# WESTERN AUSTRALIAN BEACHES AND HAZARDS

*This article has been extracted from the 'Beaches of the Western Australian Coast Eucla to Roebuck Bay', written by Andrew D Short for Surf Life Saving Australia.*

*Incomplete article, figures missing, complete article under development.*

## Beach usage

The Australian coast remained untouched until the arrival of the first Aborigines some tens of thousands of years ago. The coast and beaches that they found, however, no longer exist. Probably crossing to Australia during one of the glacial low sea level periods, they not only reached a far larger, cooler, drier and windier continent, but one where the shoreline was some tens of metres below present sea level. Hence the coast they walked and fished now lies out below sea level on the inner continental shelf.

The present Australian coast only formed some 6,500 years ago, when sea level rose to approximately its present position. As it was rising, at about 1 m every 100 years, the Aborigines no doubt followed its progress by slowly moving inland and to higher ground. Therefore, we can assume that usage of the present Western Australian beaches began as soon as the beaches began forming some 6,000 years ago and continued in the traditional way until the 1800s.

Following the initial European settlements in Albany (1826) and Perth (1829) the beaches and coast were largely ignored by the new settlers, considered a barren wasteland for farming purposes, and a place to avoid for the ships sailing the reef-strewn coast. It was not until the late 19$^{th}$ century that people began looking to the coast as a source of recreation, and in the process their attitude to beaches and coastal real estate changed dramatically, a process that continues today as more and more Australians choose to work and live near the coast..

## The Surf Lifesaving Movement

The history of surf life saving in Western Australia is well documented by Jaggard (1979) and this summary is based on his excellent book. Ed Jaggard and a team of authors are presently writing the history of Surf Life Saving Australia (SLSA) for its centenary in 2007.

To understand the formation of the surf lifesaving clubs (SLSCs) and the broader Surf Life Saving Australia is to realise two things. Firstly, in their rush to the surf, most beachgoers could not swim and had little or no knowledge of the surf and its dangers. Secondly, the open coast of Western Australia is as dangerous as it is inviting to the unprepared.

Only in the early 1900s did beach and surf swimming become a popular recreational pastime, in both the east and west of the nation. In Perth it followed the opening of the Perth-Fremantle railway in 1880 and the development of Cottesloe, Perth's first beach suburb, from 1886. By the early 1900s up to a few thousand people were using

Cottesloe Beach on hot Sundays. In 1905 one of the first recorded rescues took place on Cottesloe, prompting the placement of four lifebelts along the beach. As crowds continued to grow, a caretaker to patrol the beach was appointed in 1906 and a group of volunteers began patrolling in 1908. Finally in 1909 the Cottesloe Life Saving and Athletic Club was formed. This was followed by North Cottesloe SLSC in 1912. Between the wars the movement expanded in Perth with City of Perth SLSC formed in 1924, Scarboro SLSC in 1928, Swanbourne Nedlands SLSC in 1932 and Fremantle SLSC in 1934. To the south the third club in the state was City of Bunbury SLSC in 1915, with Geraldton SLSC the second country club forming in 1930.

Following World War 2 the surf life saving movement continued to expand in Perth, with Floreat SLSC established in 1948, followed by Trigg Island SLSC in 1954, which was able to assist neighbour Scarboro' patrol Perth's most dangerous section of beach, then Sorrento SLSC in 1958 and Mullaloo SLSC in 1960. In the country Albany SLSC started in 1956 and Denmark SLSC, patrolling the most dangerous beach in the state, in 1958.

There was then a lull in the formation of new clubs until the expansion of coastal communities and population north and south of Perth led to the foundation of Secret Harbour SLSC in 1981 and Quinns Mindarie SLSC in 1982, while up north Broome SLSC was founded in 1988 following the 'discovery' of Cable Beach as one of Australia's premier tourist destinations, and down south Esperance Goldfields SLSC started in 1990 to provide a safer patrolled beach along the hazardous Esperance coast.

The continuing population growth in the state, particularly its concentration and spread along the coast, have been matched by the formation of new clubs, all in areas of rapidly growing coastal population, with Yanchep SLSC formed in 1991 and the probationary Mandurah SLSC in 1996. Since 2002 there has been the biggest single increase in club numbers, with four new clubs (Binningup SLSC, 2002; Broadwater Bay SLSC, 2003; Coogee Beach SLSC, 2003; Dongara-Denison SLSC, 2004) and two probationary clubs (Margaret River SLSC, 2003; Port Bouvard SLSC, 2004), all but Coogee Beach in country areas. Table 3.1 lists all 26 Western Australian surf lifesaving clubs by their year of formation.

*Table 3.1 Formation of Western Australian Surf Lifesaving Clubs*

| *Surf Life Saving Club* | *Year* |
|---|---|
| Cottesloe | 1909 |
| North Cottesloe | 1912 |
| City of Bunbury | 1915 |
| City of Perth | 1924 |
| Scarboro' | 1928 |
| Geraldton | 1930 |
| Swanbourne Nedlands | 1932 |
| Fremantle | 1934 |
| Floreat | 1948 |
| Trigg Island | 1954 |
| Albany | 1956 |
| Sorrento | 1958 |
| Denmark | 1958 |
| Mullaloo | 1960 |
| Secret Harbour | 1981 |
| Quinns Mindarie | 1982 |

| | |
|---|---|
| Broome | 1988 |
| Esperance Goldfields | 1990 |
| Yanchep | 1991 |
| Binningup | 2002 |
| Broadwater Bay | 2003 |
| Coogee Beach | 2003 |
| Dongara-Denison | 2004 |
| *Probationary Affiliated Clubs* | |
| Mandurah | 1996 |
| Margaret River | 2003 |
| Port Bouvard | 2004 |

All beaches with surf lifesaving clubs are patrolled during the summer months by volunteer surf lifesavers (Table 3.2). In addition several beaches have professional lifeguards during the peak summer months, and two also have beach inspectors. For full and up-to-date details on all Western Australian surf lifesaving clubs and their patrol periods, as well as other information, visit Surf Life Saving Western Australia's official web site at www.mybeach.com.au.

*Table 3.2* *Western Australian volunteer surf lifesaving patrol periods (south to north). Note: based on 2004 periods, dates may vary in future.* ***Bold*** *indicates also professional lifeguards; * indicates Beach Inspector during all patrol periods.*

| SLSC | Sept | Oct | Nov | Dec | Jan | Feb | March | April |
|---|---|---|---|---|---|---|---|---|
| Esperance Goldfields | | | | 27/12 | x | x | x | |
| Albany | | | | **7/12** | **x** | x | x | |
| Denmark | | | | **7/12** | **x** | x | x | |
| Margaret River | | | | | | | | |
| Binningup | | | 2/11 | x | x | x | x | |
| Port Bouvard | | | | | | | | |
| Bunbury | 28/9 | x | x | x | x | x | x | |
| Mandurah | | | | | | | | |
| Secret Harbour | | 5/10 | x | x | x | x | x | |
| Coogee Beach | | | 9/11 | x | x | x | x | |
| Fremantle | 29/9 | **x** | **x** | **x** | **x** | **x** | **x** | |
| Cottesloe* | 27/9 | x | x | x | x | x | x | |
| North Cottesloe | 28/9 | x | x | x | x | x | x | x |
| Swanbourne Nedlands | | 5/10 | x | x | x | x | x | |
| City of Perth* | 28/9 | x | x | **x** | **x** | **x** | x | |
| Floreat | 2/9 | x | x | **x** | **x** | **x** | x | |
| Scarboro' | 27/9 | x | x | x | x | x | x | |
| Trigg Island | 27/9 | x | x | x | x | x | x | |
| Sorrento | 28/9 | x | x | **x** | **x** | **x** | **x** | |
| Mullaloo | 27/9 | x | x | **x** | **x** | **x** | **x** | x |
| Quinns Mindarie | 28/9 | x | x | x | x | x | x | |
| Yanchep | 28/9 | x | x | **x** | **x** | x | x | |
| Dongara-Denison | | | x | x | x | x | x | |
| Geraldton | | | 1/11 | **x** | **x** | x | x | |
| Broadwater Bay | 28/9 | x | x | x | x | x | x | |
| Broome | | | | | | | | |

The first surf lifesaving clubs and their national association (SLSA), formed in 1907, had embarked upon the establishment of an organisation that has become an integral part of Australian beach usage and culture, and through which it is so readily identified internationally.

Now, more than a century after the initial rush to the beaches and the foundation of the early surf lifesaving clubs, both beach usage and the 303 surf lifesaving clubs around the coast are accepted as part of Australian beaches and beach life. However, at the beginning of the 21st century, beach usage is undergoing yet another surge as the Australian population and visiting tourists increasingly concentrate on the coast. This is resulting in more beaches being used, more of the time, by more people, many of whom are unfamiliar with beaches and their dangers. In addition, while this has led to a rapid expansion of surf lifesaving clubs in Western Australia, still the vast majority of beaches have no surf lifesaving club or patrols.

There is now a greater need than ever to maintain public safety on these beaches, a service that is provided on patrolled beaches by volunteer lifesavers and professional lifeguards. This book is the result of a joint Surf Life Saving Australia, Surf Life Saving Western Australia and the Coastal Studies Unit project that is addressing this problem. The book is designed to provide information on each and every beach in Western Australia, between Eucla and Roebuck Bay, including Rottnest Island, in all, 2051 mainland beaches and 63 on Rottnest Island. It contains information on all 26 patrolled beaches including a map of each and their general characteristics and hazards. It also provides a description of every beach including its general characteristics, access and suitability for swimming and surfing. In this way, swimmers may be forewarned of potential hazards before they get to the beach and consequently swim more safely.

If you are interested in joining a surf lifesaving club or learning more about surf lifesaving, contact Surf Life Saving Australia, your state centre (listed below) or your nearest surf lifesaving club, or check www.mybeach.com.au.

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|---|---|
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|---|---|
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## Physical beach hazards

*Beach hazards* are elements of the beach-surf environment that expose the public to danger or harm (Fig. 3.1). *Beach safety* is the mitigation of such hazards and requires a combination of common sense, swimming ability and beach-surf knowledge and experience. The following section highlights the major physical hazards encountered in the surf, with hints on how to spot, avoid or escape from such hazards. This is followed by the biological hazards.

There are seven major physical hazards on Western Australian beaches:

1. water depth (deep and shallow)
2. breaking waves
3. surf zone currents (particularly rip currents)
4. tidal currents
5. strong winds
6. rocks, reefs and headlands
7. water temperature

In the surf zone, three or four hazards, particularly water depth, breaking waves and currents, usually occur together. In order to swim safely, it is simply a matter of avoiding or being able to handle the above when they constitute a hazard to you, your friends or children.

### Water depth

Any depth of water is potentially a hazard.

- *Shallow water* is a hazard when people are diving in the surf or catching waves. Both can result in spinal injury if people hit the sand head first.
- *Knee depth* water can be a problem for a toddler or young child.
- *Chest depth* is hazardous to non-swimmers, as well as to panicking swimmers. In the presence of a current, it is only possible to wade against the current when

water is below chest depth. Be very careful when water begins to exceed waist depth, particularly if younger or smaller people are present and if in the vicinity of longshore, rip or tidal currents.

Figure 0.1 *Western Australian physical beach hazards include high waves, rocks, rips and tidal inlets, as illustrated in this series of photographs. (a) Surf, rocks and topographic rips at Warrenup; and (b) beachrock reefs, surf and a strong central rip at Ten Mile Lagoon, Esperance.*

**Water depth**

- Safest: knee deep - can walk against a strong rip current
- Moderately safe: waist deep - can maintain footing in rip current
- Unsafe: chest deep - unable to maintain footing in rip current

Remember: what is shallow and safe for an adult can be deep and distressing for a child.

**Shallow water hazards**

Spinal injuries are usually caused by people surfing dumping waves in shallow water, or by people running and diving into shallow water.

To avoid these:

- Always check the water depth prior to entering the surf.
- If unsure, WALK, do not run and dive into the surf.
- Only dive under waves when water is at least waist deep.
- Always dive with your hands outstretched.

Also

- Do not surf dumping waves.
- Do not surf in shallow water.

Breaking waves

As waves break, they generate turbulence and currents which can knock people over, drag and hold them under water, and dump them on the sand bar or shore. If you do not know how to handle breaking waves (most people don't), stay away from them. stay close to shore and on the inner part of the bar.

If you are knocked over by a wave, remember two points - the wave usually holds you under for only two to three seconds (though it may seem like much longer), therefore do not fight the wave, you will only waste energy. Rather, let the wave turbulence subside, then return to the surface. The best place to be when a big wave is breaking on you is as close to the seafloor as possible. Experienced surfers will actually 'hold on' by digging their hands into the sand as the wave passes overhead, then kick off the seabed to speed their return to the surface.

If a wave does happen to gather you up in its wave bore (white water) it will only take you towards the shore and will quickly weaken, allowing you to reach the surface after two to three seconds and usually leave you in a safer more shoreward location than where you started.

**Breaking waves and wave energy**

**Surging waves** - low hazard when low

- break by surging up beach face - usually less than 0.5 m high
- can be a problem for children and elderly, who are more easily knocked over
- become increasingly strong and dangerous when over 0.5 m high

**Spilling waves** - moderately hazardous

- break slowly over a wide surf zone
- are good body surfing waves

**Plunging (dumping) waves** - the most hazardous waves

- break by plunging heavily onto sand bar
- strong wave bore (white water) can knock swimmers over
- very dangerous at low tide or where water is shallow
- waves can dump surfers onto sand bar, causing injury
- most spinal injuries are caused by people body surfing or body boarding on dumping waves
- to avoid spinal injury, do not surf dumping waves or in shallow water. If caught by a wave do not let it dump you head first, turn sideways and cover your head with your arms
- only very experienced surfers should attempt to catch plunging waves

**Wave energy** ≈ square of the wave height and is proportional to wave period.
Wave energy represents the amount of power in a wave of a particular height.

0.3 m wave = 1 unit wave energy/power
1.0 m wave = 11 units
1.5 m wave = 25 units
2.0 m wave = 44 units
2.5 m wave = 70 units
3.0 m wave = 100 units

Therefore, a 3 m wave is 10 times more powerful than a 1 m wave and 100 times more powerful than a 0.3 m wave. Likewise a 10 sec wave will have twice the energy of a 5 sec wave of the same height.

## Surf zone currents and rip currents

*Surf zone currents* and particularly *rip currents* are the biggest hazards to most swimmers. They are the hardest for the inexperienced to spot and can generate panic when swimmers are caught by them. See the later section on how to identify and escape from rip currents.

The problem with currents, particularly rip currents, is that they can move you unwillingly around the surf zone and ultimately seaward (Fig. 3.2). In moving seaward, they will also take you into deeper water and possibly toward and beyond the breakers. As mentioned earlier, currents are manageable when the water is below waist level, but as water depth reaches chest height they will sweep you off your feet.

Figure 0.2 *There are approximately 1,470 beach rips and 900 permanent (topographic) rips operating at any one time along the more exposed sections of the Western Australian coast. This view of Whalebone Beach shows a central beach rip, with topographic rips to either end.*

| **Rip and surf zone current velocity** | | |
|---|---|---|
| **Breaking waves** | travel at 3-4 m/sec | (10-15 km/hr) |
| **Wave bores** (white water) | travel at 1-2 m/sec | (3-7 km/hr) |
| **Rip feeder** and longshore currents | travel at 0.5-1.5 m/sec | (2-5 km/hr) |
| **Rip currents** under average wave conditions (< 1.5 m high) attain maximum velocities of 1.5 m/sec = 5.4 km/hr | | |
| (Note: Olympic swimmers swim at about 7 km/hr) | | |
| An average rip in a surf zone 50 m wide can carry you outside the breakers in as little as 30 seconds. | | |

## Tidal currents

Tidal currents are generally weak around the southern half of the state and only impact beach processes near tidal inlets. However, amongst the higher tides of the Pilbara, Canning and Kimberley coasts the combination of shallower, constricted water and in places increasing tide range can generate strong tidal currents. Where such constrictions and stronger currents occur, tides must flow in and out twice a day and in so doing generate strong reversing currents, which also maintain deeper tidal channels (Fig. 3.3a). These strong currents and deep channels are a very real hazard on all such beaches. They are particularly hazardous on a falling tide as the currents flow seaward. Ocean Beach at Denmark is located next to the mouth of Wilson Inlet and is a good example of a beach with a low tide range (0.6 m), being impacted by a constricted and strong tidal flow (Fig. 3.3b).

When swimming or even boating in or near tidal creeks and inlets, always check the state and direction of the tide and be prepared for strong currents. Swimmers should not venture beyond waist deep water.

Figure 3.3 a) *Deep tidal inlet flowing along beach at Ocean Beach, Denmark; and (b) a deep tidal inlet with strong tidal currents at the mouth of the Maitland River.*

## Strong winds

The Western Australian coast is exposed to predominantly westerly winds in the south associated with both the subtropical high and the passage of cyclonic cold fronts, southerly winds and sea breezes along the Central West, and a mix of seasonal winter easterlies and summer westerlies in the north. The strongest winds are associated with the southerly cold fronts, which tend to hit from the west and gradually swing more to the south, and with strong summer sea breeze. As a consequence wind strength and direction must be factored into the hazard level whenever beaches are exposed to moderate to strong winds (Table 3.3).

Along much of the Central West coast, where reefs filter the ocean waves, including most of the Perth beaches, the strong southerly sea breezes are responsible for a significant proportion of the wave energy at the shoreline (Table 3.4). They produce waves arriving obliquely from the south, which combined with the following wind produce a strong northerly current along the shore. This current can feed into mobile or flash rips flowing seaward of the surf zone, which are a major hazard during such conditions.

Whenever strong winds occur, their direction determines the impact they will have on beach and surf conditions, as follows:

- *Longshore winds,* particularly strong westerly winds, will cause wind waves to run along the beach, with accompanying longshore and rip currents also running along the beach. The waves and currents can very quickly sweep a person alongshore and into mobile rips on lower energy beaches or into deeper rip channels and stronger currents on higher energy beaches.
- *Onshore winds* will help pile more water onto the beach and increase the water level at the shore. They also produce more irregular surf, which makes it more difficult to spot rips and currents.
- *Offshore winds* tend to clean up the surf. They are generally restricted to hot summer northerly conditions and the winter Trades winds in the north. However, if you are floating on a surfboard, bodyboard, ski or wind surfer, it also means it will blow the board offshore. In very strong offshore winds, it may be difficult or impossible for some people to paddle against this wind.

*Table 3.3 Wind hazard rating for Western Australian beaches, based on wind direction and strength. Winds blowing on and alongshore will intensify wave breaking and surf zone currents, with strong longshore winds capable of producing a strong longshore drag. Their impact on surf zone hazards and beach safety is indicated by the relevant hazard rating, which should be added to the prevailing beach hazard rating.*

| | *Light* | *Mod* | *Strong* | *Gale* |
|---|---|---|---|---|
| *Longshore* | *0* | *1* | *3* | *4* |
| *Onshore* | *0* | *1* | *2* | *3* |
| *Offshore* | *0* | *1* | *1* | *2* |

*Table 3.4 In waters sheltered from ocean swell sea wave height depends on strength of on or alongshore winds. Maximum sea height can reach about 3 m along the West coast. These seas are short and steep, compared to the longer ocean swell of the same height.*

| On-alongshore wind velocity | Max. sea wave height (m)* |
|---|---|
| Light | 0.3 |
| Moderate | 0.5 |
| Strong | 1.0 |
| Gale | 3.0-4.0 |

* wave period 2-5 sec

Wind generated waves and currents

Winds in the Southern Ocean are responsible for the high swell that arrives at the coast, while the same winds also drive the great circumpolar ocean current. Closer to shore and at the coast winds generate seas, rather than swell, and can generate local wind driven currents.

Along the Central West coast the southerly sea breezes are responsible for the generation of southerly wind wave (seas) particularly during summer, with stronger northwest winds in winter. In addition these same winds along the open coast will generate a sea on top of any existing swell, hence the weather forecast for sea and swell conditions. The locally generated seas are by definition short, steep and more irregular (some say confused) compared to swell.

If winds are of sufficient strength and duration they can generate locally wind-driven currents at the coast. In Western Australian open waters, most wind-driven currents set to the east in the south following the larger ocean currents to the south. Changes to this pattern occur during strong northerly winds, which push water offshore, causing upwelling, while strong onshore winds push water onshore, causing downwelling. Along the Central West coast the southerly sea breeze causes coastal waters to move offshore generating cooler upwelling at the shore, while the winter northerlies will drive water shoreward resulting in warmer downwelling. In the North West the offshore easterlies will tend to drive surface waters to the west, while the onshore summer westerlies will drive the water to the east.

Rocks, reefs and headlands

Most open coast Western Australian beaches have some rocks, calcarenite reefs and headlands. These pose problems on higher energy beaches in the south of the state because they cause additional wave breaking, generate more strong topographic rips, and have hard and often dangerous surfaces. When they occur in shallow water and/or close to shore, they are also a danger to people walking, swimming or diving because of the hard seabed and the fact that they may not be visible from the surface.

**Rocks, reefs and headlands**

- If there is surf against rocks or a headland, there will usually be a rip channel and current (topographic rip) next to the rocks. There are 900 topographic rips around the Western Australian coast.
- Rocks and reefs can be hidden by waves and tides, so be wary.
- Most calcarenite reefs will be submerged at high tide.
- Do not dive or surf near rocks, as they generate greater wave turbulence and stronger currents.
- Rocks often have sharp, shelled organisms growing on their surface which can inflict additional injury.
- If walking or fishing from rocks, be wary of being washed off by sets of larger waves

Safe swimming

The safest place to swim is on a patrolled beach between the red and yellow flags, as these indicate the safest area of the beach and the area under the surveillance of the lifesavers. If there are no flags then stay in the shallow inshore or toward the centre of attached bars, or close to shore if water is deep. However, remember that rip feeder currents are strongest close to shore and rip currents depart from the shore. The most hazardous parts of a beach are in or near rips and/or rocks, outside the flags or on unpatrolled beaches and when you swim alone.

Remember these points:

- DO swim on patrolled beaches.
- DO swim between the red and yellow flags.
- DO swim in the net enclosure (where present).
- DO observe and obey the instructions of the lifesavers or lifeguards.
- DO swim close to shore, on the shallow inshore and/or on sand bars.
- ALWAYS have at least one experienced surf swimmer in your group.
- NEVER swim alone.
- DO swim under supervision if uncertain of conditions.
- DO NOT enter the surf if you cannot swim or are a poor swimmer.
- DO NOT swim or surf in rips, troughs, channels or near rocks.
- DO NOT enter the surf if you are at all unsure where to swim or where the rips are.
- BE AWARE of hypothermia caused by exposure to cold air and water, particularly on bare skin and with small children. Wind will add to the chill factor.
- DO check the tides in the north, as there may be no water at low tide
- DO be aware of strong tidal currents near inlets and tidal creeks

Patrolled beaches

- swim between the red and yellow flags
- obey the signs and instructions of the lifesavers or lifeguards
- still keep a check on all the above, as over 500 people are rescued from patrolled beaches in Western Australia each year

Unpatrolled beaches

- always look first and check out the surf, bars and rips
- select the safest place to swim, do not just go to the point in front of your car or the beach access track
- try to identify any rips that may be present
- select a spot behind a bar and away from rips and rocks
- on entering the surf, check for any side currents (these are rip feeder currents) or seaward moving currents (rip currents)
- if these currents are present, look for a safer spot
- it's generally safer to swim at low tide, if you avoid the rips

Children

- NEVER let them out of your sight
- ADVISE them on where to swim and why
- ALWAYS accompany young children or inexperienced children and teenagers into the surf

- REMEMBER they are small, inexperienced and usually poor swimmers and can get into difficulty at a much faster rate than an adult

Beach Hazard Rating

The *beach hazard rating* refers to the scaling of a beach according to the physical hazards associated with its beach type under normal wave conditions, together with any local physical hazards. It ranges from the low, least hazardous rating of 1 to a high, most hazardous rating of 10. It does not include biological hazards, such as sharks and crocodiles; these are discussed later in this chapter. The beach characteristics and hazard rating for wave-dominated beaches are shown in Figures 2.4 and 2.5, for tide-modified beaches (Fig. 2.14) and tide-dominated beaches (Fig. 2.16).

The *modal beach hazard rating* indicates the level of hazard under typical or modal wave conditions for each beach type. Figure 3.4 lists the six wave-dominated, three tide-modified and three tide-dominated beaches, together with their beach hazard rating under waves between less than 0.5 m and greater than 3 m. The modal wave height and modal hazard rating are indicated in **BOLD**. The rating ranges from a low of 1 on most tide-dominated and some tide-modified beaches, to a high of 10 on high energy dissipative beaches. The figure also indicates how the hazard rating will change under changing wave and beach type conditions, together with the more generalised hazards associated with each.

Figure 0.4 *Matrix for calculating the prevailing beach hazard rating for wave-dominated, tide-modified and tide-dominated beaches, based on beach type and prevailing wave height and, on tide-modified beaches, state of tide.*

The *prevailing beach hazard rating* refers to the hazard rating prevailing at a given time as a result of the prevailing wave, tide wind and beach type conditions. Figure 3.3 can be used to determine the prevailing hazard based on beach type and wave height, with Table 3.3 providing the additional wind hazard. If the beach also has local hazards such as rocks, reefs, headlands and inlets an additional 1 is added to the rating. The prevailing beach hazard rating is therefore a function of:

wave height + beach type + wind hazard + other local hazards

What this implies is that beach hazards are a function of some permanent features such as rocks and reefs, and some low energy beach types, as well as more variable factors such as waves, tides and wind, as well as changing beach types, particularly on more energetic beaches. It also means that the hazard rating will change both between beaches as well as over time on any particular beach or part of a beach. These changes can occur quickly as wave, tide and wind conditions change.

**Beach Hazard Ratings**

1 - least hazardous beach
10 - most hazardous beach

*Beach hazard rating* is the scaling of a beach according to the physical hazards associated with its beach type and local beach and surf environment.

*Modal* beach hazard rating is based on the beach type prevailing under average or modal wave conditions, for a particular beach type or beach.

*Prevailing* beach hazard rating refers to the level of beach hazard associated with the prevailing wave, tide, wind and beach conditions on a particular day or time.

Table 3.4 summarises the rating for all Western Australian beaches.

*Table 3.4 Western Australian physical beach hazard rating, by number of beaches and their length (excluding wind hazard) for (a) the mainland coast between Eucla and Roebuck Bay, (b) the Kimberley coast and (c) the entire Western Australian coast. Modal conditions in* ***Bold****.*

*a. WA: Eucla-Roebuck Bay*

| Beach hazard rating | Number | % | Mean length (km) | Std Dev. | Total length (km) | Total % |
|---|---|---|---|---|---|---|
| 1 | **550** | 26.8 | 1.93 | 4.1 | **1,060** | 28.6 |
| 2 | 247 | 12.0 | 1.49 | 2.05 | 368 | 10.0 |
| 3 | **331** | 16.1 | 2.06 | 5.4 | **682** | 18.4 |
| 4 | 216 | 10.5 | 1.78 | 5.0 | 386 | 10.5 |
| 5 | 163 | 7.9 | 1.65 | 8.3 | 268 | 7.3 |
| 6 | 119 | 5.8 | 2.54 | 4.3 | 302 | 8.2 |
| 7 | 137 | 6.7 | 1.57 | 2.6 | 215 | 6.0 |
| 8 | 171 | 8.3 | 1.97 | 4.1 | 337 | 9.1 |
| 9 | 76 | 3.7 | 0.56 | 0.6 | 42 | 1.1 |
| 10 | 41 | 2.0 | 0.68 | 1.6 | 28 | 0.8 |
| | 2,051 | 99.8 | | | 3,688 | 100 |

*b. Kimberley coast*

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 621 | 45.7 | 0.40 | 0.9 | 246 | 34.4 |
| 2 | **633** | 46.5 | 0.55 | 1.1 | **348** | 48.7 |
| 3 | 84 | 6.2 | 0.52 | 0.8 | 44 | 6.2 |
| 4 | 10 | 0.7 | 5.30 | 3.9 | 54 | 7.6 |
| 5 | 12 | 0.9 | 1.85 | 3.0 | 22 | 3.1 |
| | 1360 | 100 | | | 714 | 100 |

*c. Western Australia (entire coast)*

| Beach hazard rating | WA number | % | WA km | % |
|---|---|---|---|---|
| 1 | **1,171** | 34.4 | **1,306** | 28.6 |
| 2 | 880 | 25.8 | 716 | 10.0 |
| 3 | 415 | 12.2 | 726 | 18.4 |
| 4 | 226 | 6.6 | 440 | 10.5 |
| 5 | 175 | 5.1 | 290 | 7.3 |
| 6 | 119 | 3.5 | 302 | 8.2 |
| 7 | 137 | 4.0 | 215 | 6.0 |
| 8 | **171** | 5.0 | **337** | 9.1 |
| 9 | 76 | 2.2 | 42 | 1.1 |

| | | | | |
|---|---|---|---|---|
| 10 | 41 | 1.2 | 28 | 0.8 |
| | 3,411 | 100 | 4,402 | 100 |

Table 3.4 provides an overview of beach hazard ratings around the entire Western Australian coast. Table 3.4a covers the beaches contained in this book. It highlights three aspects of the coast. First, the full range of hazards (1-10), a function of the wide range of wave-beach conditions around the coast. Second, the predominance of lower hazard ratings, a function of the sheltered Central West coast and lower wave energy Carnarvon, Pilbara and Canning coasts; and third, a still substantial number of beaches (1,192) rating 5 and above, a product of the high wave conditions along much of the south and parts of the west coast, including 41 rating an extremely hazardous 10, the greatest number for any state. In comparison the Kimberley coast (Table 3.4b) has no beaches rating greater than 5. This is a result of the generally low to very low waves and absence of strong surf and rips.

Compared to other Australian states (Table 3.5) Western Australia has the greatest number of beaches (3,411), it has the greatest number of beaches with a hazard rating 8, 9 and 10, and the greatest number rating 5 and higher. In other words it has the greatest concentration of hazardous beaches on the Australian coast, with the more hazardous beaches spread along the South East, South, and parts of the Leeuwin and Central West coasts. At the other extreme it also has the greatest number of beaches with a low hazard rating of 1 and 2, most of these located in Shark Bay and along the Carnarvon, Pilbara, Canning and Kimberley coasts.

*Table 3.5 Beach hazard rating of all Australian beaches, by number of beaches.*
***Bold** indicates modal hazard rating/s. (Source: Short, 1993, 1996, 2000)*

| Beach Hazard Rating | Qld | NSW | Vic | Tas | SA | WA | NT | Aust. Number | Aust. % |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 325 | 0 | 61 | **118** | **320** | **1,171** | 544 | 2,539 | 23.8 |
| 2 | **748** | 45 | 36 | 101 | 271 | 880 | **738** | **2,819** | **26.4** |
| 3 | 473 | 103 | 90 | 197 | 206 | 415 | 132 | 1,616 | 15.1 |
| 4 | 58 | 134 | **92** | 242 | 154 | 226 | 54 | 960 | 9.0 |
| 5 | 13 | 85 | 66 | **263** | 125 | 175 | 11 | 738 | 6.9 |
| 6 | **23** | **232** | 109 | 140 | 93 | 119 | 9 | 725 | 6.8 |
| 7 | 9 | 112 | **148** | 103 | **137** | 137 | | 646 | 6.0 |
| 8 | 1 | 7 | 77 | 78 | 117 | **171** | | 451 | 4.2 |
| 9 | | | 11 | 23 | 20 | 76 | | 130 | 1.2 |
| 10 | | 3 | 2 | 4 | 11 | 41 | | 61 | 0.6 |
| Total | 1,650 | 721 | 692 | 1,269 | 1,454 | 3,411 | 1,488 | 10,685 | 100.0 |

Three factors contribute to the high number of hazardous beaches in the state. *First* is the prevailing high southerly swell, which averages 2 m and more year round (Fig. 1.15). The high waves themselves are a hazard as well as the dangerous surf and rips they generate. *Second* is the prevalence of rips on all exposed high energy beaches, with a total of 1,470 beach rips usually present around the coast, particularly along the South East and South coasts, but also present along the Leeuwin, Central West and Carnarvon coasts. These rips have an average longshore spacing of 350 m, the largest in Australia. *Third* is the presence of rocks, reefs and headlands along or at the boundaries of many beaches. These features are a hazard in themselves, as well as

generating topographic (or headland) rips where surf breaks against the rocks and the associated currents are deflected seaward. In all there are 900 such rips around the coast, again primarily along the South East, South and Leeuwin coasts. When the beach and topographic rips are combined, on an average day 2,370 rips are operating around the coast. This book identifies every beach where rips occur and provides information on their location and general spacing.

### 3.1.1 Rip identification - how to spot rips

To the experienced surfer rips are not only easy to spot, but they are the surfer's friend, providing a quick way (and at times the only way) to get through the surf and 'out the back' beyond the breakers, as well as carving channels to produce better waves. To the inexperienced however, rips are not only unknown or 'invisible' to them, but if caught in one it can be a terrifying and even fatal experience. Most recreational swimmers and visitors do not have the time or desire to become experienced swimmers and surfers. In order to assist them, a check list of features that indicate a rip or rips are present on the beach is noted below:

| Rip Current Spotting<br>Check List |
|---|
| Note: any one of these features indicates a rip, but not all will necessarily be present.<br>* indicates always present<br>+ indicates may be present |

* A seaward movement of water (Fig. 3.2) either at right angles to or diagonally across the surf. To check on currents, watch the movement of the water or throw a piece of driftwood or seaweed into the surf and follow its movement.

* Rips only occur when there are breaking waves seaward of the beach. If water is moving shoreward, it must return seaward somewhere.

* Disturbed water surface (ripples or chop) above the rip, caused by the rip current as it pushes against incoming waves and water. May be difficult to spot.

\+ Longshore rip feeder channels and/or currents running alongshore, hard against the base of the sloping beach face. Rips are usually supplied by two rip feeder channels converging from either side of the rip.

\+ Rhythmic or undulating beach topography, with the rips located in the indented rip embayments.

\+ Areas where waves are not breaking, or are breaking less across a surf zone, owing to the deeper rip channel.

\+ A deep channel or trough, usually located between two bars or against rocks. The channel may contain inviting, clear, calmer water compared to the adjacent turbulent surf on the bars. However, do not be fooled. In the surf, calm water usually means it's deeper and contains currents.

\+ A low point in the bar where waves are not breaking, or break less. This is where the rip channel exits the surf zone.

+ Turbid, sandy water moving seaward, either across the surf zone and/or out past the breakers.
+ In the rip feeder and rip channel, the stronger currents produce a rippled seabed. These ripples are called megaripples and are sandy undulations up to 30 cm high and 1.5 m long. If you see or can feel large ripples on the seabed, then strong currents are present, so stay clear.
+ If you see one rip on a long beach, there will be more if wave height remains the same along the beach. Rip spacing can vary from 200 to 700 m, depending on wave-beach conditions.
+ If there is surf and rocks, reef or a headland, a rip will always flow out close to or against the rocks. These are called **topographic rips**, in that they are controlled by the topography of the headland or reef. These rips are often permanent and have local names like *the express, the accelerator, the garbage bowl* and *the alley.*

3.1.1.1 Rips - how to escape if caught in one

- If the water is less than chest deep, adults should be able to walk out of a rip. Conversely, avoid going into deeper water. So if you are in any surf current, become very careful once the water exceeds waist depth. Get out while the water is shallow.
- Most people rescued in rips are children. Never let them out of your sight and if they get into difficulties, go to them immediately while the water is still relatively shallow.
- As long as you can swim or float, the rip will not drown you. There is no such thing as an undertow associated with rips, or for that matter, with surf zone currents. Only breaking waves can drive you under water. Most swimmers who drown when caught in rips do so because they panic. So stay calm, tread water, float and conserve your energy.
- If there are people/lifesavers on the beach, raise one arm to signal for assistance.
- Do not try to swim or wade in deep water directly against the rip, as you are fighting the strongest current. There are easier ways out.
- Where possible, wade rather than swim, as your feet act as an anchor and help you fight the current.
- If it is a relatively weak and/or shallow rip, swim or wade sidewards to the nearest bar. Once on the bar, walk or let the waves or wave bores return you to shore.
- If it is a strong and/or deep rip, go with it through the breakers. Do not panic. When beyond the breakers, slowly and calmly swim alongshore in the direction of the nearest bar, indicated by heavier wave breaking. If you are not a surfer, simply wait for a lull in the waves, swim into the break and allow the waves to wash you to shore. Stay near the surface so the broken wave can wash you shoreward. Do not dive under the waves as they will wash over you.
- To summarise: stay calm, swim sideways toward breakers or the bar and let the broken waves return you to shore. Raise an arm to signal for help if people are on the beach.
- If rescued, thank the rescuer.

## 3.2 Surf safety

Surfing, as opposed to swimming, requires the surfer to go out to and beyond the breakers, so he or she can catch and ride the waves, in other words, go surfing. This can be done using just your body (body surfing) or a range of surfboards, bodyboards and skis.

Surfing safely requires a substantially greater knowledge of the surf, compared to swimming on the bar or close to shore. The following points should be observed before you begin to surf:

1. You must be a strong swimmer.
2. You must also be experienced at swimming in the surf.
3. You must be able to tell if and when a wave will break.
4. You must know the basics of how breaking waves and the surf zone operate. You should be able to spot rip currents.
5. Equally, you should know what hazards are associated with the surf, including breaking waves, rips, reefs, rocks and so on.
6. You must only use equipment that is suitable for you, i.e. the right size and level.
7. You must know how to use your equipment, whether it be flippers, bodyboard, surfboard or wave ski.
8. You should use safety equipment as appropriate, including a legrope or handrope, wetsuit, flippers and in some cases a helmet.
9. You should ensure your equipment is in good condition, with no broken fibreglass, frayed legrope, etc.

### 3.2.1 Some tips on safe surfing:

- Remember surfing is fun, but it is also hazardous.
- Never surf alone. If you get into trouble, who will help you?
- Before you enter the water, always look at the surf for at least five minutes. This will enable you to first, gauge the true size of the sets, which may come only every few minutes; and secondly, besides picking out the best spot to surf, you can also check out the breaker pattern, channels, currents and rips; in other words, the circulation pattern in the surf. This is important as you can use this to your advantage.
- On patrolled beaches, observe the flags, surfboard signs and directions of the lifesavers. Do not surf between the red and yellow flags or near a group of swimmers.
- If you are surfing out the back, the safest, quickest and usually the easiest way to get out is via a rip. This is because the water is moving seaward, making it easier to paddle; the rip flows in a deeper channel, resulting in lower waves; and the rip will keep you away from the bar or rocks where waves break more heavily.
- Once out past the breakers, particularly if paddling out in a rip, move sidewards and position yourself behind the break.
- Buy and read the Surf Survival Guide, published by Surf Life Saving Australia and available at all newsagents.
- Obtain an SLSA Surf Survival Certificate from your school.

### 3.2.2 Some general tips:

Surfers conduct many rescues around the Australian coast, so be prepared to assist if required. Remember, if you are on a surfboard, bodyboard or wave ski and have a legrope and wetsuit, you are already kitted out to perform rescues. The board is a good flotation device that can be used to support someone in difficulty. The wetsuit will keep you warm and buoyant and thereby give you more energy and flotation to assist someone in distress; and the legrope or board can be used to tow someone in difficulty, while you paddle them toward safety.

The simplest way to get someone back to shore is to lay them on your board while you swim at the side or rear of the board and let the waves wash the board, patient and you back to shore.

Some surfing hazards to watch out for when paddling out:

* Heavily breaking/plunging waves, particularly the lip of breaking waves.
* Rocks and reefs.
* Strong currents, particularly in big surf.
* Other surfers and their equipment.

... when you are surfing:

* Other surfers - the surfer on the waves has more control and is responsible for avoiding surfers paddling out, or in the way.
* Heavily breaking waves.
* Your own and other surfboards. They can and do hit you and can knock you out.
* Shallow sand bars.
* Rocks and reefs.
* Close-out sets and big surf.

... when returning to shore:

* Heavy shorebreaks.
* Rocks and reefs.
* Strong longshore/rip feeder currents.

Remember: The greatest danger to surfers is to be knocked out and drown. Most surfers are knocked out by their own boards or by hitting shallow sand or rocks. This can be avoided by always covering your head with your arms when wiped out, by wearing a wetsuit for flotation, by wearing a helmet and by surfing with other surfers who can render assistance if required.

**Sharks and crocodiles**

This book is not designed to deal with biological hazards. However some mention must be made of sharks and crocodiles, as there have been a number of fatal shark attacks since 2000 in Western Australia at Cottesloe and Cowaramup and in South

Australia at Cactus and Elliston. There have also been several fatal crocodile attacks in Western Australia, all in the Kimberley region.

There is no way of avoiding sharks once you enter their territory. If you are concerned about sharks then it is best to stay out of their domain. However all surfers and divers and many swimmers are prepared to spend some time in the ocean with the knowledge that the chances of being attacked are extremely small. On average only one person is fatally attacked in all of Australia each year, and as unfortunate as they are the above four attacks maintain this average. If you are at all concerned then swim only at patrolled beaches during patrol periods, where lookouts and at times aerial surveillance is used to spot and warn swimmers and surfers of the presence of sharks.

Likewise with crocodiles, the best way to avoid them is to stay well clear of their territory, which not only includes all creeks and estuaries but also many creek and river banks. While crocodile attacks on open beaches are rare, crocodiles commonly visit and come ashore on ocean beaches. I have seen crocodiles and particularly fresh crocodile tracks on many beaches around the Kimberley coast. I strongly recommend anyone working, fishing or recreating in the Kimberley coast region to visit a crocodile park in Broome or elsewhere to see crocodiles first hand and learn about their behaviour. Do this before venturing into their domain.

The best reference for biological hazards is:
*Venomous and Poisonous Marine Animals - a Medical and Biological Handbook,* 504 pp.
edited by J A Williamson, P J Fenner, J W Burnett and J F Rifkin
published by University of New South Wales Press, Sydney, 1996
ISBN 0 86840 279 6
Available through UNSW Press or the Medical Journal of Australia.
This is an excellent and authoritative text, which provides the most extensive and up-to-date description and illustrations of these marine animals and the treatment for their envenomation.

## 3.3 Rock fishing safety

Rock fishing is a very popular pastime around most of the Western Australian coast. However, the rocky sections are the most hazardous part of the coast, with most fatalities due to fishermen drowning after being washed off the rocks.

Photo rock fishing ???

Rock fishing is hazardous because:

- Deep water lies immediately off the rocks, often containing submerged reefs and rocks and heavily breaking waves.
- Occasional higher sets of waves can wash unwary fishermen off the rocks.
- Most fishermen are not prepared or dressed for swimming, as they are often wearing heavy waterproof clothing, shoes and tackle, rather than buoyant and protective wetsuits.

- Many fishermen are not experienced surf swimmers and many cannot even swim.

To minimise your chances of joining this distressing statistic, two points must be heeded. Firstly, avoid being washed off; and secondly, if you are washed off, make sure you are prepared and know how to handle yourself in the waves until you can return to the rocks or await rescue.

The biggest problems usually occur when inexperienced fishermen are washed off rock platforms. To compound the problem, they either cannot swim or are not prepared for a swim. You only need to watch experienced board, bodyboard and body surfers surfing rocky point and reef breaks, to realise rocks are not a serious hazard to experienced and properly equipped surfers.

So the rules are:

1. Before you leave home:

- Check the weather forecast. Avoid rock fishing in strong winds and rain.
- Phone the boat or surf forecast and check the wave height. Avoid waves greater than 1 m.
- Check the tide state and time. Avoid high and spring tides.
- Are you suitably attired for rock fishing, particularly footwear?
- Are you suitably attired in case of being washed off the rocks?
- A loose fitting wetsuit is both comfortable and warm, and it will keep you afloat and protected if washed off the rock platform.

2. Before you start fishing:

- Check the waves for ten minutes, particularly watching for bigger sets.
- Choose a spot where you consider you will be safe.
- When choosing a spot to fish: if the rocks are wet, then waves are reaching that spot; if the rocks are dry, waves are not reaching them, but may if the tide is rising or wave height is increasing.
- Ensure you have somewhere to easily and quickly retreat to, if threatened by larger waves.
- Place your tackle box and equipment high and dry.

3. When you are fishing:

- Never turn your back on the sea, unless it is a safe location.
- Watch every wave.
- Be aware of the tide: if it is rising, the rocks will become increasingly awash.
- Watch the waves, to check for:
  - increasing wave height, leading to more hazardous conditions;
  - the general pattern of wave sets: it is the sets of higher waves that usually wash people off rocks.
- Remember, ‘freak waves’ exist only in media reports. No waves are freak, all that happens is that a set of larger waves arrives, as any experienced fisherman or surfer can tell you. These larger sets are likely to arrive every several minutes.

- Do not fish alone, two can watch and assist better than one.
- If you see a larger set of waves approaching - retreat. If you cannot retreat, lie flat and attach all your limbs to the rock. Forget your gear, you are more valuable. As soon as the wave has passed, get up and retreat.
- Wear sensible clothing. A wetsuit provides warmth, protection and safety, particularly if you are washed off or knocked over. Sandals with cleats to prevent slipping are also popular.

4. If you are washed off, here are some hints:

- If you have sensible clothing, that is, clothing that will keep you buoyant, such as a wetsuit or life jacket, then you should do the following:
  - Head out to sea away from the rocks, as they are your greatest danger.
  - Abandon your gear, it will not keep you afloat.
  - Take off any shoes or boots and you will be able to swim better.
  - Tread water and await rescue, assuming there is someone who can raise the alarm.
- If you are alone, or can only be saved by returning to the rocks, try the following:
  - Move seaward of the rocks and watch the waves breaking over the rocks in the general area, then:

  Choose a spot where there is either:
  a channel - this may offer a safer, more protected route;
  a gradually sloping rock - if waves are surging up the slope, you can ride one up the slope, feet and bottom first, then grab hold of the rocks as the swash returns;
  or a steep vertical face with a flat top reached by the waves - swim in close to the rocks, wait for a high wave that will surge up to the top of the rocks, float up with the wave, then grab the top of the rocks and crawl onto the rock as the wave peaks. As the wave drops, you can stand or crawl to a safer location.