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Ability of beach users to identify rip currents at Pensacola Beach, Florida

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Abstract Quasi-permanent rip current hot spots at Pensacola Beach, Florida, pose a significant hazard to beach users, largely because the hot spots are located at or close to the primary access points. While an increase in the number of lifeguards has led to a decrease in the number of drownings since 2004, the number of rescues and contacts has increased to over a 30,000 year. Despite warning signs at access points along the beach, it is not clear whether beach users are able to identify a rip channel or an active rip current. To assess beach users' knowledge of rip currents and their ability to identify rip channels and currents, 97 surveys were conducted between June and September of 2010 at Pensacola Beach. Beach users were asked to identify rip channels in oblique photographs taken on green, yellow and red flag days when the potential for rip currents is low, medium and high, respectively. A majority of participants suggested that they could identify a rip channel or current (if present), but less than 20 % of beach users were able to identify the rip channels and currents. The majority of participants identified heavy surf areas as the location of the rips versus the relatively flat water of the current or the darker color water of the channel. Results further suggest that most beach users, and particularly local participants, are overconfident in their ability to identify rip channels and currents. The focus of beach users on heavy surf as an indication of the rip current potential and the overconfidence in identifying a rip channel or current affects the spatial distribution of beach users and to some degree the location of rescues and drownings. While it can be quite difficult for the average beach user to identify rip channels and active rip currents, the results of the study suggest a need for further education efforts to reduce the rip hazard, particularly in areas where lifeguards are not permanently stationed.

Keywords Risk · Beach user · Rip current

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1 Introduction

Rip currents are a significant hazard for beach users due to the combination of quick currents, deepening channels, and the potential for breaking waves across the exit point of the rip (Short and Hogan 1994). Rip currents are a global hazard that has received considerable attention especially in the United States and Australia. Rip currents are responsible for 89 % of the more than 25,000 surf rescues in Australia each year (Short and Hogan 1994), with between 40 and 50 drownings attributed to rip currents (Sherker et al. 2008; Surf Life Saving Australia 2009). On average, 30 to 40 individuals drown each year in the Unite States as a result of being caught in a rip current (Gensini and Ashley 2010), although Lushine (1991) suggests that rips may account for up to 150 drownings each year. Branche and Stewart (2001) estimate that the total cost of rip current drownings between 1960 and 2000 is $4.2 billion based on the economic value of each unintentional injury death defined by the National Safety Council.

While the economic impact of rip current drownings is quite large ($105 million per year on average), the cost would significantly higher without lifeguards (Branche and Stewart (2001).The United States Lifesaving Association (USLA) estimates that more than 80 % of lifeguard rescue efforts are due to rip currents (referenced from MacMahan et al. 2006). The National Rip Current Task Force was created in 2003 through a collaboration of the United States Lifesaving Association, the National Weather Service and the National Sea Grant Program to raise awareness of the rip hazard (www.ripcurrents.noaa.gov). To date over 900 rip current education signs, describing what do if caught in a rip current, have been posted at public access points throughout the State of Florida. The organization has also provided over 5,000 brochures to be distributed by local governments (Rip Currents 2010).Even with an increasing number of lifeguards and more signage, approximately 20 people drown in Florida each year, after being caught in a rip current (Gensini and Ashley 2010).

The Lifesaving Association of the United States identified Pensacola Beach, Florida, as "worst in nation for beach drownings" (Tuscaloosa News 2002). Between 2000 and 2009, 25 individuals drowned after being caught in rip currents (Houser et al. 2011b), and there were 3 drownings in the first couple of months of 2012. An increase in the number of lifeguards since 2004 has significantly reduced the number of drownings (*pers. Comm.*-West), and the lifeguards make over 30,000 rescues and contacts with beach users each year. The rip current drownings at Pensacola Beach tend to be clustered at semi-permanent "hot spots" forced by transverse bar and ridges on the inner-shelf (see Houser et al. 2011a; Barrett and Houser 2012). Wave refraction across the transverse ridge and swale topography creates an alongshore variation in storm waves that in turn forces an alongshore variation in the bar morphology. Wave convergence at the ridges leads to smaller storm waves in the swales, which in turn forces the innermost bar into a transverse bar and rip morphology (Houser et al. 2011a). The rip channels are attached to the beach face and are not oriented perpendicular to the shoreline, unlike the erosion rip current depicted on the signs at all public access points along the island. While the intent of the signs is to describe preventative actions whether caught in a rip, the signs show an idealized rip that beach users may not be able to translate to a real-world feature.

Whether or not there is a rip-related drowning or rescue depends on the spatial and temporal correspondence of weather and environmental factors, the distribution of the beach users, and the distribution of the beach users who are most vulnerable to rescues and drownings. In other words, the hazard posed by rip currents is partly dependent on site selection by the beach users, which is in turn dependent on their ability to identify and avoid unsafe locations of the beach. Preliminary field observations by Houser et al. (2011a) suggest that beach users tend to prefer the deeper water of the rip channel and believe that the greatest rip hazard is associated with the largest waves and not the areas of flat water between breakpoints (see also Sherker et al. 2010). Moreover, beach users may select an area of beach directly landward of a rip channel that is not active in the morning, but develops into a rip current as the afternoon sea breeze develops (Gensini and Ashley 2010). In other words, beach users at Pensacola Beach may be unaware of the rip current potential and/or incapable of identifying a rip channel or rip current. Accurately and consistently identifying a rip channel is not always straightforward, particularly for erosion rips that tend to be transient in time and space (Short 1985). However, the semi-permanent rip current hot spots at Pensacola Beach may make it possible for beach users to identify the rip current when waves are breaking across the shoals and the channel when the current is not active. Hatfield et al. (2012) demonstrated that beach users can develop an ability and confidence in identifying a rip current through the distribution of posters, postcards and brochures. Despite the ability to identify a rip current or recognize posted warnings about the rip current danger, beach users may still choose to swim in unsafe and unpatrolled sections of the beach (Drozdzewski et al. 2012; Williamson et al. 2012).

The purpose of this study is to assess beach user understanding of rip currents and ability to identify a rip channel or active current by means of a survey questionnaire administered at Pensacola Beach during the summer (May through August) of 2010. The survey questionnaire includes a series of oblique photographs taken on sequential green, yellow and red flag days when the potential for rip currents is low, medium and high, respectively, to determine whether beach users at Pensacola Beach are able to identify rip channels.

2 Study site

Pensacola Beach developed after the construction of a bridge connecting Santa Rosa Island to Gulf Breeze and Pensacola (Fig. 1) in the 1930s, allowing for water-based recreation to become the primary activity on the island. The beach's white sand and clear water makes the resort a large tourist destination today, attracting about 1.8 million visitors each year and contributing as much as $277 million to local commerce annually (Livingston and Arthur 2002). The majority of tourists visit Santa Rosa Island, and specifically Pensacola Beach, during the summer season (traditionally defined as Memorial Day through Labor Day). Pensacola Beach makes up an 8-mile stretch of Santa Rosa Island flanked on the east and west by the Gulf Islands National Seashore and is a popular choice for beachgoers since it is convenient to hotels, restaurants and other recreational activities. Lifeguards are permanently stationed at Casino Beach between March and October and at Fort Pickens Gate and Park East between May and August, while the rest of the beach is patrolled by foot and vehicle (Houser et al. 2011b). The lifeguard stations are at the semi-permanent hot spots of rip activity identified by Barrett and Houser (2012) and where drownings have been clustered since 2000 (when location details were first recorded).

To warn of the current and surf hazard, the Santa Rosa Island Authority has deployed flags and interpretive signs at primary beach access points (Table 1). The Florida Coastal Management Program designed the flags in conjunction with the Florida Beach Patrol Chiefs Association, the United States Lifesaving Association (USLA) and the International Life Saving Federation. The flags are provided free of charge to local communities by the Florida Department of Environmental Protection. The flags provide a general warning

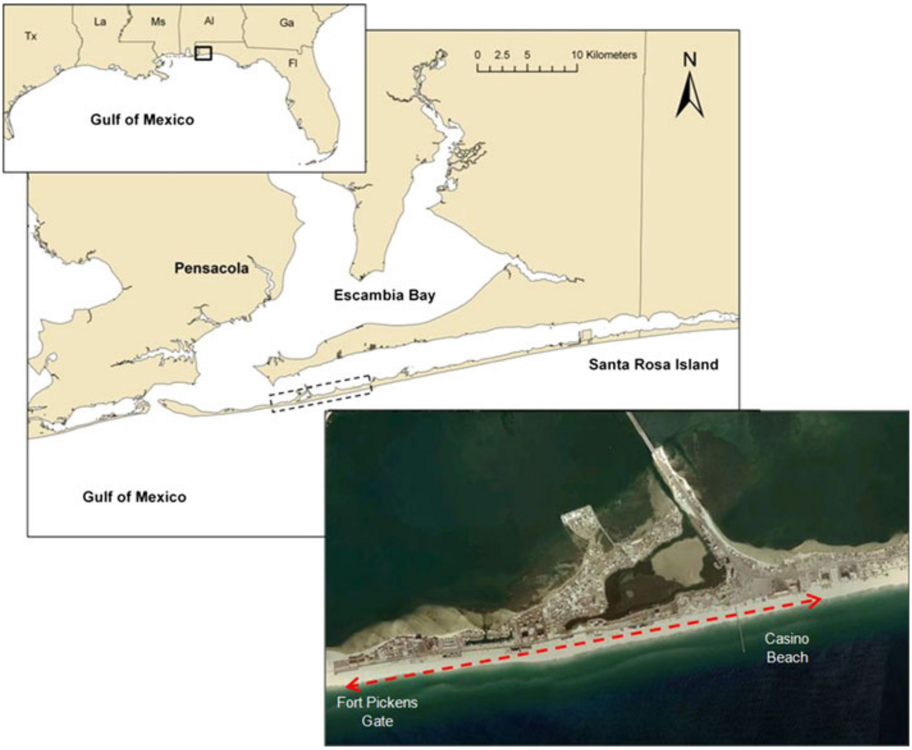


Fig. 1 Study location at Pensacola Beach in northwest Florida. The beach surveys were conducted along a 4.5 km stretch of Pensacola Beach shown in the *inset photograph*

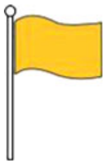
about hazardous surf conditions and the potential for rip currents. However, depending on the variable nearshore morphology, rip channels may not actually be present.

3 Methodology

3.1 Beach survey

The beach user survey consists of general demographic questions, in addition to open-ended questions concerning individual beach preferences and beach safety. Individuals were also asked to identify and define the meaning of the flag currently flying, comment on what their safety concerns are before entering the water, as well as test their knowledge on rip currents. Participants were also asked whether they feel they could identify a rip if present, draw a schematic of what they believe a rip current to look like, and to identify rip currents in three photographs, by selecting which photographs depict a rip current and then carefully circling where within those photographs they believed a rip to exist. The photographs were taken at the same location of beach on different days, so that the only variable between the photographs is the rip current potential defined by the flags (green, yellow, red), which are not visible to the respondent (Fig. 2). The order of the photographs varied from survey to survey as an attempt to avoid obvious recognition that the photographs were in a particular sequence, and the presence of the rip channels and currents was

Table 1 Flag system used by the Santa Rosa Island Authority to warn beach users of the surf hazard and the potential for rip currents at Pensacola Beach

Flag		Explanation
Double Red		Extreme hazard Water closed to public
Red		High hazard High surf and/or strong currents
Yellow		Medium hazard Moderate surf and/or currents
Green		Low hazard Cal conditions, exercise caution
Purple		Dangerous marine life

directly verified by the authors before being used in the survey. Respondents were asked to identify which photographs had rip currents or channels present and then to carefully circle only the rip current or channel that they identified. Although rip currents or channels are more difficult to identify on oblique photographs than on aerial photographs, the photos used in the survey were taken at a height and distance consistent with the top of the dune boardwalks or a hotel exit when a beach user is deciding on where to access the beach. Taking the photograph from the beach did not provide sufficient contrast to allow the beach user to distinguish between areas with a rip channel or current and those without.

The survey instrument received Institutional Review Board (IRB) approval from the University of West Florida (IRB00001740). Individuals asked to participate in the survey were informed that participation was voluntary and they could stop participation at any time. Those interested in participating were required to be at least 13 years old, and all those under the age of 18 had to have signed parental consent. Those willing to participate in the survey were asked to record their responses on the surveys provided and instructed

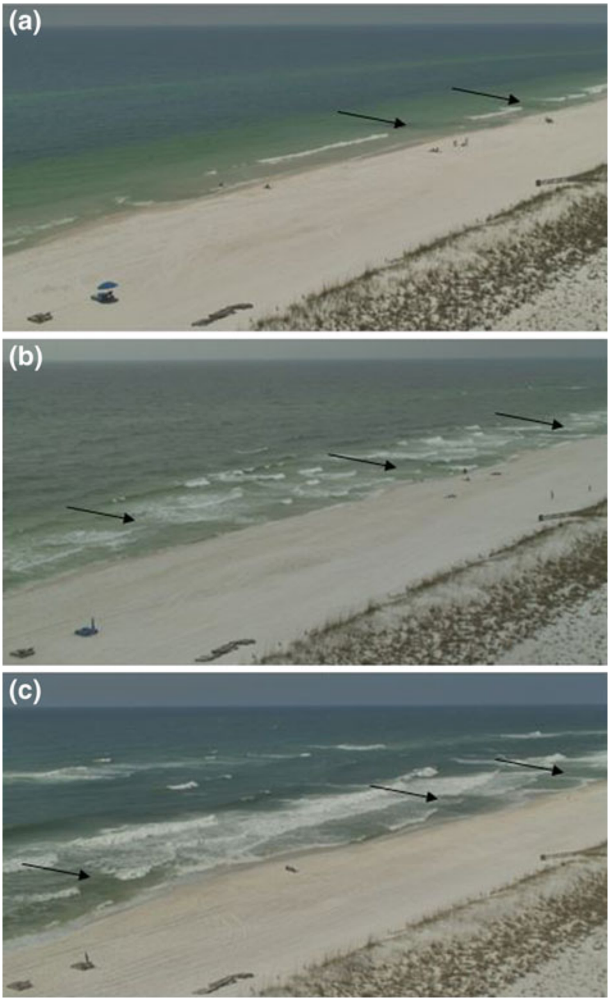


Fig. 2 Oblique photographs showing rip channels and active rip currents (**b** and **c** only) for *green* (**a**), *yellow* (**b**) and *red* (**c**) flag conditions. Respondents were asked to identify the location of rip channels and/or currents in each of the photographs. Note that the *highlighted* rip channels or currents were not visible to the respondents

not to confer with others within their group for answers. The surveyor began at one end of the beach (either Fort Pickens Gate in the west or Casino Beach in the east; Fig. 1) and worked her way from group to group, leaving enough space between groups to ensure the next participant was unable to hear any discussion following the completion of the survey. After each survey was completed, the surveyor used it as an educational tool. In other words, the surveyor answered any questions and participants may have had about rip currents and indicated, using the photographs within the survey, the characteristics of rip currents and how to escape them if ever caught in one.

All surveys for this study were conducted during summer 2010 on Pensacola Beach, where most beachgoers recreate (Santa Rosa Island Authority 2010). Survey data were collected primarily at the Casino Beach access points, which are most commonly used. Surveys were collected primarily on Saturdays and Sundays between 12:00 p.m. and 4:00 p.m., when the beach population was at its peak. This ensured optimal survey responses. However, due to the Gulf of Mexico oil spill that occurred in April 2010, beach visitation greatly decreased. This resulted in a reduction in the number of tourists available to participate and the total number of surveys that could be collected.

3.2 Data analysis

The ability of beach users to identify a rip channel or current was assessed using the oblique photographs from green, yellow and red flag days. The green flag photograph had two identifiable rip channels (but without measurable currents), while the yellow and red flag photographs each had three active rip currents. Each photograph was divided into 1-cm-square grids, and the percentage of that square that circled by the participant was estimated. The value for each grid cell was summed across all participants for the green, yellow and red flag conditions to characterize the spatial distribution of responses for tourists, locals and everyone combined. The first rip channel in the green flag photograph was located in cells 40 and 41, and the second located in cells 37–39 (Fig. 2a). In the yellow flag photograph, the first channel was located in grids 40–42, the second in grids 50–53, and the third in grids 59–61 (Fig. 2b). The first channel in the red flag photograph was located in grids 39–42, the second was split between grids 35–38 and 50–53, and the third channel was split between grids 58–59 and 72–73 (Fig. 2c). The respondent's circle was considered accurate if they included the rip channels and precise if they only included the cells with the rips. For example, if a respondent centered their circle on the rip channel or current, then they were considered accurate, but precision depended on whether they created a tight and specific circle or circled a broad area with the rip at the center (imprecise). If a respondent's circle touched or included part or the entire rip but was not centered on the rip, it was considered to be in accurate.

Participants in the study were also asked to draw a schematic of what they believed a rip current to look like and their drawings were categorized as blank, poor, satisfactory, good or excellent. A poor rating means the individual drew something, but it was indiscernible as a rip. A satisfactory rating means the individual drew something resembling a rip current but did not include many of the identifying characteristics; while a rating of good included most of the identifying characteristics. In order to receive an excellent rating, the individual needed to include in the drawing areas of calm between wave crests, identify the beach and show a current flowing away from the beach. The drawing needed to resemble the rip current warning signs with water flowing offshore but also include the shore-attached bar morphology that controls rips at Pensacola Beach.

4 Results

A total of 97 beach surveys were conducted between June and September of 2010. The mean age of all participants was 37, and there was a near even split between locals (49) and tourists (48), and between males (56) and females (41). Respondents noted that their selection of beach site was largely based on the recommendation of friend or family (18 %), ease of access to parking and beach access points (17.5 %), and proximity to their home or hotel (16.5 %). In contrast, safety concerns, such as the presence of lifeguards,

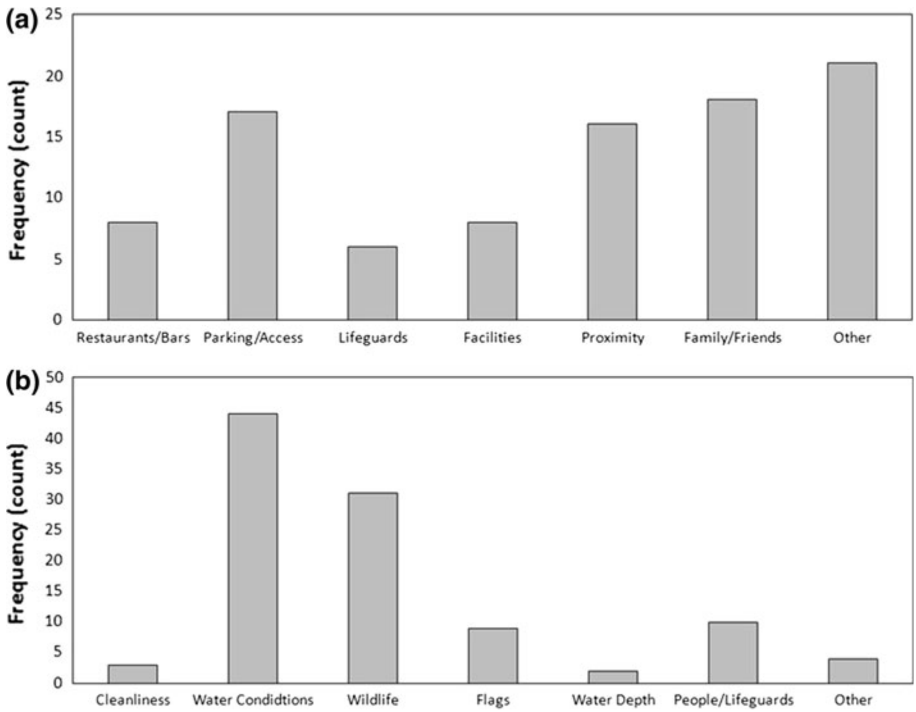


Fig. 3 Leading reasons for site selection on Pensacola Beach among participants (**a**) and the concerns of beach users before entering the water (**b**)

received the lowest number of responses (6 %). The only responses concerning facilities (7.5 %) and safety were located at or immediately adjacent to Casino Beach where lifeguards are permanently stationed (Fig. 3a). The primary concern of the participants before entering the water was the conditions of the water (45 %), which included the size of the waves, water clarity and ocean currents (Fig. 3b). Some participants also expressed concern about wildlife, such as sharks and jellyfish (31 %), the color of the flags (9 %) and the proximity to lifeguards and other people (10 %).

Respondents were also asked to identify the color of the flag flying at the time they were participating in the survey. While 86 % were able to correctly identify color of the flag at that time, 42 % of total respondents had to locate a flag before they could answer. It is not known whether they simply did not know the color or had to reassure themselves of the color before answering. Regardless of their answer, the respondents seemed to understand the meaning of the flag (e.g., yellow means caution), although there were some notable exceptions: Don't know, strength of wind, "what's going on with the water", high tide and heat advisory. When asked whether they could identify a rip current if present, 57 % stated that they could with high confidence, 7 % were unsure of their abilities and 36 % stated that they were unable to identify a rip correctly. In general, local were more confident than tourists in their ability to identify a rip current and all of the respondents who identified having been previously caught in a rip (36 %) were confident that they could identify a rip in the future.

4.1 Rip identification

There were 2 rip channels (not active currents) characterized by darker water in the oblique photograph of green flag conditions. Only 15 % of the participants were able to identify either of the channels (partly or completely), and none of the respondents were able to identify the channels independently. Most of the respondents circled the center of the rip rather than the entire channel, which starts at the shoreline and ends past the innermost bar. In general, most of the respondents identified a smaller area on the photographs, suggesting that they had a better sense of scale and were looking for similar rip characteristics. Tourists, in contrast, circled a larger area on the maps (i.e., less precise) but tended to include the actual rip within their circled area (i.e., more accurate). The majority of those who stated that they could identify a rip with high confidence were unable to identify the rip channels in the green flag photograph. There were only 7 participants with high confidence that correctly identified both rip channels and 6 of those participants were tourists (Fig. 4).

The accuracy of the respondents to identify a rip channel increased as the wave height and intensity of breaking increased in the photographs from the yellow and red flag days, which had 3 rips each. However, the increase in accuracy (circling part or all of the rip channel and with the circle centered on the rip) is actually a result of larger (less-specific) circles, particularly for the tourists and for the photograph from the red flag day. Participants' responses within the red flag conditions averaged 8.51 grid squares compared with 5.72 and 4.85 grid squares per response for yellow or green flag conditions, respectively. Similar to the green flag photograph, local respondents identified a smaller area, but were less accurate in the squares that they selected. In other words, the locals had a greater confidence in their abilities to spot a rip, while the tourists had greater accuracy due to larger and less-specific areas identified (Figs. 5, 6). For the yellow flag photograph, those with greater confidence in their ability to identify a rip current were also less accurate with, but were more accurate on the red flag photograph (Fig. 7). Only 2 respondents were able to identify 2 of the 3 rips on the yellow flag photograph, and only 1 respondent was able to

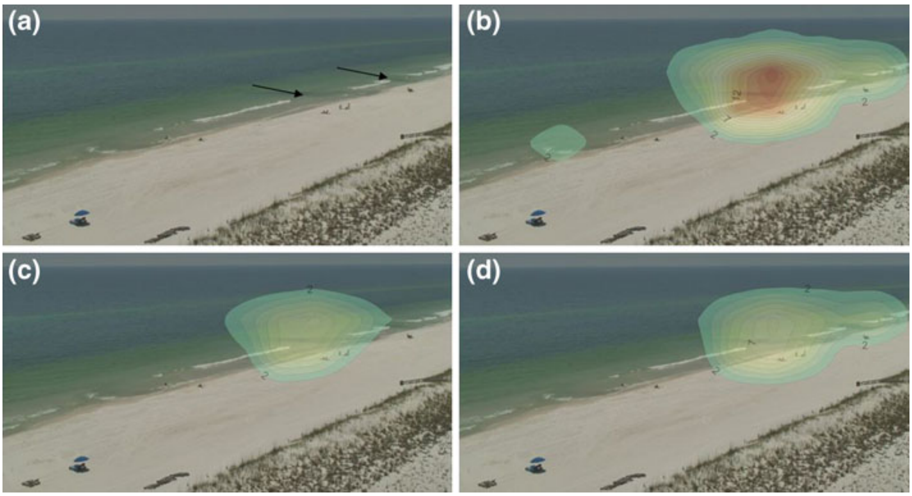


Fig. 4 Oblique photograph of *green* flag conditions showing the location of rip channels (*highlighted* in *red*) on that day. Also shown are the perceived locations of the rip currents by **b** all beach users, **c** local beach users and **d** tourist beach users

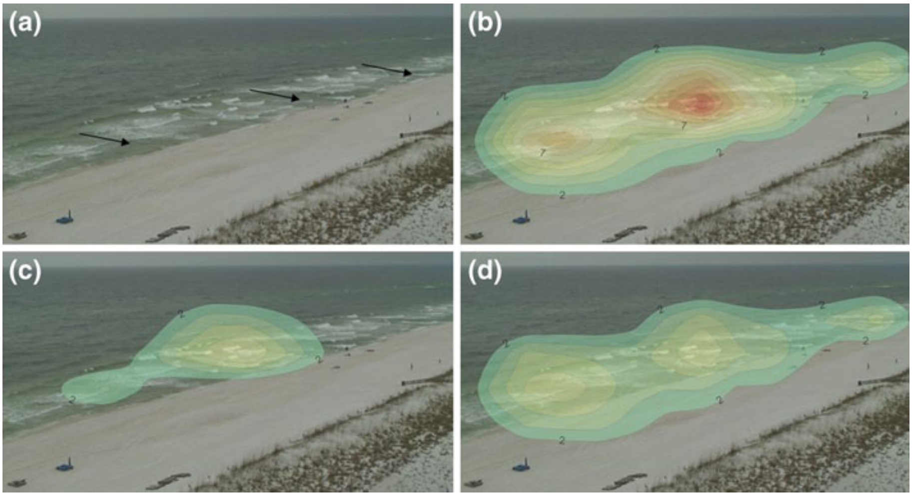


Fig. 5 Oblique photograph of *yellow* flag conditions showing the location of rip channels (*highlighted* in *red*) on that day. Also shown are the perceived locations of the rip currents by **b** all beach users, **c** local beach users and **d** tourist beach users

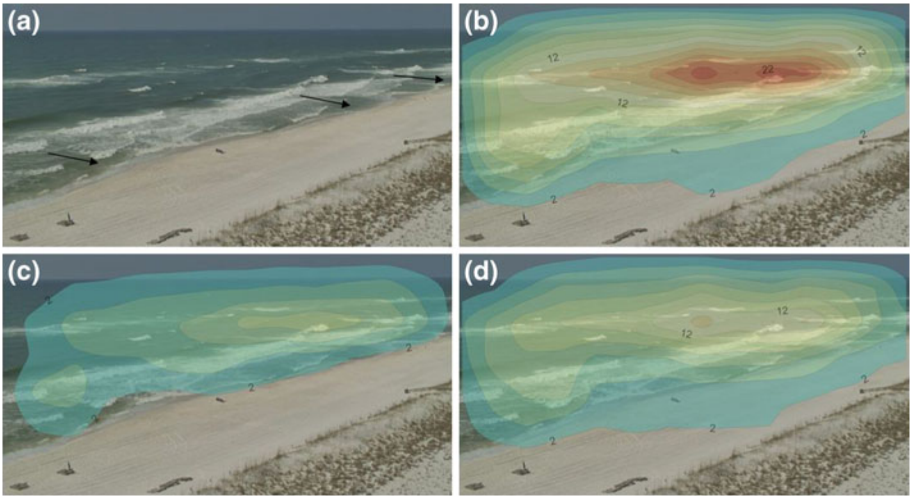


Fig. 6 Oblique photograph of *red* flag conditions showing the location of active rip currents (*highlighted* in *red*) on that day. Also shown are the perceived locations of the rip currents by **b** all beach users, **c** local beach users and **d** tourist beach users

identify all 3 rip currents. In contrast, over half of the confident respondents ($n = 29$) were able to identify at least 1 rip current on the red flag photograph.

4.2 Graphic response versus accuracy

As noted, the drawings completed by the participants were categorized as blank (no drawing), poor, satisfactory, good or excellent. Each rating was dependent on the detail of

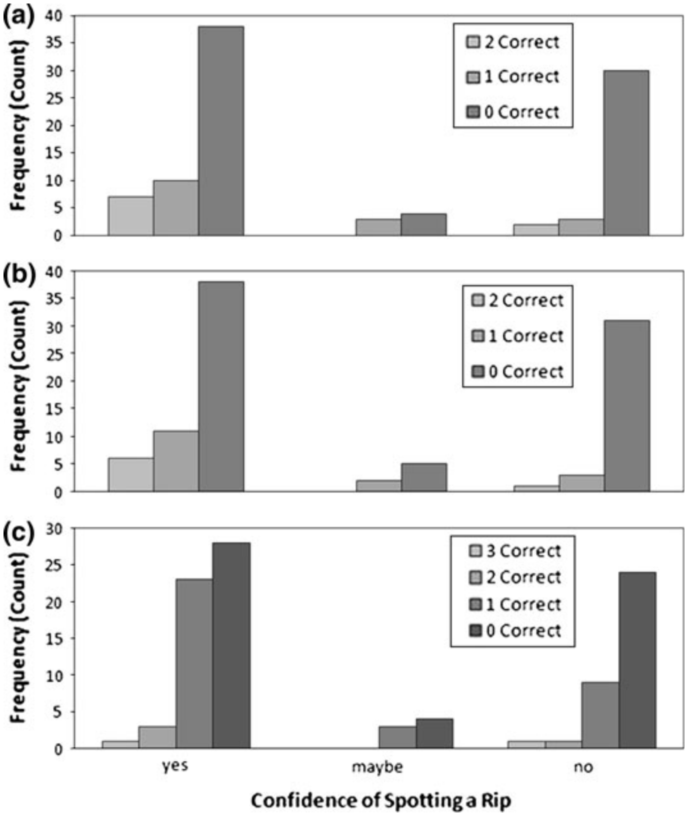


Fig. 7 Declared confidence of a beach user to spot a rip current or channel in one of the photographs (yes, maybe or no) relative to the number of rip currents or channels that they were able to identify correctly in the **a** *green*, **b** *yellow* or **c** *red* flag photograph

the drawing relative to the rip current signs, posted at all public access points and actual rip morphology from the field. The drawings were then compared with each participant's accuracy in identifying the rip channels within each of the three photographs (Fig. 8). In general, as the (judged) quality of the schematic improved so, did the ability of the respondent to identify the rip currents in the oblique photographs (Fig. 9). Those who were able to draw a good or excellent schematic were able to identify at least one rip current more accurately due equally in part to greater precision and also smaller and more specific circles. Within all three photographs, participants who drew a schematic achieving a good rating correctly identified more rip channels than in any other category, including excellent. Those respondents who left the drawing section of the survey blank were the least accurate.

5 Discussion

Rip currents are a significant hazard for beach users, and it is estimated that more than 80 % of lifeguard rescue efforts are due to rip currents (USLA cited by MacMahan et al. 2006). The

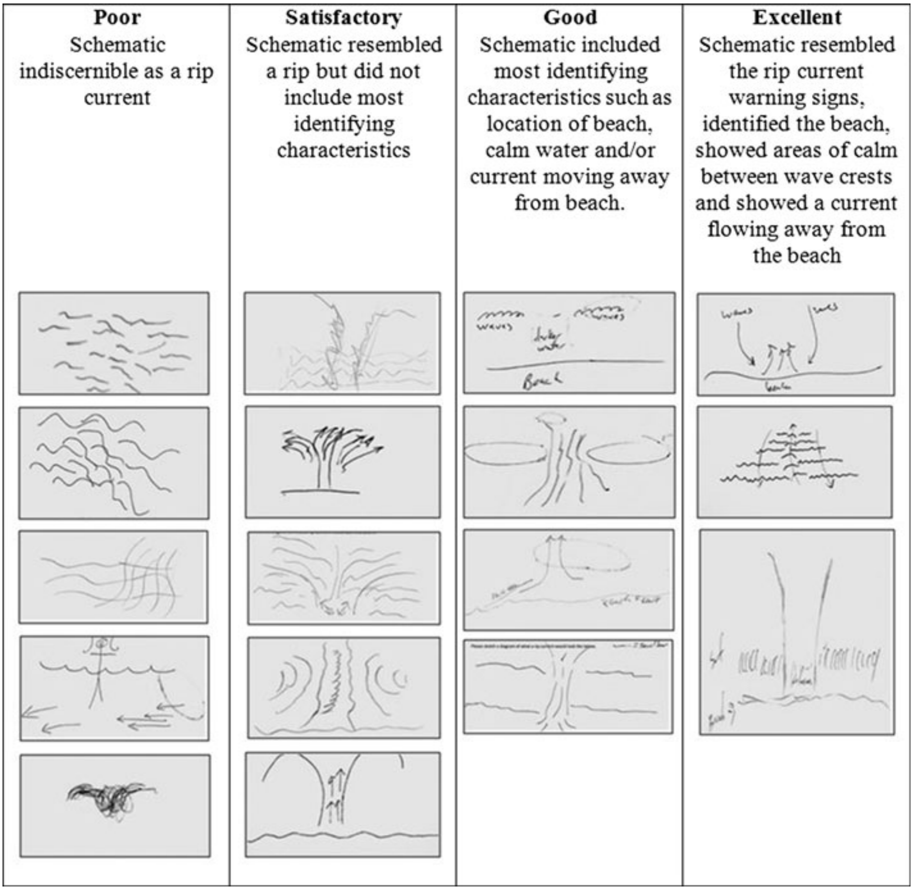


Fig. 8 Representative drawings by beach users that were deemed poor, satisfactory, good or excellent based on the criteria given

potential for a beach user to drown depends on the spatial and temporal juxtaposition of active rip forcing, the beach population and the presence and behavior of vulnerable beach users. Lifeguards can prevent drownings, and warning signs inform beach users that a hazard is present, but where and when lifeguards are not available the potential for drowning in a rip is dependent on the ability of the beach user to personally recognize the hazard. The ability of a beach user to identify a rip current directly or recognize conditions and beach states that have the greatest potential for rip development provides the beach user with an additional level of control over their own well being (Sherker et al. 2010).While it is recognized that rip currents and channels can be difficult for the average beach user to identify, results of the present study suggest that beach users at Pensacola Beach tend to be overconfident in their ability to spot and avoid a rip current. This false sense of security may put a subset of the beach users at greater risk of drowning or a near drowning.

Beach users surveyed in the present study tended to select a site on the beach based on proximity and access, while very few made their selection based on safety (Fig. 3). As noted by Houser et al. (2011b), the beach access points at Pensacola Beach tend to be located landward of swales on the inner-continental shelf. Wave refraction over the

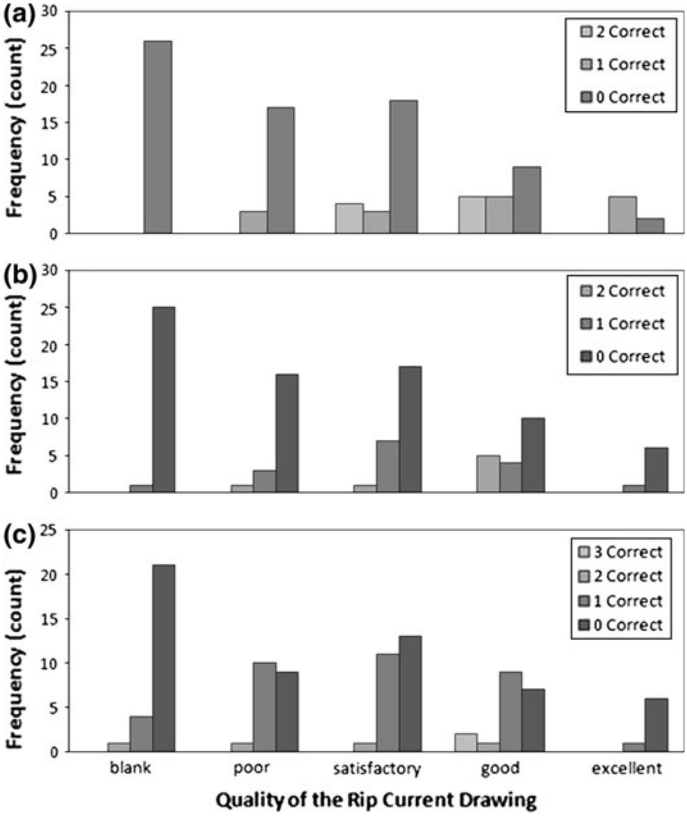


Fig. 9 Comparison of schematic quality verses accuracy of identifying rip currents in the photographs of **a** *green*, **b** *yellow* and **c** *red* flag conditions

adjacent ridges forces the bars within the swales to be closer to the shoreline that tends to be characterized by a transverse bar and rip morphology. Beach access points and parking lots were also preferentially placed landward of the swales due to the relatively small and discontinuous dunes (see Houser et al. 2008). As a consequence, there is a tendency for beach users to be concentrated at the rip current hot spots (see Barrett and Houser 2012), which increase the potential for drowning, particularly when and where lifeguards are not present. Similarly, Williamson et al. (2012) found that while most beach users may be aware that swimming within patrolled sections of beach is a relatively safe swimming option, a majority of beach users do not choose to swim in those areas. Those who have survived a rip current tend to recall the need to swim parallel to the beach, but nonetheless still panicked and were unable to recall other rip safety tips (Drazdzewski et al. 2012). While younger, component and frequent ocean swimmers tend to swim in unpatrolled areas and are confident in their ability to identify a rip current, they still get caught in rips and panic. Those unfamiliar with the beach or the meaning of the flags (including international tourists) tend not to make safe choices compared with local beach users (Drazdzewski et al. 2012).

Unsafe decision-making about where to swim is compounded considering that the majority of beach users surveyed in the present study could not recall the color of the flag flying that day and was therefore unaware of the potential for rip currents being present. Most did not select their location based on the presence of lifeguards. In contrast, the results of Sherker et al. (2010) suggest that beach users can be directed toward safer swimming areas through the use of beach flags that identify where it is relatively safe to swim and lifeguards are present (yellow flag) and where it is not safe to swim and lifeguards are not present (red flag). Parents and caregivers tended to seek out the yellow flagged areas and only those with a basic knowledge of rip currents and beach safety tend to swim in the red flag areas where there may be an active rip. However, the authors conclude that it is important for the beach user to "know what a rip looks like in order to avoid swimming in it." As noted, however, the results of the present study suggest that the majority of beach users are unable to identify a rip channel or an active rip current, particularly in the presence of heavy surf (Figs. 4, 5, 6).

As a direct test of beach user knowledge "about what a rip looks like," the ability of the beach user to identify rip channels (green flag) and rip currents (yellow and red flags) was examined in the present study using oblique photographs at one of the rip current hot spots on Pensacola Beach. The majority of beach users surveyed were confident that they could spot a rip current, particularly local respondents who, it is reasonable to expect, have been to the beach on multiple occasions. However, greater confidence did not translate to greater accuracy compared to those with little to no confidence in their ability to spot a rip current (Fig. 7). Those who were able to draw an accurate and complete rip current exhibited the greatest accuracy in identifying one or more rip currents in the photographs. Those respondents circled smaller areas on the photographs, suggesting that they were very confident about the location of the rip current or channel. In contrast, those who drew a poor to satisfactory schematic of a rip current circled larger parts of the photographs and tended to focus on areas where waves were larger and breaking was more intense particularly for the red flag conditions (Fig. 9). In fact, those respondents tended not to circle the rip currents with little to no breaking, consistent with the tendency of the beach users to identify wave height and the surf as one of their primary concerns before entering the water. As the area of wave breaking increased in the photograph, the larger the area that was identified as being a rip current or channel. This suggests that beach users recognize the hazard of an intense surf zone, but believe that those areas with smaller or no wave breaking (the active rip currents) were the safest. This is particularly evident in the beach user drawings (Fig. 8), in which the poorest drawings tend to focus on waves and breaking and did not include a definable channel. Those with the most accurate drawings were able to show the location of the rip relative to breaking waves and/or the nearshore bars and an offshore flow of water. However, the beach users with the most accurate drawings did not fare better when identifying rip currents during yellow and red flag conditions.

While the results of the study suggest that most beach users are overconfident in their ability to identify a rip current, there is a need to repeat the study at different sites and using ground-based photographs. The oblique photographs used in the study simulate what is visible to the beach from the top of the dune or balcony of their residence or hotel. Although beach users may make initially select a location on the beach from this perspective, it is not clear whether they would alter their choice or make different decisions about whether to enter the water when looking at the surf directly in front of them. What is clear, however, is that the areas of the beach that they consider to be more hazardous and potentially where they believe a rip current to be are areas with larger waves and more intense breaking. A large number of respondents were able to identify the rip channels from the green flag photograph (Fig. 4) due to the color contrast (see also Sherker et al. 2010), but were not able to identify those same channels (now with a current) in the yellow or red photograph. The tendency not to circle those areas with less intense breaking (i.e., the rip current) suggests that the beach users are not able to spot a rip current. Despite the inability of beach users to identify to the rip currents in the present study, there is evidence that print-based campaigns can, however, be effective in warning beach users of the rip current hazard (Hatfield et al. 2012). Specifically, the authors found that the distribution of posters, postcards and brochures can improve beach users ability to identify a rip, understanding to swim away from a rip and to never swim with unpatrolled areas of the beach. Further analysis using photographs of a lower angle and looking straight toward the water is required to verify the results of the present study and to help in the design of new education materials.

6 Conclusions

Results of this study suggest that beach users at Pensacola Beach are overconfident in their ability to identify and avoid a rip current or channel that may develop a current as wave heights increase. Respondents tended to focus on areas where the waves were larger and breaking was more intense rather than adjacent (rip) areas with low wave heights and less intense breaking. The inability to spot a rip current and the false sense of security in their abilities can lead to a dangerous situation and contribute to drownings and near-drownings, particularly since beach users tend to select convenient and not necessarily locations to swim. Those who could draw an accurate and detailed schematic of a rip current showed the greatest ability to spot a rip current, suggesting that education can improve beach safety. However, greater education efforts are needed to ensure that beach users can apply the information gathered from safety signs to their environment. The current rip current safety signs stress how to escape a rip current once caught. Beach users need a greater understanding of the dynamics of rip currents in the local environment. This knowledge will help reduce the number of individuals caught in rip currents and, in turn, lower the number of necessary contacts made by lifeguards each year. However, the local-dependent nature of rip morphology makes it difficult to develop a standard representation that can be used on all beaches.

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