Scolobig et al., 2012; Green et al., 1991; Mileti and O'Brien, 1993).

179 Furthermore, the generic nature of the rip current forecasts can result in situations where the

180 actual intensity of rips varies substantially from the forecast. Beachgoers could easily observe a

181 discrepancy between their beach location and the rip forecast, caused by either the generalized

182 nature of the forecast or their inability to identify a rip current (Caldwell et al., 2012; Brannstrom

183 et al., 2014, 2015).

184   The national US rip current education program is clearly an impressive effort yet many

185 rip current related fatalities and rescues still occur on US beaches and overseas (Gensini and

186 Ashley 2010) and there is little quantitative evidence available to assess the overall effectiveness

187 of the program. This is largely because no 'pre-program' study was conducted on public

188 understanding, perception, or behavior in relation to the rip current hazard. There is also a lack of

189 hard data on rip current related fatalities, beach visitation numbers and how incident frequency

190 and exposure rate may have changed over time. In this regard, NOAA sponsored a workshop in

191 2015 to review the "Break the Grip of the Rip" ® program and NWS rip current forecasts to

192 discuss whether existing messaging is scientifically sound, as well as effective and clear in

193 reaching all age groups and demographics (NOAA, 2015).

194   It was acknowledged at the NOAA workshop that while there have been several recent

195 studies to describe the extent of rip current knowledge amongst beach users (or lack thereof) on

196 specific beaches in the United States (Caldwell et al., 2013; Brannstrom et al., 2014, 2015) there

197 is insufficient understanding about beach user knowledge of rip currents and their behavior at the

198 beach at a national level. This study describes results of a national online survey focused on

199 United States based beachgoers and their understanding of, and experience with, the "Break the

200 Grip of the Rip" ® program and the rip current hazard to provide quantitative evidence to guide

201 future improvements to beach safety education material and forecasting efforts.

202
203 **2 Methodology**
204
205   The study research design relied on an internet-based survey instrument using Qualtrics

206 approved by the relevant human subject protection program from Texas A&M University. The

207 survey consisted of questions re-phrased from Sherker et al. (2010) and photograph-based rip

208 current identification protocols (Fig. 2) modified from Brannstrom et al. (2014, 2015), with

209 questions grouped into six categories (Table 1). The survey had 75 questions and took

210 approximately 20-30 minutes to complete. It remained open from May-August 2015 and all

211 answers were recorded anonymously through Qualtrics Survey Software. A copy of the survey

212 instrument is provided as an appendix to this manuscript.

213   The survey was distributed by email to cooperating organizations and individuals for

214 distribution though listservs, websites, social media and in advertisements. It was disseminated

215 via secure Internet and social media links for Texas A&M University, Sea Grant, Science of the

216 Surf, NWS, and the National Oceanic and Atmospheric Association (NOAA). While this

217 internet-based recruitment process attempted to target a much wider demographic of the US

218 population, it is also reasonable to assume that as the host websites were all beach and surf-

219 related, survey respondents likely had greater interest in, and understanding of, coastal

220 environments and hazards leading to a potential bias that was also experienced in a beach safety

221 related study by Drozdzweski et al. (2012).

222
223 **3 Results**
224

225   Between May and August 2015, a total of 2084 respondents started the online survey, but

226   only 1622 completed all questions (completion rate: 78%). Geographically, the largest number of

227   respondents were from the state of Texas (n=368) where Texas Sea Grant and the local NWS

228   office conducted significant advertisement for the survey. Large numbers of respondents also

229   came from North Carolina (n=214), California (n=184), and Florida (n=130), with most

230   remaining states having <50 respondents. Of the 50 US states, only Nebraska did not have a

231   respondent. Overall this cohort managed to capture respondents who use each of the coastlines in

232   the continental US. Respondents were evenly distributed by age (>18 years); each 10-year range

233   between 21 and 60 garnered about between 320 and 420 respondents. A slight majority of the

234   respondents were female (55%).

235

236   **3.1 Familiarity with the Break the Grip of the Rip ® Campaign**

237   Only 18% (n=304) of respondents reported hearing about the Break the Grip of the Rip ®

238   Campaign with nearly identical split by gender and age. Approximately 40% of respondents

239   reported hearing about the campaign either through a brochure/pamphlet (n=120) or at the

240   entrance to a beach (n=119), whereas 163 respondents (54%) reported hearing about the

241   campaign through various sources on the internet. 90 respondents reported having heard about

242   the campaign from the Break the Grip of the Rip ® website. When asked what Break the Grip of

243   the Rip means, most respondents (familiar with the campaign) reported (to varying degrees of

244   accuracy) that it was designed to provide information about what to do if caught in a rip current:

245   ➢ *Do not try to fight the current, instead work with the current until you can break free of its*
246   *pull*

247

248   ➢ *Advises affected swimmers not to struggle while heading shoreward but to swim parallel*
249   *to the beach till out of the off-beach current*

250

251 There were, however, several respondents (familiar with the campaign) who believed that the

252 messaging was not appropriate and needed to be rethought:

253 ➢ *The slogan is useless to anyone caught in a rip current! What can you do by knowing this*
254 *slogan? ...."Wave, Yell & Swim Parallel" is a far better slogan...it provides 3 lifesaving*
255 *pieces of information. The existing slogan provides nothing.*
256
257 ➢ *It's an advertising slogan; it doesn't mean much at all. It's a bad slogan; it does not tell*
258 *folks what to do, what to watch for, or anything useful.*
259
260 Responses from those who were not familiar with the campaign were much shorter and did not

261 contain the level about survival strategies provided by those familiar with the campaign.

262 Representative responses include "how to escape", "tips to survive", and "how to get out of a

263 rip".

264

265 **3.2 Beach Preference**

266 As presented in Fig. 3, most respondents visited the beach either once per year on

267 vacation (22%) or multiple times per year (42%). Visitation exhibits a statistically significant

268 relationship with age, with older respondents (>40) visiting the beach more often than younger

269 respondents (χ^2=46.5, ρ<0.01). Perceived wave size on beaches visited by respondents depends

270 on age and frequency of beach visitation with older respondents who visit the beach frequently

271 tending to report beaches they visited having strong waves, while younger respondents, who

272 tended to visit the beach infrequently, identified the beach as having small waves (χ^2=84,

273 ρ<0.01). In general, respondents who visit the beach infrequently tend to describe the beach as

274 having small waves and that their primary beach activity is swimming and/or wading. All

275 respondents who visit the beach frequently (weekly or daily) identified board riding as their main

276 activity and tended to frequent beaches with strong wave activity (χ^2=111, ρ<0.01), suggesting a

277 greater understanding of wave conditions. There was no statistically significant variation in wave

278   description based on home state, suggesting that perception of wave activity is largely based on

279   frequency of beach visitation and other personal characteristics. In terms of choice of beach

280   visited, wave activity and the potential hazard posed by rip currents or the absence of lifeguards

281   is less important than cleanliness and at the same level of importance as crowds (Fig. 4).

282   When determining which beach to visit, frequent beach users, who were mostly board

283   riders, tended to prefer beaches with lots of waves, whereas infrequent users emphasized safety

284   and cleanliness (χ^2=159, ρ<0.01). Frequent beach users also believed it was very important to

285   swim near a lifeguard, while infrequent users did not (χ^2=51, ρ<0.01). Across both groups,

286   however, respondents suggested they would still enter the water even if a lifeguard was not

287   present, suggesting that recognition about the importance of lifeguards is not consistent with

288   behavior in selecting where and when to swim (Fig. 5).   Frequent beach visitors were also more

289   confident in their ability to 'always' spot a rip current in contrast to infrequent beach visitors

290   (χ^2=247, ρ<0.01). Those who visit the beach less often (e.g. several times per year or month)

291   believed they could spot a rip 'sometimes' or believed it is not possible to see a rip current,

292   consistent with the response from all respondents (Fig. 6).

293
294   **3.3 Swimming Ability**
295
296   Most respondents (~52%) self-identified as competent swimmers (Fig. 7) and reported in

297   a separate question that they were capable of swimming between 25 and 100 yards (or more than

298   100 yards) without having to stop or pause in open water (χ^2=1391, ρ<0.01). Respondents who

299   self-reported as *highly* competent open water swimmers (n=213, 12%) primarily believed they

300   could swim more than 500 yards in open water without resting, while those who self-reported as

301   weak swimmers (n=566, 31%) believed that they were only capable of swimming 25 yards or

302   less. Those who identified as highly competent or weak swimmers tended to have the narrowest

303 range of self-reported ranges of swimming ability, while those who self-identified as competent

304 swimmers had the widest range of self-reported swimming distances for both pools and open

305 water.

306
307 **3.4 Ability to Identify a Rip Current**
308
309   When asked "Where on this photograph would you swim?", approximately 54% of

310 respondents correctly identified the location furthest away from the rip current in Photograph 1

311 (Figs. 2a and 8a). However, 182 (11%) respondents incorrectly selected the rip current as the

312 safest location to enter the water, with the remaining respondents identifying other areas of the

313 photograph (adjacent to the rip) as being the safest location. Results of a z-test suggest that

314 respondents who selected the rip as the safest location are significantly younger than those who

315 correctly identified the safest location in the photograph (z=12.1, $\rho<0.01$). Those who correctly

316 identified the safest location in the photograph also visited beaches more frequently (z=6.1,

317 $\rho<0.01$) and self-reported beaches they visited as having strong waves (z=6.4, $\rho<0.01$). Most

318 respondents who identified the rip as the safest location self-reported never having swimming

319 lessons (z=2.8, $\rho<0.01$) and described themselves as weak swimmers in both pools (z=3.7,

320 $\rho<0.01$) and open water (z=6.2, $\rho<0.01$). Those same respondents also self-reported that it was

321 important to swim near a lifeguard (z=5.8, $\rho<0.01$), but tended to not consider hazards before

322 going to the beach, unlike respondents who were able to correctly identify the safest spot to enter

323 the water (z=14.1, $\rho<0.01$).

324   When asked what beach features they believed to be most dangerous, respondents who

325 correctly identified the safest swimming location away from the rip were more likely to report

326 alongshore currents and rip currents as dangerous features, while those who selected the rip as

327 the safest location tended to identify jellyfish, sharks, and big waves. Respondents who

328   incorrectly selected the rip current as the safest location were also least familiar with the

329   common US beach safety flag system ($z=11.5$, $\rho<0.01$), and tended to have not heard of rip

330   currents ($z=17.3$, $\rho<0.01$). Respondents who selected the rip as the safest location did not

331   understand what was meant by a "high risk" ($z=3.2$, $\rho<0.01$) or a "low risk" ($z=7.5$, $\rho<0.01$) of

332   rip current development as broadcast by some NWS services. The same respondents also noted

333   that rip forecasts are apt to be inconsistent with the conditions they encountered on the beach, in

334   contrast to respondents who correctly identified the safest location in the photograph and noted

335   that forecasts tended to be consistent with their experience ($z=3.3$, $\rho<0.01$).

336   Approximately 25% of respondents (n=630) incorrectly identified the left side of the

337   groin (with an active rip) as the safest spot to enter the water in Photograph 2 (Figs. 2b and 8b).

338   Like the responses to Photograph 1, those respondents tended to be younger ($z=5.2$, $\rho<0.01$), go

339   to the beach infrequently ($z=7.8$, $\rho<0.01$), and self-report waves being relatively small ($z=7.3$,

340    $\rho<0.01$) and their swimming ability in open water to be relatively poor ($z=2.2$, $\rho<0.01$). These

341   respondents are also unlikely to consider hazards before going to the beach ($z=10.9$, $\rho<0.01$), are

342   unfamiliar with the common beach flag system in the United States ($z=12.5$, $\rho<0.01$), do not

343   understand the definition of a "high-risk" of rip current development ($z=4.2$, $\rho<0.01$), and

344   believe that rip forecasts are not consistent with their personal beach experiences ($z=2.8$,

345    $\rho<0.01$). Unlike responses for Photograph 1, those respondents who incorrectly identified the rip

346   as the safest location were not significantly different (at the 95% confidence level) from those

347   who correctly identified the safest location (right side of the groin) with respect to: pool

348   swimming, swimming near a lifeguard, type of water activity at the beach, knowledge of the

349   "*Break the Grip of the Rip*" ® campaign, or their perceived ability to use the sign to identify a rip

350   current.

351   A similar pattern was observed in respondent' ability to identify the safest location to

352   enter the water in Photograph 3 (Figs. 2c and 8c), with 26% of respondents incorrectly

353   identifying the rip current as the safest location. Like responses for the other photographs,

354   respondents who identified the rip as the safest location to enter the water did not visit beaches as

355   often (z=4.5, ρ<0.01), self-reported having relatively limited swimming ability in pools (z=3.1,

356   ρ<0.01) and open water (z=2.8, ρ<0.01), and did not believe it was important to swim near a

357   lifeguard (z=3.0, ρ<0.01), unlike those who correctly identified the safest location to enter the

358   water in the photograph. Respondents who selected the rip current as safe for swimming were

359   not as familiar with the flag system used in the United States (z=5.6, ρ<0.01), rip currents (z=3.9,

360   ρ<0.01), or the "*Break the Grip of the Rip*" ® campaign (z=4.4, ρ<0.01). These respondents also

361   did not understand what was meant by a "low risk" (z=2.5, ρ<0.01) and a "high risk" (z=3.4,

362   ρ<0.01) of rips. However, unlike Photographs 1 and 2, no statistically significant difference was

363   observed between those who correctly or incorrectly identified the safest spot to enter the water

364   with respect to: age, self-reported wave activity, swimming lessons, behavior in the absence of

365   lifeguards, importance of checking for hazards, or the ability to use the sign to identify a rip

366   current.

367
368 **3.5 Response to the Rip Current Warning Sign**
369
370   Only 31% of all respondents believed the NOAA rip current warning sign could be used

371   to identify a rip current. Interestingly, those respondents who incorrectly identified the rip

372   current as the safest spot on the beach to enter the water tended to believe that the NOAA rip

373   current warning sign could *not* help a beach user identify a rip current. This contrasted with those

374   who correctly identified the safest location in any of the photographs (z=5.2, ρ<0.01). When

375 asked to describe how the sign could be used to identify a rip current, some of the latter

376 respondents were able to relate the rip in the picture to a real rip:

377 ➢ *It shows that in a rip current, there appears to be a break in the water, with*
378 *water moving in a different direction.*
379
380 ➢ *It shows you the "calm" area between the two areas of normal wave activity*
381 *indicating the channel where the rip is located*
382

383 Most of these responses focused on the pattern of wave breaking and the orientation of the

384 'calmer' water to the beach. There is evidence that some respondents believed the picture to be

385 an accurate representation of a rip, but they could not provide specific detail about the real-world

386 features on the beach it depicted, for example "*Graphic depiction of what the tide looks like.*"

387 This suggests that some respondents believe the sign is accurate since it was designed and placed

388 there by an authority.

389 As previously noted, the rip current warning sign was not designed to help beach users

390 identify a rip current, but rather to inform them how to escape a rip. Most respondents could

391 clearly state what the sign was informing them about swimming parallel to the beach to escape a

392 rip:

393 ➢ *Let the current take you out and then swim parallel the shore to escape.*
394
395 ➢ *Swim parallel to the shore, or wait until the rip gets less strong further offshore.*
396

397 96% of respondents could provide a response to this question and virtually all responses

398 indicated that the sign informed them to swim parallel to shore to escape the rip current,

399 suggesting that the sign has been effective in communicating this message. When asked how

400 seeing this sign would change their behavior of the beach, a majority (65%) of respondents

401 suggested they would take precaution when entering the water:

> *Might avoid going in water if I see surface signs of rip activity and drive to another beach*

> *Consider not going in. Look carefully for signs of rips. Look for flags and lifeguards*

This suggests that while most respondents understood that the sign provided them with information on how to escape a rip current, it also helped with prevention as most respondents also noted that they would take precaution or use it to spot (and presumably avoid) a rip, rather than focus on escape strategies.

Most respondents (86%) provided ideas on how to improve the rip current warning sign, with more than half suggesting the sign needed to provide a more accurate depiction and/or description of a rip current:

> *I don't think it clearly identifies it enough that the waves will not break where a rip current is. It is great because it shows how to get out of one but I think with another picture of an actual rip current people would identify them easier.*

> *Pictures showing what actual rip currents look like would be useful. / Most casual beachgoers are not confident that they could identify a rip current from shore or predict where one might be forming.*

> *There needs to be more info on how to detect, recognize and avoid a rip current. Information on conditions during which rip currents are most likely to form would also be useful.*

A small number of respondents (<10%) suggested that the sign should either include step-by-step instructions on what to do and/or provide more information about the experience of being caught in a rip current:

> *Multiple steps: / 1. Know when you're in a rip / 2. Stay calm and tread water / 3. Wait until you've floated out to a slower moving water. / 4. Swim sideways*

437   ➢   *Specific instructions on what one should do if caught in a rip current - Should I*
438   *swim left, right, straight? What if I'm not a strong swimmer? What are some*
439   *other exit options?*

440
441 Another group of respondents (~15%) either did not provide suggestions on how the sign can be

442 improved or noted that it only needed minor edits, including space for local emergency numbers

443 and contacts. A small number of respondents (<5%) believed that the sign should include

444 statements that elicit fear amongst beach users including statements such as "Rip currents can

445 drown you."

446
447 **3.6 Prevention**
448
449 One in four (25%) respondents reported they had been previously caught in a rip current by

450 accident, while 10% of respondents reported that they had purposely entered a rip for surfing.

451 When asked how to escape a rip, those who had accidently been caught in a rip current provided

452 relatively detailed responses that either described escape by swimming parallel or riding the

453 current without panic:

454
455   ➢   *Let it flow. Don't fight it. Perhaps as long as you minimize tiring exertions try*
456   *to flow towards the side of the current. Basically do the same thing you'd do if*
457   *you fell in a strong river about to empty into a lake. You certainly wouldn't kill*
458   *yourself trying to swim out upstream.*
459
460   ➢   *Don't panic!!! Either swim - without too much exertion - parallel to the beach*
461   *for 25+ yards, OR tread water and allow yourself to be carried out until the rip*
462   *loses power, then swim parallel to the beach. Once out of the rip, swim back*
463   *towards shore (again in a relaxed manner, taking time to prevent exhaustion).*
464   *When nearing the beach, take care not to get drawn back into the rip by water*
465   *flow parallel to the shoreline.*
466
467 Of those who had not been previously been in a rip 7% (n=36) did not provide a description of

468 how to escape. The remaining respondents provided relatively short responses that described

469 escape through combinations of swimming parallel and relaxation

470   Assuming no response is an indication of a lack of knowledge about rips, the number of

471   respondents who did not provide an accurate description of how to escape a rip current is ~9%,

472   suggesting that overall the campaign has been successful in informing beach users to: 1) not fight

473   the current; 2) swim out of the current, then to shore; 3) if you can't escape, float or tread water;

474   and 4) if you need help, call or wave for assistance.

475
476   **3.7 Forecasts**
477
478   Respondents were also asked about whether they were aware of rip forecasts, if forecasts

479   altered their behavior, and if the forecasts conformed with their observations at the beach. Since

480   existing rip forecasts are not consistent and few are based on an understanding of pre-existing

481   morphology, the focus here was not on the actual accuracy of the forecast, but on whether the

482   respondent believed the message to be consistent with their observations. About half of

483   respondents (52%) reported seeking information about beach and surf conditions before going to

484   a beach with the majority (83%) using the internet to find that information. A large majority

485   (88%) of respondents stated that information about beach and surf conditions affected their

486   behavior, with many saying that they would either "not go" (to the beach), "not go in the water",

487   or "look for rips". When asked whether the rip current forecast (either high or low) was

488   consistent with conditions they experienced at the beach, approximately 67% of respondents

489   stated that the forecasts were not necessarily consistent with their observations. For some, this

490   inconsistency reflected the temporal and spatial broadness of the rip forecast compared to what

491   they observed:

492
493   ➢ *Weather changed quickly and no beach flags were posted, advising of rip*
494   *currents.*
495

496   ➤ *Rip currents cannot be predicted for individual beaches, they are blanket*
497   *warnings.*
498

499 Other respondents noted the forecast was inaccurate because other beach users had not adjusted

500 their behavior:

501

502   ➤ *I never noticed an[y] thing unusual and people in general don't seem to adjust*
503   *their behavior.*

504

505

506 Others noted it was not possible to determine if the forecast was accurate because they were not

507 able to spot a rip on the beach at that specific time or in general:

508   ➤ *I couldn't determine if/where rip tide activity might be in the water if the*
509   *forecasts had warned beach-goers to be aware of a high risk on that day.*

510

511 In several cases (n=59), respondents noted they had not heard a forecast warning of the rip

512 hazard on a given day or in general through responses such as "*I don't know if I've ever heard a*

513 *rip current forecast?*"

514   Additional questions about high-risk rip conditions solicited written responses that

515 suggest many respondents understood the high-risk warning to mean that wind and wave activity

516 are tantamount to the development of rips:

517

518   ➤ *Due to tides, weather, etc., there is a much greater risk for rip currents in the*
519   *ocean.*

520

521 There was a mix of responses in which respondents believed that 'high risk' meant that rips

522 would form or that there was a greater chance of rip formation. Others (n=102) believed that the

523 use of the terms high and low risk were misleading:

524

525   ➤ *Whenever or wherever there are waves there can be rip currents, so I am not*
526   *sure what 'high' or 'low' risk of rip currents means. All rips are potentially*
527   *dangerous.*

528

529   In response to the definition of low risk, respondents tended to suggest this implied that rips were

530   unlikely or would not form:

531   ➢ *Rip currents may still exist but are weaker or fewer than normal.*
532

533   ➢ *Conditions are not conducive to rip currents.*
534

535   ➢ *The factors necessary for rip currents to form are absent- not likely to encounter rip.*
536

537   Of note, whether a respondent described high and low risk of rips as a probability (likely,

538   unlikely) or in absolute terms (is or is not present) is not related to whether the respondent noted

539   that the rip forecast was consistent with their observations at the beach. For both high and low-

540   risk, some respondents believed that the forecast (by radio, internet, etc.) was not based on the

541   predicted weather, but rather on whether a rip had been sited on a beach or not with statements

542   such as: *"Not Sighted"* or *"Strong rips observed."* Others (n=129) believed that high and low

543   risk was associated with the local bathymetry being conducive to the formation of rips: *"the*

544   *topography/bathymetry is suited to rip currents."*

545

3.8 Trusted Sources of Information
547

548   Respondents were also asked to rank sources of information about rip currents from (1)

549   most trusted to (5) least trusted. Except for social media (including Facebook, Twitter, etc.), all

550   sources of information were nearly equally ranked from most to least trusted with no discernable

551   pattern. Only social media exhibited a discernable pattern, with more than 35% of respondents

552   identifying it as the least trusted source, although 18% of respondents also identified it as the

553   most trusted. More respondents identified internet sources as the most trusted compared to other

554   sources, while television and radio were identified as trusted (rank 2 and 3), but not the most

555   trusted. No significant correlations were observed between trust in a source of information and

556   respondent demographics, suggesting that a broad communication strategy is the most effective

557   to reach the widest audience.

558
559   **4 Discussion**
560
561   The primary results of this US-based rip current survey are summarised in Table 2.

562   Results suggest that while many are not aware of the "Break the Grip of the Rip" ® campaign,

563   the US beach-going public is informed about rip current safety. While this is an encouraging

564   result, it needs to be placed in context. The goal of this study was to examine United States based

565   beachgoers understanding of, and experience with, the national "Break the Grip of the Rip" ®

566   program and the rip current hazard to provide quantitative evidence for improving the program.

567   Despite the dissemination of the online survey leading to a potentially biased cohort (Section 2)

568   that was dominated by respondents who were relatively frequent beachgoers, self-rated as

569   competent swimmers, and could successfully identify the safest location to enter the water based

570   on photographs, approximately 10% of survey respondents were infrequent beachgoers, poor

571   swimmers and largely ignorant of the rip current hazard and more liable to make poor swim

572   location choices.

573   When taking the entire US beachgoing population into account, this cohort represents a

574   significant population of potential 'at risk' beachgoers. Given that this population was a key

575   target of the "Break the Grip of the Rip" ® campaign, it is therefore of considerable concern that

576   this cohort: i) tended to select the rip current as the safest location to enter the water on each of

577   the survey photographs; ii) did not consider hazards before going to the beach; iii) were not

578   familiar with the beach flag system in the United States; and iv) did not seek out lifeguards when

579   visiting a beach. These results clearly highlight how at risk infrequent beach users still are

580   despite the decadal existence and ongoing presence of the campaign.

581   In contrast, survey respondents who were frequent beachgoers and had previous

582   experience with rip currents had a better understanding of what rip currents were, the danger

583   they represent and how to escape from a rip. As described by Brannstrom and Houser (2015),

584   those who get caught in a rip current "*understand the dangers of rips first hand and…. realize*

585   *[they] never want to be caught in that situation or accident [again].*" Similar results were found

586   in studies involving surveys of people who had been caught in rip currents in Australia

587   (Drozdzewski et al., 2012; 2015). Those with indirect or no experience tend to underestimate the

588   danger compared to those with direct experience (Ruin et al., 2007).

589   It is also interesting to note that while many survey respondents were not familiar with

590   the "*Break the Grip of the Rip*" ® campaign itself, a clear majority (~91%) understood the

591   primary message of the campaign and were able to provide an accurate explanation of the

592   message (i.e. "break the grip"). Respondents previously familiar with the campaign provided

593   detailed explanations of how to escape a rip by swimming parallel and/or floating until the

594   current weakened, indicating they may also have gained this knowledge from other sources.

595   Survey results also suggest that other factors can influence behavioral response in relation

596   to the rip current hazard. For example, as noted by several survey respondents, if everyone else

597   at the beach is entering the water and not heeding an existing rip current warning (out of

598   ignorance or purposeful neglect) there is a chance that the beach user may become complacent

599   and also enter the water despite understanding the risk. This suggests that decisions can be made

600   based on what other beach users are doing rather than rip forecasts (Lapinski et al., 2014). The

601   tendency to follow the behavior of others may be enhanced when someone goes together as part

602   of a group and enters the water because everyone is willfully ignoring the risk or is ignorant to

603   the severity of the risk (see Mollen et al., 2012; Aronzarena et al., 2015). A regional forecast or

604   global warning will not necessarily deter beach user behavior as much as direct intervention by

605   lifeguards.

606   This study has also revealed some important issues with existing rip forecasting methods

607   and resultant warnings (Table 2). Approximately 67% of all respondents stated that rip current

608   forecasts are not necessarily consistent with what they observe on the beach. Consistent with

609   previous studies on natural hazards, those who have not experienced a predicted hazard or did

610   not experience personal damage during a visit to the beach are more likely to downplay the

611   danger the next time they visit (Hall and Slothower, 2009; Scolobig et al., 2012; Green et al.,

612   1991; Mileti and O'Brien, 1993). Any inconsistency between a rip forecast and direct

613   observations therefore has the potential for some beach users to downplay the rip current risk on

614   future beach visits. While forecast methodology varies by WFO, most rip forecasts do not

615   consider bathymetry, local topography, or hard structures that may force rips over a range of

616   wind wave conditions. It is also not clear how many forecasts are based on the actual presence of

617   rips observed by lifeguards.

618   The key problem is that rip forecasts tend to be generalized for a large region and time,

619   whereas actual rip development and flow behavior is extremely variable over space and time

620   (Castelle et al., 2016). It is also difficult to predict the potential for rip development without an

621   understanding of the pre-existing nearshore morphology, which itself is difficult to measure

622   directly, remotely or through numerical modelling. A static daily regional rip warning may

623   therefore fail to replicate different rip conditions that occur during that day. For beachgoers, this

624   can lead to a different interpretation of the forecast accuracy and may potentially lead to

625   downplaying the actual risk (see Brilly and Polic, 2005). Mileti and O'Brien (1993, p 40)

626   describe this reasoning as "*The first impact did not affect me negatively, therefore, subsequent*

627 *impacts will also avoid me."* At the same time, beach users will not be able to conceptualize

628 events that have never occurred or to see future trips to the beach as anything more than a mirror

629 of past visits or experiences (Kates, 1962; Tversky and Kahneman, 1973). If the rip forecast and

630 warnings are inaccurate or perceived to be inaccurate by the beach user, there may also be a

631 potential loss of trust in that authority (Espluga et al., 2009) and future forecasts.

632   It can be assumed that beach users who rely heavily on rip forecasts and assume they are

633 accurate might use them to calibrate their own observations and experiences, which will impact

634 their future forecast expectations. If a low rip risk forecast is issued and the rips are prevalent and

635 strong, then beach users may lose faith in forecast accuracy. Similarly, if a high rip risk forecast

636 is issued and no rips are observed with relatively calm conditions, then beach users may become

637 complacent about the hazard and discount or ignore future forecasts in the future. However,

638 results of this study suggest that given time and experience at the beach over a range of

639 conditions, beach users can develop a nuanced understanding of the forecast and gain greater

640 confidence that it is appropriate. Rip forecast inaccuracies appear to be most problematic for

641 infrequent beach users who also do not appear to seek out lifeguards and are unable to spot rips

642 correctly.

643   Most respondents could clearly state what the standardized rip current sign was informing

644 them to do in terms of swimming parallel to the beach to escape the rip, but many identified a

645 need to provide information that would allow beach users to identify a rip current in general (e.g.

646 "*Pictures showing what actual rip currents look like would be useful*") or specific to the local

647 beach (e.g. "*Picture of rip at actual beach [the sign] is placed on*"). However, evidence from

648 beach surveys in Florida and Texas suggest that beach users are not able to accurately identify a

649 rip current (Caldwell et al., 2012; Brannstrom et al., 2014), although there may be ways in which

650 the sign can be made more accurate through small revisions to the perspective, colors, and beach

651 morphology (Brannstrom et al., 2015). While local information may improve the accuracy and

652 interpretation of the sign, there is the potential for different signs and messaging being used (of

653 varying quality and detail), leading to confusion and misinterpretation by beach users. A more

654 appropriate strategy may be to take a more local-approach to risk and emergency management

655 including local emergency contact information. This approach places greater authority in local

656 managers and emergency responders, without resulting in different signs.

657   A local approach also includes putting greater emphasis on the expertise of lifeguards to

658 prevent accidents and respond to emergencies promptly and properly. This would also partially

659 consider the fact that there are different types of rip currents and associated behavior in different

660 geographic locations and regions (Castelle et al., 2016). Of note, Surf Life Saving Australia has

661 recently adopted a 'combined approach' to promoting how to escape a rip current (Bradstreet et

662 al., 2014). This decision was largely based on field tests of rip escape strategies (McCarroll et al.,

663 2014; Van Leeuwen et al., 2016), which clearly showed that natural variance in rip flow behavior

664 influences effectiveness of different rip escape strategy strategies. This has also been illustrated

665 by recent numerical modelling studies (McCarroll et al., 2016; Castelle et al., 2016). However,

666 communicating such a complex and mixed message is problematic. In contrast, concepts of rip

667 avoidance instruction are consistent and simpler to explain, making them more suitable for

668 advertising campaigns and signage (Bradstreet et al. 2014).

669   While there is still insufficient evidence to suggest that present warning systems help

670 people avoid and escape rip currents (see also Lapinski et al., 2014), there is evidence that

671 lifeguards are effective at preventing drowning death through preventive actions and rescues.

672 With proper training and experience a lifeguard can provide invaluable local understanding of

673   the rip hazard to provide effective mitigation. Unfortunately, there is no consensus amongst

674   beach users that it is safe (or not) to swim in the surf after lifeguards are off duty (Petrass and

675   Blitvich, 2014), despite evidence that it is safer to swim in the presence of a lifeguard. In this

676   respect, greater focus should be placed on reminding beach users to swim near lifeguards and

677   only at times that lifeguards are present because "the chances of drowning at a beach protected

678   by lifeguards trained under USLA standards is less than one in 18 million" (Branche et al. 2001).

679

680 **5 Conclusions**

681

682   A survey about the extent of public rip current knowledge in the United States was

683   conducted with the aim of establishing a dataset that provides guidance for the improvement and

684   enhancement of existing beach safety interventions. Results suggest that the US-based "Break

685   the Grip of the Rip" ® campaign has been successful in helping inform the public about rip

686   current safety. Although few respondents were familiar with the campaign itself, most

687   respondents could provide an accurate description of how to escape a rip current by swimming

688   parallel and/or floating until the current weakened. Results suggest that the most at-risk

689   population are infrequent beach users because they do not seek out lifeguards, do not take the

690   same precautions as frequent beach users, and believe there are large discrepancies between rip

691   forecasts and their own observations at the beach. Survey results provide a conservative estimate

692   of 10% of US beachgoers being at risk of being caught in a rip due to ignorance and/or poor

693   swimming choices. Future education efforts should attempt to target this beachgoing

694   demographic group. Knowledge of rips, visual ability to accurately identify a safe swimming

695   location in where rip currents are present, and ability to interpret rip forecasts are each dependent

696   on prior experience with rips and the frequency of beach visitation. In addition to concerns

697   about the spatial and temporal accuracy of public rip forecasts, many respondents identified a

698   lack of local detail in the rip current warning sign as a concern, with more than half of

699   respondents suggesting the sign needed to provide a more accurate depiction and/or description

700   of a rip current and local emergency information. This suggests a need for greater focus on

701   locally specific and verified rip forecasts and signage in coordination with lifeguards, but not at

702   the expense of the successful "Break the Grip of the Rip" ® campaign.

703

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Tables

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Table 1. Question groups used to elicit responses from respondents notified about the survey by various agencies in the United States.

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Group	Focus of Questions	Example topics
1	Informed Consent	
2	Non-identifying personal information	ZIP code, age, ethnicity, and beach use
3	Swimming behavior	Self-assessed swimming ability
4	Beach behavior and beach safety information	Frequency of visits; perceived risks at the beach
5	Rip identification and knowledge	Description of a rip current; ability to identify rip current in a photograph
6	Memorability, conspicuity, comprehension, priming	Source of rip information; memory of observing rip safety warnings
7	Rip current sign knowledge and understanding	Understanding rip current warning sign and warnings

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897 **Table 2.** Summary of major findings from the "Break the Grip of the Rip!" ® National Rip
898 Current Survey.
899

Focus of Questions	Example topics
Beach Preference	• Frequency and purpose of visits to a beach affect perception of surf conditions, importance of swimming near a lifeguard and self-reported ability to spot a rip current
Swimming Ability	• Range of self-reported swimming ability (distance in open water) related to self-reported competency
Ability to Identify a Rip Current	• Ability to identify safest location in a photograph related to frequency of beach visits, self-reported swimming competency and training • Ability to identify safest location related to perceived importance of and concern about surf hazards, self-reported understanding of "high" and "low" risk conditions, and perceived accuracy of rip forecasts
Response to Warning Sign	• Perceived ability to use sign to identify a rip current varied with ability to identify safest location on a photograph • Sign has been effective in communicating swimming parallel as an escape strategy, and taking caution when entering the water • Identified need to provide a more accurate depiction of a rip current, detailed instructions on how to escape a rip current, and local emergency information
Prevention	• "Break the Grip of the Rip" ® Campaign has been successful in informing beach users to: 1) not fight the current, 2) swim out of the current, then to shore, 3) if you can't escape, float or tread water, and 4) if you need help, call or wave for assistance
Forecasts	• Self-reported change in behavior based on forecasted beach and surf conditions, but tendency for forecasts to be inconsistent with observations • Perceived inaccuracy of forecast related to spatial and temporal broadness of forecast, inability to identify a rip, and behavior of other beach users
Trusted Sources of Information	• No significant correlations were observed between trust in a source of information and respondent demographics

900   **Figures**
901
902   **Fig. 1.** Rip current warning sign developed by the United States Rip Current Task Force as part
903   of the "Break the Grip of the Rip!" ® education campaign.
904
905   **Fig. 2.** Photographs used in Questions 42 through 44 of the survey to ask respondents "Where
906   on this photograph would you swim?". The location of the rip current in each photograph is
907   shown by the red arrow, which was not visible to the respondents.
908
909   **Fig. 3.** Percent of self-reported beach visitation by respondents.
910
911   **Fig. 4.** Relative importance of beach and surf factors to respondents when selecting a beach.
912   Note that respondents were asked to identify all factors that applied.
913
914   **Fig. 5.** Self-reported tendency to enter the water in the absence of a lifeguard on a beach.
915
916   **Fig. 6.** Percent of respondents' belief that rip currents can be seen by beach users.
917
918   **Fig. 7.** Percent of self-reported swimming ability in a pool and in open water with waves.
919   `
920   **Fig. 8.** Identified location of safest location to enter the water in the photographs presented in
921   Question 42 through 44 and also presented in Figure 2. Warm (red) colors indicate large
922   number of responses, while cold (blue) colors indicate few responses. No color (background
923   picture) represents areas that received no responses.
924

925 **Appendix**

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927 Survey Instrument

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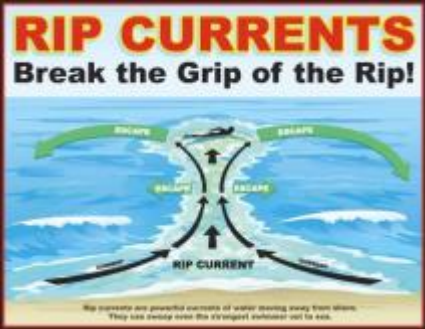
Question	Response
Are you a resident of the United States?	Yes/No
If resident- in what state do you currently reside?	List of US States
If resident- What is your zip code?	Open response
If not resident- In which country do you reside?	List of Countries
Which best describes your gender?	Male/Female/No respose
What is your Age?	• 18-20 years • 21-30 years • 31-40 years • 41-50 years • 51-60 years • 61-64 years • 65 years and over
Which statement about beach visitation best describes your experience?	• Infrequently (fewer than 10 times in my life) • Once every year typically on vacation • I go multiple times per year • Several times per month • Frequently (weekly or daily)
How would you describe the beaches that you commonly visit?	• Calm with small to no waves • Occasional wave activity, primarily during storms • Regular wave activity but typically small or medium sized waves • Strong waves are common
What is the main type of activity you do when you go to the beach?	• Swimming and wading • Board riding (including surfboard, boogie board, stand up, etc.) • Beach activities only (sunbathing, shell collecting, etc.) • Snorkeling or diving • Other
If Other selected- describe what you tend to do at the beach.	Open Response
Have you ever had swimming lessons or training, either in a pool or ocean?	Yes/No
How would you rate your pool swimming	• unable to swim

ability?	• weak swimmer • competent swimmer • highly competent swimmer
How far do you think you can swim in a pool before you have to stop/pause?	• I can't swim • Less than 25 yards (one length of a typical community swimming pool) • More that 25 yards but less than 100 yards • More than 100 yards but less than 500 yards • More than 500 yards
How would you rate your swimming ability in open water with waves (like an ocean or lake)?	• I have never swum in water with lots of waves • Weak swimmer • Competent swimmer • Highly competent swimmer
How far do you think you can swim in open water with waves before you have to stop/pause?	• Less than 25 yards • More than 25 yards but less than 100 yards • More than 100 yards but less than 500 yards • More than 500 yards • I can't swim
Have you ever swum in an open ocean or lake with lots of wave breaking?	• Yes • No • Unsure
What is the most important factor for you when choosing an ocean or lake beach to visit, with the intention of going into the water?	• Safety (are not prone to theft, etc.) • Safety in the water (avoid dangerous water hazards) • Lifeguard presence • Cleanliness of the beach and water • Crowds (prefer to be on a popular beach) • Crowds (prefer to be on a secluded, private or empty beach) • Ease of access • Avoid lots of breaking waves (i.e., prefer calm conditions) • Prefer lots of breaking waves • Other
You answered "other" to the previous questions. Please describe the most important factor for you when choosing an ocean or lake beach to visit:	• Open Response
When you go to the beach, how important is it to you to swim near a lifeguard?	• Not important • Important

	• Very important
If you visit a beach with no lifeguards, do you still go into the water to wade, swim or float?	• Always • Most of the Time • Sometimes • Rarely • Never
Do you think about or check for hazards when you go to the beach?	• Always • Most of the Time • Sometimes • Rarely • Never
What do you think is the most dangerous hazard when you swim, wade or float at the beach?	• Jellyfish • Sharks • Big waves • Shorebreaks • Undertow • Alongshore currents • Rip currents • Surfboards/boogie boards/other swimmers • Sunburn • Other
You answered "other" to the previous question. Please identify what you think is the most dangerous hazard at the beach.	Open Response
Have you ever seen or heard information about beach hazards. Please select all that apply.	• Never • Yes, in primary school • Yes, in high school • Yes, at university/college • Yes, from my parents • Yes, through pamphlets and brochures • Yes, through warning signs on the beach • Yes, on the internet • Yes, on television • Yes, on the radio • Yes, at my rental property in the guide material • Other

You answered "other' to the previous question. Please describe where you have heard about beach hazards.	Open Response
Are you familiar with any beach safety flag system in the United States?	Yes/No
You answered "yes" to the previous question. Can you describe what you know about the beach safety flag system in the United States?	Open Response
Have you heard of rip currents?	• Yes • No
Can you describe a rip current?	• Open Response
Where have you learned/heard about rip currents? Select all that apply.	• I have never heard of a rip current • Television • Magazine/book • Radio • Primary school • High school • College/University • Parents • Pamphlets and/or brochures • Internet • Beach signs • Lifeguard • I have been caught in one (direct experience) • Other
You answered "other" to the previous question. Please tell us where you have heard about rip currents.	Open Response
If you were at a beach, would you know how to spot a rip current?	• Yes, always • Yes, sometimes • No • You can't see a rip current • Unsure
You answered "yes" to the previous question. Can you describe what a rip current looks like?	Open Response

Where on this photograph would you feel most safe to enter the water? Click on the picture at the spot along the beach that you believe is the safest.	
Where on this photograph would you feel most safe to enter the water? Click on the picture at the spot along the beach that you believe is the safest.	
Where on this photograph would you feel most safe to enter the water? Click on the picture at the spot along the beach that you believe is the safest.	
Explain what you should do if caught in a rip current?	Open Response
Have you ever been caught in a rip current?	• Yes, I was caught in a rip by accident • Yes, I used the rip on purpose (e.g., for surfing) • No • Not sure
You answered that you had been caught in a rip current. Where (ie. what beach) were you caught in a rip current?	Open Response
You answered that you were caught in a rip current by accident. How did you get out of the rip current the first time this happened to you?	• Self-escaped by swimming parallel to the beach first, then back to the beach • Self-escaped by swimming straight back to the beach • Self-escaped by just floating • Rescued by lifeguard • Rescued by bystander (e.g. family, friend, stranger, surfer)

	• Don't know/can't remember
Before going to the beach, do you get information on the beach and surf conditions for the day?	• Yes • No
You answered "yes" to the previous question. What source do you use to get information on the beach and surf conditions for the day? Select all that apply.	• Radio • Television • Internet • Facebook or other social media • Acquaintance • Other
You answered "other" to the previous question. Please explain the other source of information about beach and surf conditions that you use.	Open Response
Does this information tend to affect your behavior when you go to the beach?	• It doesn't affect my behavior • It affects my behavior
Please explain how it affects your behavior at the beach.	Open Response
Rank the following sources of information from "most trusted" (1) to "least trusted" (5).	_______ Radio _______ Television _______ Internet _______ Facebook or other social media _______ Acquaintance
Please explain why you trust one source of information more than another.	Open Response

Have you ever seen beach safety information at the entrance to, or on beaches, that you have visited?	• Yes • No
What type of beach safety information do you remember seeing?	• signs/posters • flags • pamphlets/brochures • other
You answered "other" to the previous question. Please explain the type of beach safety information that you tend to see at the entrance to the beach.	Open Response
Where do you tend to see the beach safety information?	• At the entrance to the beach • On the beach • Both on the beach and at the entrance to the beach
What is the primary message of the safety information that you tend to see?	Open Response
Have you ever heard of the national United States rip current education campaign called "Break the Grip of the Rip"©?	• Yes • No
You answered "yes" to the previous question. Please tell us where you heard or have seen information related to the "Break the Grip of the Rip"© campaign. Select all that apply	• Radio • Television • Newspaper • Magazine/book • Local magazine or newspaper during my stay • Brochure/pamphlet • At my rental property here • Primary school • High school • College/University • Parents • Internet • "Break the Grip of the Rip"© website • Youtube or other internet video site • Facebook • Twitter • Other social media • Signs at the entrance to a beach

	• Signs on the beach • Lifeguards • Other
What do you think "Break the Grip of the Rip"© means?	Open Response
What does this sign tell you to do if caught in a rip current? 	Open Response
If you see this sign at a beach, how would it change your behavior at the beach?	• Yes • No
Does this sign help you identify a rip current?	Open Response
You answered "yes" to the previous question. How does it help you identify a rip current?	Open Response
What other information would be useful to be included in the "Break the Grip of the Rip"© sign?	Open Response
Have you ever seen or heard rip current forecasts from the following sources? Select all that apply.	• Radio • Newspaper • Television • Internet • Social media • No
Do you understand what it means if there is a "high risk" for rip currents?	• Yes • No
You answered "yes" to the previous question. What does a high risk of rip currents mean?	Open Response
Do you understand what it means if there is a "low risk" for rip currents?	• Yes

	• No
You answered "yes" to the previous question. What does a low risk of rip currents mean?	Open Response
Do you adjust your activities at the beach based on the rip forecast?	Open Response
If you heard a rip current forecast (e.g. low risk or high risk) and went to the beach on the same day, did the forecast match the conditions that you encountered at the beach?	• Yes • No
You answered "no" to the previous question. How did the conditions that you encountered differ from the conditions that you experienced at the beach?	Open Response

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