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SURF LIFE SAVING AUSTRALIA

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Measurements of rip current flow and swimmer behaviour in Australian rip current systems using low cost GPS – implications for beach safety

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Background

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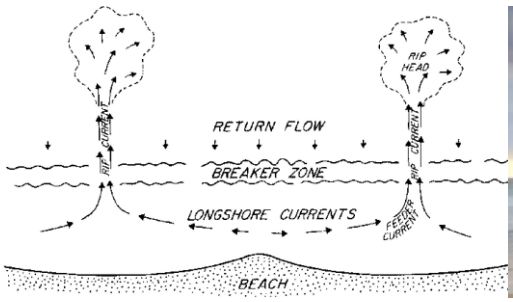
The traditional scientific paradigm of rip current flow has strongly influenced rip current education and awareness

Traditional Paradigm



Rip Current Education

Is this paradigm correct?

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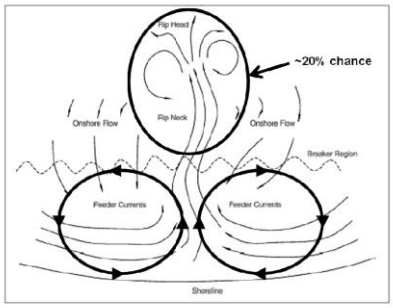
Recent field measurements of rip current flow by *MacMahan et al. (2010)* using GPS drifters and human 'floaters' have challenged the existing paradigm

New Paradigm?



This created the *'swim parallel'* vs *'stay afloat'* debate!

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These measurements apply to *'fixed'* rip currents on open coast beaches - the most commonly occurring type of rip current

What about Australian rip currents?

Study Aims

SLSA funded a team of UNSW researchers in 2010 to:

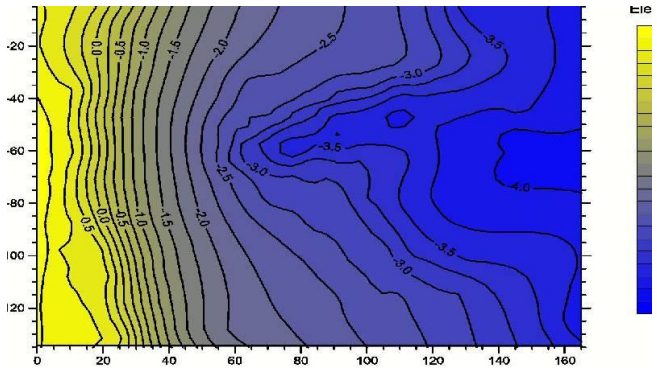
1. **Monitor the trajectory of rip current flow on Australian beaches using low-cost GPS and human 'floaters'**

2. **To provide quantitative physical information on the efficacy of the *'swim parallel'* vs *'stay afloat'* behavioural response to being caught in a rip current**

This was a PILOT STUDY for an Australian Research Council (ARC) Linkage Grant application by UNSW/SLSA (outcome pending)

Methods: Field Site

Experiments conducted at Bondi Beach Sept 6-7, 2010



3-4 hours of measurements each day around low tide

Methods: Equipment

20 x Drifters with GPS attached

Staggered releases into rip current in groups of 4-5

Methods: Equipment

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15 x Volunteer rip 'floaters' and 'swimmers' with GPS attached

Methods: Equipment

Teams of 4 'floaters' and 'swimmers' enter rip current

Methods: Equipment

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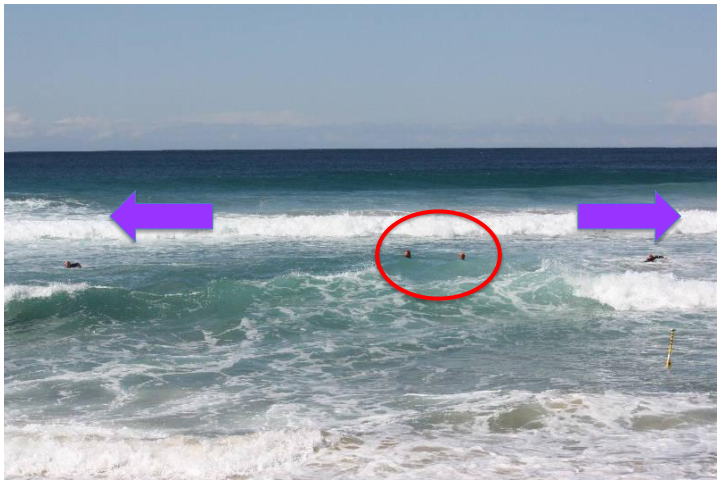
Instructions given for: 2 = stay afloat; and 2 = swim parallel

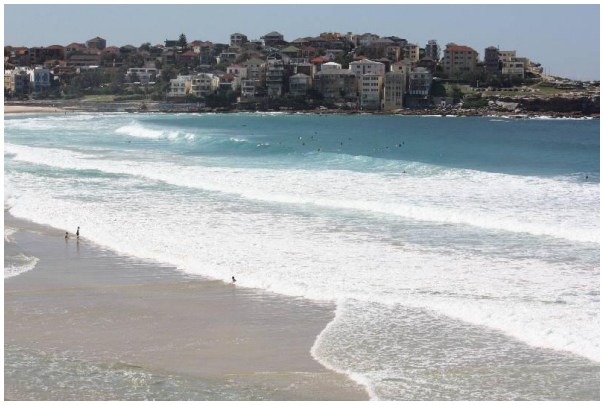


Methods: Retrieval

Inflatable Rescue Boats (IRB) used for both drifters and floaters

Results: Conditions

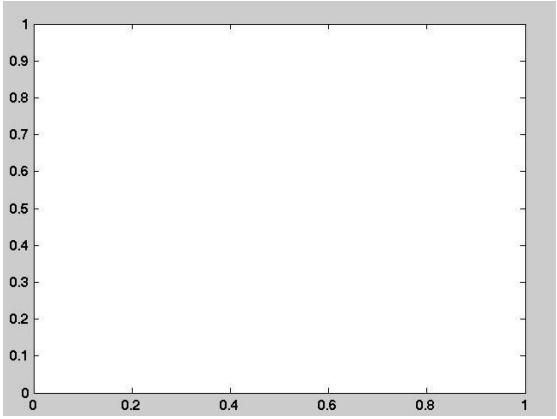
Not optimum; sudden increase in wave height to 1.7 m



Strong winds from SW contributed to longshore drift at low tide

Results: Drifters

114 drifter deployments over 2 days



Note: Simulation is based on California rip current data with similar results to Bondi study

96.5% recirculated <u>within</u> the surf zone; only 4 exited

Results: Drifters

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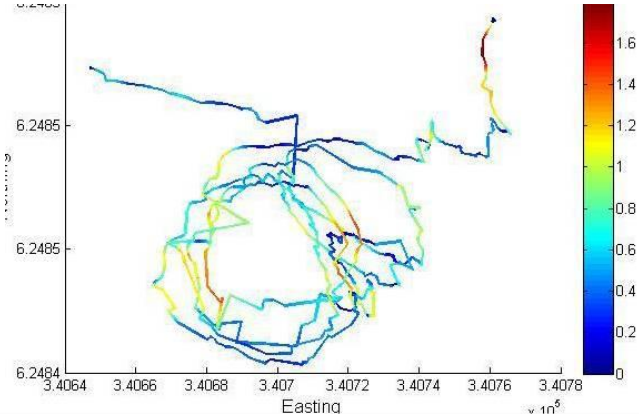
<u>Average</u> drifter velocity: Sept 6 = 0.63 m/s; Sept 7 = 0.55 m/s

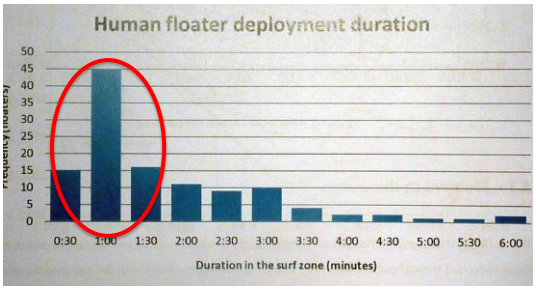


<u>Maximum</u> velocities were 1.9 m/s and 1.6 m/s

Results: Floaters and Swimmers

125 floaters/swimmers entered the rip current over 2 days

→ 71 simply stayed afloat; 27 swam parallel left; 27 right



99% of the floaters were re-circulated onto the adjacent sandbars where they could stand up; none exited the surf zone

100% of the swimmers reached the safety of adjacent sandbars

Results: Floaters and Swimmers

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- **Trajectory of floaters strongly influenced by rip channel geometry**
- **Presence of longshore current influenced 'parallel' swimmers**
- **Floaters /swimmers more likely to be carried further offshore near low tide**
- **60% of floaters/swimmers carried onto sandbar in ≤ 1 minute; 10% ≥ 3 minutes**

Implications for Beach Safety

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1. This example of an Australian fixed rip current showed dominant flow re-circulation within the surf zone

2. Both the 'swim parallel' and 'stay afloat' strategies resulted in successful escapes from the rip current.

3. In a narrow rip current channel oriented perpendicular offshore, confident and aware surf swimmers can reach safety faster by swimming parallel, but….

There are a lot of 'buts'!!

Recommendations

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1. Future work must test multiple rip currents and rip current types over varying wave energy and morphology conditions

2. Swimmers and floaters with a range of surf swimming ability and experience should be used

3. New GPS should be found – significant data loss with these units, up to 50% for swimmers/floaters

4. Significant logistics involved even for small scale experiment

5. Keep volunteers warm and feed them biscuits

THANK YOU

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We thank Surf Life Saving Australia for funds, resources, and volunteers to support the pilot project and commitment to larger ongoing research efforts.

All of the brave volunteer floaters and swimmers who entered the rip and did not drown.

Drifter animation courtesy of Dr Jamie MacMahan and the Nearshore Processes Lab at NPS.

Julica Jungchulsing, Larry Paice and Andre Slade for use of their photos.

Cited Reference:

MacMahan, J., Brown, J., Brown, J., Thornton, E., Reniers, A., Stanton, T., Henriquez, M., Gallagher, E., Morrison, J., Austin, M.J., Scott, T.M. and Senechal, N. (2010). Mean lagrangian flow behavior on an open coast rip-channeled beach: a new perspective. *Marine Geology*, 268:1-15.