Rip Currents, Safety, and Human Health

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Dangerous Currents in the Great Lakes
What is a Dangerous Current?

- Technically: 2 mph or faster is considered dangerous. Dangerous Currents pull swimmers out to open water or push them into rocks or structures.
- Dangerous currents do not pull a swimmer under the water.
- Some dangerous currents are strong enough to pull an Olympic swimmer off course.
- Age, swimming ability and other factors may impact a person’s ability to survive a dangerous current or assist a swimmer in distress.
- Areas near structures are dangerous, regardless of the speed of currents or wave heights.
Types of Dangerous Currents

- Rip
- Structural
- Longshore
- Outlet
- Channel
Rip Currents

- Waves break over sandbar near shore, trapping water and energy.

- Water and momentum build, with pressure relieved when water returns to sea.

- Water “rips” away from shore in the form of a narrow-but-powerful stream.

- Vary in size and speed.

- Can be found on many beaches every day around the world including Great Lakes beaches.
RIP CURRENTS

ESCAPE

ESCAPE

dangerouscurrents.org

Produced by Michigan Sea Grant College Program | MICHU-15-401
Structural Currents

- Forms alongside or as a result of structures, like piers and breakwalls, and may always be present.

- The combination of currents and high waves crashing into structures, is very dangerous for swimmers.

- Jumping off or swimming near piers can be deadly.

- Stay 100 feet or more away from structures.
Longshore Currents

- Move parallel (or alongside) to the shoreline.
- Can swiftly move a swimmer down the shore.
- Often happen between first and second sandbars near the shore.
- Become more dangerous when combined with other currents. Can lead a swimmer unaware, into the path of another current or structure.
LONGSHORE CURRENTS

LONGSHORE CURRENT

ESCAPE

DANGEROUS
Outlet Currents

- Happen where rivers and streams empty into the Great Lakes.
- Water from a river or stream can move quickly. As it enters a lake, it may take time to dissipate.
- Pair river or stream currents with those in the lake, and the situation can become dangerous.
- The drop-off may be severe in areas where the river or stream moves into the lake.
Channel Currents

- Are similar to a fast flowing river between the shore and an island or structure, like a group of rocks.
- Water flows quickly in this channel.
- Swimmers on or near the sandbar are at risk of being swept off these unstable areas and into the swift moving channel current.

- When wind speed increases, waves also intensify and cause currents to move faster and become stronger.
Science of Great Lakes Currents and Waves
Environmental Factors

Four unique features of the Great Lakes and contribute to the development of dangerous currents:

1. Breaking Waves
2. Structures
3. Seiches
4. Gently sloping sandy beaches
About Waves

Breaking waves pose a significant risk to swimmers.

Wave Height Risks:
• 2-3 ft. Waves hazardous for small children and weak swimmers, also rip currents may pose a danger
• 4-5 ft. Waves are hazardous for everyone and strong rip currents are expected

Wave Period:
• The distance in time between waves
• Average Great Lakes wave period is 4 seconds, vs. 9+ seconds on the oceans
• Swimmers have reported that a short wave period is “like swimming in a big washing machine”
Wave Height and Period

Challenges for Swimmers:
- Great Lakes waves have a short period between each wave
- The time between each wave could be as little as 3-4 seconds, making it difficult for swimmers to recover
Fetch

- The distance that waves and wind travel across the water.
- The longer the fetch, the larger the waves with a persistent wind direction.
- The longest fetch in the Great Lakes is on Lake Michigan, from northern Illinois to Mackinac County.
The prevailing wind direction in the Great Lakes is westerly, including southwest, west and northwest.

Winds cause waves.
Hot Spots - Popular Beaches

- **Hot Spot:** Southeast Lake Michigan, but there are many other areas with reported incidents and fatalities.

- **Beaches:** Petoskey, Ludington, Mears, Muskegon, Grand Haven, Holland, Warren Dunes

[Website Link] www.dangerouscurrents.org
Structures Are Dangerous

• Structural currents occur near piers and breakwalls, even during periods with slow wind speed and low wave heights.

• These are permanent currents (National Weather Service).

• Areas near structures are particularly dangerous because:
  1. Escape routes for swimmers are extremely limited
  2. Current speed
  3. Possible combination of currents
  4. Waves near structures
  5. Large rocks that surround and support structures
Seiches

- French word meaning to sway back and forth.
- Occur in lakes when strong low pressure systems move across the lake. This results in strong onshore winds that move water from one side of the lake to the other. This back-and-forth is similar to ocean tidal motion.
- When water moves to one side and then retreats, seiches often enhance the development of rip currents.

www.dangerouscurrents.org
Gently Sloping Shorelines

• Southeast shore of Lake Michigan = many gently sloping beaches.

• **Medium to fine grain** sand, common throughout the Great Lakes region, is conducive to rip currents, as the sand is easily swept away.

• **Sandbars** parallel to the shore can trap water near the beach, leading to the generation of rip currents. Nearshore sandbars can also enhance the speed of longshore currents, leading to stronger currents.
Other Factors

Fluctuating Water Levels:
• Low water levels may contribute to increased wave energy and the development of dangerous currents.

Three Major Types of Water Level Fluctuations:
• Short-term
• Long-term
• Seasonal
Meadows, G., and L. Meadows. Rip Currents in the Great Lakes: Advancing Forecasting Through Perishable Data Recovery and Analysis. The team used combination of GPS, radar and satellite to gather data before, during and after weather events that may contribute to rip currents.

**Field Study:**
- Rip Currents in the Great Lakes: Advancing Forecasting through Perishable Data Recovery.

**Remote Sensing:**

**Impact:** Research results are informing improvements to the designated beach policy.

Key Findings of Interest:
• Many participants had first-hand experience with water safety events. “Stay calm, don’t fight the current” and “swim parallel” were the most common behaviors described to help remove oneself from a current.

• Groups regularly raised the use of alcohol while pier or cliff jumping and swimming. Many participants reported swimming on red flag days or seeking out red flag conditions, as well as diving and jumping off piers.
Research

Overarching Recommendations:

• Using multiple media and communication methods is a more effective risk communication strategy than relying on just signs, publications or flags to reduce risks.

• Focus efforts on developing high-quality graphics with fewer but descriptive words.

• Promoting information about preferred behavior related to specific risks is preferable with this target audience, as opposed to information seeking messages (e.g., “Know Before you Go”).

Lapinski, M., and Viken, G., 2014 report
Overarching Recommendations, continued:
• Addressing information to parents is important, as families and particularly, mothers, play a key role in the communication of risk information to boys and young men.

• The clarity of messages is extremely important in light of the fact that swimming while drinking is something that was discussed regularly by participants and cannot be ignored.

• Signs and flags are a valuable sources of information about swimming risks. It’s important to remember that despite reading and understanding the information on the signs, young males use other factors in deciding whether to jump off structures.

*Lapinski, M., and Viken, G., 2014 report*
Public Outreach and Education
Before You Get to the Beach

Check the weather:
• Forecasts - NWS
• Beach Apps

www.dangerouscurrents.org
While At the Beach

Stay Safe
Attention: Flag Warning System
There are dangerous currents at this beach, and fatalities have occurred.

Red = Stop.
Stay on the beach and out of the water.

Yellow = Caution.
Watch for dangerous currents and high waves.

Green = Go.
But stay aware of changing conditions.

- A red flag means that there is a high risk of drowning.
- Swimmers: Stay away from piers and other structures.
- Even an Olympic swimmer couldn't win a race with a dangerous current.

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• Pay attention to warning flags.

• A red flag means that swimmers are in danger of drowning due to rip currents and other hazards.

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Water Safety Tip

- Stay away from structures.
- Dangerous currents are often present near structures, regardless of weather conditions.
Incidents by Current Type and by Lake

Number of Current Related Incidents By Type 2002-2014

Number of Current-Related Incidents By Lake 2002-2014
Incidents and Wind Speed

Wind Speeds During Current Related Incidents
2002-2014

Number of Incidents

Wind Speed (MPH)
0 to 10 5 to 15 10 to 20 15 to 25 20 to 30 25 to 35 >35
Victim Demographics

• All but one of the 2014 victims in the Great Lakes were male. Similar to drowning incidents in the nation.

• Half lived within 60 miles of the beach, and half lived between 90 and 300 miles from the beach.

• Age of the 2014 victims ranged from 7-50 years, with most victims in adolescent and young adult age groups.

• Majority of victims on the Great Lakes are between the ages of 15 to 25 years or are parents.
Gender of Victims

Percentage based on Dangerous Currents Incident Database, reflects only incidents with complete data (319 total incidents with missing data).
The majority of fatalities occurred in the victim’s home state. Total Incidents with hometown distance data: 282/451 (DB total incidents) Incidents missing distance data (unavailable): 169.
Resources

Dangerous Currents Regional Website: www.dangerouscurrents.org
• Key resources:
  o Great Lakes Dangerous Currents Incident Database:
    http://www.miseagrant.umich.edu/dcd/dcdsearch.php
  o Types of Currents
  o Currents 101: The Science of Currents
  o Be Safe at the Beach: Tips for Swimmers
• Dangerous Currents Outreach Project:
  http://www.miseagrant.umich.edu/dangerous-currents-outreach-project/

Diagrams, graphics and publications tailored for the Great Lakes:
• Publication Templates
• Illustrations of the Types of Dangerous Currents
• Articles and Fact Sheets
Resources

• **National Weather Service**
  Annual Incident Statistics, see:
  [http://www.crh.noaa.gov/mqt/?n=g1cidyearlystats](http://www.crh.noaa.gov/mqt/?n=g1cidyearlystats)

• New central Beach Hazards Forecast webpage, coming soon.

• **Teaching Great Lakes Science** (K-12 lessons and activities)
  • See: [www.greatlakeslessons.com](http://www.greatlakeslessons.com)
    o Dangerous Currents 101
    o Surges and Seiches
      - *Activities:*
        - Investigating Wind and Water
        - Storm Behavior
    o Dangerous Currents: Don’t Get Swept Away
      - *Activities:*
        - Who is Drowning in the Great Lakes?
        - What Does Drowning Look Like?
Resources

Reports:

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