Surfing at bombora controlled beaches

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Abstract

Surfers are an active coastal user group. Surfing locations, or surf breaks are limited to a small fraction of the coast. Which fraction of the coast and why there?

Surf and beach lifestyle defines Australian culture. More than two million Australians 'went surfing' on a bodyboard, longboard or surfboard in the summer of 2007/8. Surfing is a stimulus for a growing surf-industry, job creation and tourism. Surfing contests increase overnight visitor stays in the tourism off-seasons.

Most surfing takes place at a beach or a reef. Popular surfing beaches include Scarborough (WA), Waitpinga (SA), Gunnamatta (Vic), Maroubra (NSW), Sunshine (Qld) and Clifton (Tas). Popular surfing reefs include Margaret River (WA), Cactus (SA), Bells (Vic) and Cronulla Point (NSW). Australia has 10,685 beaches and NSW has 205 recognised surfing reefs. Closer investigation reveals 26 of NSW's most popular surfing beaches are located inshore of a deep water reef, called a bombora.

'Bombora controlled beaches' in NSW include North Narrabeen, Merewether, Woonona and North Narrawallee. At these locations surfing takes place in the lee of the bombora, though over sand. While the actual bombora's are rarely, if ever, surfed. This topographic arrangement is not limited to NSW, other examples of bombora controlled beaches include:- Peregian (Qld), Woolamai (Vic),13th Beach (Vic), Gisborne Pipe (New Zealand) and locations in southern WA

This paper will seek to answer the following questions. Why are bombora controlled beaches popular with surfers? What are the bathymetric features of bomboras that encourage wave refraction and wave amplification to pre-condition breaking waves?

How can a greater understanding of bombora controlled beaches assist in the development of artificial surfing reefs? Who should be consulted in the process to develop these works? What are the benefits for other coastal stakeholders and the wider community?

Introduction; surfing in context

Surf and beach lifestyle defines Australian culture. More than two million of us participate. Surfing is important as a recreation, a profession and in job creation. Surfing maintains its position as one of Australia's iconic sports. Australians Mick Fanning and Stephanie Gilmore were crowned the professional world surfing champions in 2008 and Australia won both the Senior and Junior teams event at the International Surfing Association (ISA) championships in 2008 (Sweeny Sports Report, 2008).

At the G'Day USA events in January 2008, Tourism NSW launched a Surf Tourism Strategy to tap into the global estimate of more than 10 million surfers. Each year in NSW more than a quarter of a million international visitors include surfing as part of their tourism activities, one quarter are women, many are learning to surf (Tourism NSW, 2008). Surf tourism also features on www.westernaustralia.com.au the official tourism website of the Western Australia Tourism Commission (WATC). The marketing focus is on women, learners and summer surfing in board shorts.

International, national and regional surfing contests increase overnight visitor stays, especially in the hard-to-cater-for tourism 'off-seasons' of autumn and winter, which are the better surf seasons Australia wide. The Hunter Surf Industry Study (Smith & Pitt, 1998) looked at the economic contribution and social development of the local surf industry (manufacturing, retailing, events, tourism, education and training). The study estimated the industry provided over 400 jobs in the Newcastle region and had an annual turnover of $36.5million. The week-long 'Surfest' contest/event provided most benefits and jobs to the local economy. Regional locations like Margaret River (WA), Bells Beach (Vic) and Coolangatta (Qld) have maintained long running events. Lazarow (2006) provides extensive data on the value of recreational surfing on the Gold Coast.

Surfing locations; where, why, when and how often

Most surfing takes place at a beach or a reef. A beach is defined as a wave deposited accumulation of sediment, usually sand (Short 1993). Popular surfing beaches, referred to as 'beachbreaks', include Scarborough (WA), Waitpinga (SA), Gunnamatta (Vic), Bondi (NSW), Miami (Qld) and Clifton (Tas).

Surfing reefs are referred to as 'reefbreaks' and defined in the Encyclopedia of Surfing as a '...permanent high spot in the underwater topography...' and '...formed by rock or coral...' (Warshaw 2004). Popular reefbreaks include North Point (WA), Caves (SA), Bird Rock (Vic) and Dee Why Point (NSW).

'The Peak', bombora controlled beach, south coast NSW, photo sequence 1 & 2, by Steve

Australian surfing locations are well documented, travel guide authors include Young & Farmer (1986), Warren (1988) and Wave Finder Australia (2008). Online users at www.wannasurf.com mark surfing locations (links to google earth) and add commentary. A more qualitative approach is taken in the three volume series of *The World Stormrider Guides* (Colas 2000, 2004 & 2009) which provides selected regional coverage of 'primo surf zones'. Popular surfing magazines (Tracks, Waves, ASL, Surfer, Surfing) routinely expose locations. After Horvath published *Surf Secrets No1* in 1994, few, if any, popular surfing locations remained secret on the east coast of Australia. Most of Australia's surfing breaks are located in what Short (2009) refers to as the 'high energy swell-dominated southern half' of the continent.

Climatic conditions including wave height, wave period, swell direction, wind strength, wind direction and tide are important and variable parameters affecting the quality of the surfing experience. Walker (1974) studied Hawaiian surfing reefs, primarily 'Queens' in Waikiki and concluded it is the relationship between the environmental parameters and the underlying bathymetry that determines the popularity of a surfing location. Various commentators have added to this knowledge, the most comprehensive 'one-stop-source' being a Special Issue No29 of the Journal of Coastal Research (editor Black, 2001), with solid contributions from Black, Mead, Jackson, Hutt, Andrews and Dally.

Obtaining a consensus on what qualifies as 'good surf' is more challenging. While equipment, skills, bravado and subjective preference will vary, most surfers seek surfbreaks with a long length of ride and a tubing wave shape. Tracks provided a subjective ranking of surfing locations in 2006 when Kennedy, Doherty & Blake provided two listings of 'The 101 Best Waves in Australia', determined by an expert panel and an online readers voting poll. The currently deceased 'Superbank' on the Gold Coast ranked 2nd and 1st respectively. A more scientific method to determining quality is provided by Sutton (2005).

But how often are surfing locations actually surfed? Walker (1974) provides estimates for some Hawaiian reefs, which ranged from 1% of days per year at Maalaea to 95% of days per year at Ala Moana. Yolas (2000) provides 'surf statistics' indicating bi-monthly 'consistency' as a percentage, though his methodology is not clear, some of his highest ratings of 90% are for northwestern Australia from May to August, surprisingly the Rome coast of Italy rates 45% during September/October. A more transparent methodology is provided by Bancroft (1999) who looked at Perths artificial surfing reef at Cable Station and defines a 'surfable day' as, 'surfers in the water, yes or no', with a score of 'total days per month'. She also made use of a fixed webcam, creating a brilliantly simple and effective methodology.


'The Peak', bombora controlled beach, south coast NSW, photo sequence 3 & 4, by Steve

Australian surfing beachbreaks

The Australian coastline is enormous, measured at 29,901km in length, with close to 50% of the coast containing 10,685 sandy beaches (Short 2009). They range in character from the petite and urbanised Tamarama Beach (NSW), a pocket beach guarded by a concrete promenade to the long and lonely Ninety Mile Beach (Vic).

Short (2009) expands on the controlling role of geology on Australian beaches and identifies topographic features, including natural geological features (rocks, platforms, reefs, islets, islands, headlands, outcrops) and man-made features (groynes, seawalls, river training walls) influencing the location and extent of rips and mega-rips. Brander has studied rips in Canada, New Zealand and Australia for more than two decades and developed a Science of the Surf education program (2007).

Topographic features are associated with popular surfing beachbreaks. Surfers tend to congregate at the 'corner ends' of beaches for three reasons;

1) the lee of a headland/groyne offers shelter from winds, the ocean is fanned offshore/sideshore on a larger portion of the wind rose, to provide a smoother, 'cleaner' water surface
2) topographic/headland-controlled-rips and mega-rips create semi-permanent deep channels providing reliable and easy access routes into the 'lineup'
3) rips, particularly mega-rips, deposit sand well seaward of the beach (Short 2009) and provide sand banks more conducive to surfing.

Conversely, featureless beaches with uninterrupted longshore bars parallel to the shoreline are less popular with surfers. For example, a lonely stretch of featureless beach between Dee Why and Long Reef (NSW) is referred to as 'No mans land', indicating local surfers have a low interest in that particular stretch of beach.

New South Wales Surfing Reefbreaks

The rocky length of the NSW coastline is some 615km. Reviewing available literature (Young & Farmer 1986, Warren 1988, Short 1993, Horvath 1994, WaveFinder 2008, wannasurf 2009) and with thirty years of surf travel, Andrew Pitt created an excel database locating and recognising 205 NSW surfing reefs.

NSW surfing reefs range in character from; South Maroubra reef which is a boulder field that extends off a point littered with cliff side debris (Hawkesbury Sandstone) to Guillotines which is a domed shaped and extremely hard igneous rock (essexite). The reef at Ulladulla Golf Course is a sedimentary stone ramp that gently slides under the sea.


'The Peak', bombora controlled beach, south coast NSW, photo sequence 5 & 6 by Steve

Combinations are the norm. For example Lurline Bay has bedrock and boulders. The point at Crescent Head is lined with a tightly packed boulder field, though the majority of the wave breaking action takes place over sand. Queensland's Burleigh Heads also has a boulder shoreline, though the wave breaking action takes place over a longshore (sand) bar that usually wraps around the headland, parallel to the shoreline.

Bombora's

A bombora is defined as an isolated and submerged offshore reef (Warshaw 2004). From shore, the only visible sign of a bombora's existence are breaking waves. In Australia, Aboriginal words are often utilised to describe peculiarities of the land and seascapes, like bombora. The Oxford Reference of Australian Aboriginal Words in English notes the word bombora is derived from the Eora (coastal Aboriginal) dialect of the Sydney region (Dixon, Ramson & Thomas 1990).

Many of Australia's reefbreaks are bombora's (often shortened to 'bommies') including; Bare Island Bombora (NSW) and Margaret River Bommie (WA). The term has been exported, for example Bommie Peak in the Mentawaii Islands and 'The Bommie' at Gradagan in Java.

Bombora controlled beaches

In compiling the database of NSW surfing reefbreaks, Andrew Pitt also identified offshore reefs, bombora's, at twenty six of NSW's most popular surfing beaches. 'Bombora controlled beaches' in NSW include; North Narrabeen, Old Bar, Pelicans, Bellambi, Bendalong, Narrawallee and Congo. At these locations surfing takes place over sand, yet in the lee of the bombora, the bombora's are rarely, if ever, surfed. This topographic arrangement is not limited to NSW, other examples of bombora controlled beaches include:- Pitta St Peregian (Qld), Woolamai (Vic), 13th Beach (Vic) and Gisborne Pipe (NZ).

Research aim

The primary research aim is to compare bombora controlled beaches with findings by Beamsley & Black (2003) who studied the effects of offshore reefs on inshore surfing conditions at Gisborne Pipe, New Zealand. The secondary research aim is to trial a rudimentary method of remote sensing to map nearshore bathymetry and compare results with existing bathymetry maps and onsite soundings.

Methodology

The spatial distribution of NSW bombora controlled beaches is illuminating. Twenty six have been identified, 85% are located between Port Stephens and Durras, a coastline dominated by horizontally bedded sandstone and referred to as the Sydney Basin (Troedson & Hashimoto 2008). Two study sites, North Narrabeen and The Peak were deemed representative and selected for the following reasons.

North Narrabeen (33°S 151°E) on Sydney's northern beaches was selected because it is; recognised as a quality location (Tracks magazine ranked it 28/101 best waves

in Australia), the preferred venue for NSW amateur/professional surfing contests, accessible to the author, a long history of beach profiles (Short 1977 & 1995), data from a 1:25,000 seabed information map (PWD 1989) and availability of five google earth images from 2003 to 2007.

The Peak (35°S 150°E), on the south coast of NSW was selected for contrasting reasons; it is recognised as a quality location by regional locals, accessible to the author, availability of four google earth images from 2003 to 2006, context data from a RAN Admiralty Chart 1:150,000 (1966) and because of the absence of competing topographic features, the nearest headland is 700m. Contrasting with The Peak, North Narrabeen is located near; a headland, a trained estuary mouth with a history of mechanical openings and a dune system that is artificial.

Merton (2005) successfully interprets satellite imagery to create bathymetric maps for sandy beaches, on coasts with clear water, white beach sands and occasional low wave energy. Merton's method is effective to depths of 14m, depending on water clarity. However his method requires exclusive use of satellite and complex computer programming. An alternative and rudimentary method of remote sensing was developed. Using MS Windows 'paint' program, google earth colour images were saved as low resolution 256 colour bitmaps. The resulting isobath-like image(s) are informative with sandy seabeds to 8m depths and were compared to the existing bathometric maps and spot soundings. The method was less effective on the reef bedrock.

On site spot soundings were sourced on a sunny day, with minimal wind and low swell. The equipment included a Hondex PS-7 portable depth sounder, 24° beam angle, depth in meters to one decimal point, range 0.6 to 80m, calibrated onsite with a 'lead line'. Location of sounding was determined by a Garmin GPS Etrex, the mark and depth noted on a waterproof pad with pencil, transport was an inflatable dingy, adjustments were made for tide. Accuracy was estimated at 1m vertical and 15m horizontal.

North Narrabeen, image converted to simulate bathymetry

North Narrabeen, bathymetry (Short 1977)

Results

Both sites have an east-southeast aspect, maximum tidal range of 2m, wide open swell windows and similar swell and wind climates. Wave height is greater than knee height on 98% of days and overhead on more than 15% of days. Short (1993) expands on the seasonal variations of swell direction; northeast to east swells in summer/autumn and east/southeast/south swells in winter/spring. Sydney is more receptive to northeast swell and less receptive to south swells when compared to the south coast of NSW. Narrabeen Beach is composed of fine to medium grained (0.3-0.4mm) quartz and carbonate sands, some of the coarsest beach sands in NSW (Short & others 1995).

The resulting bathymetric interpretation sketches are a compilation of; on site soundings, existing maps/charts and the isobath-like images from MS Windows paint program. The large scale existing bathymetric maps and survey charts placed the sites in context. The MS Windows Paint images were effective to depths of 8m. The site soundings linked the data and a composite map was created.

The visible portion of North Narrabeen bombora commences 200m off the beach. In form, the bombora is a dome, in plan shape a diamond, 400m at its widest hip and extending seaward to more than 750m offshore. The crest of the bombora is up to 4m higher than the surrounding sandy seabed. A semi-permanent deep hole/gutter is discernable directly in the western lee of the reef and a semi permanent headland controlled rip squeezes between the bombora and the headland 250m to the north. A semi-permanent tongue of sand forms between the bombora, the point and the outer reefs, this is the location of the classic North Narrabeen peak and long lined lefthanders. The seabed profile is 1:30 south of the bombora, 1:50 in the vicinity of the main surfing peak and 1:20 on the outer slopes of the bombora.

The visible portion of the bombora at The Peak is also approximately 150m off the beach. In form, the bombora is like a dissected and flattened cone, extending more than 750m seaward, with the pinnacle of the cone shoreward, the visible hip approximately 500m wide, with a clearly defined northern edge. A semi permanent deep gutter is discernable in the north western lee of the reef, indicating a topographically controlled rip. At -2m to -9m, the seabed profile is 1:50 adjacent the bombora and 1:60 on the slope of the bombora. The reef is up to 2m higher than the sandy seabed in the outer depths.

North Narrabeen peak, bombora controlled beach

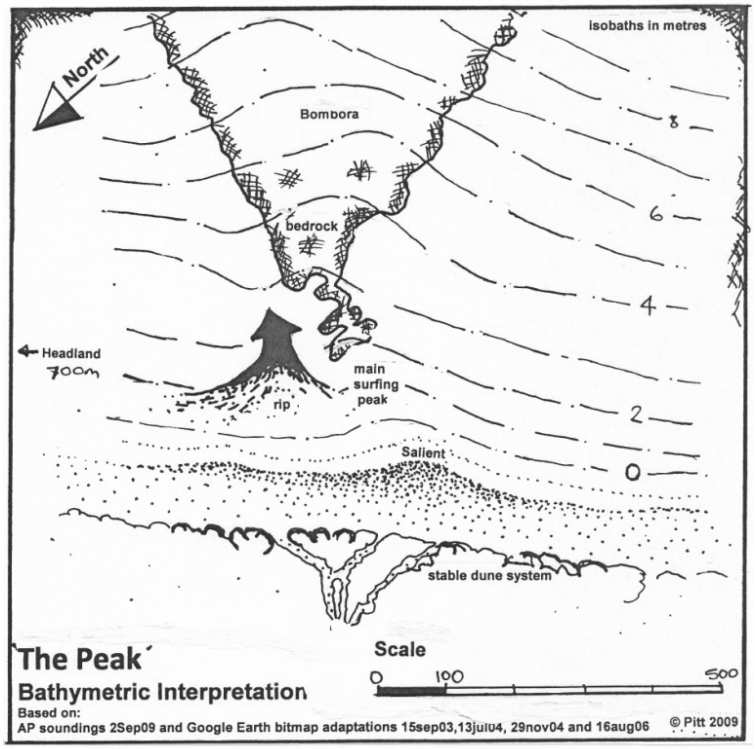
Analysis of results

The main surfing peak at North Narrabeen is on sand, in the north western lee of the bombora (a deep hole forms in the western lee of the bombora). The main surfing peak is located midway between the bombora and the headland. 'The Alley' is a righthander breaking into the headland controlled rip. In no image was a longshore bar or 'close-out' bank observed, except on the beach to the south of the bombora. North Narrabeen is sheltered from the northeasterly seabreezes.

The main surfing break at The Peak is on sand, in the western lee of the bombora. The takeoff is over reef on headhigh waves and larger. A beach salient could be observed in most of the images, on other occasions the author has observed a major kink in the shoreline. In no image was a longshore bar or 'close-out' bank observed. The Peak is side-onshore with north easterly seabreezes.

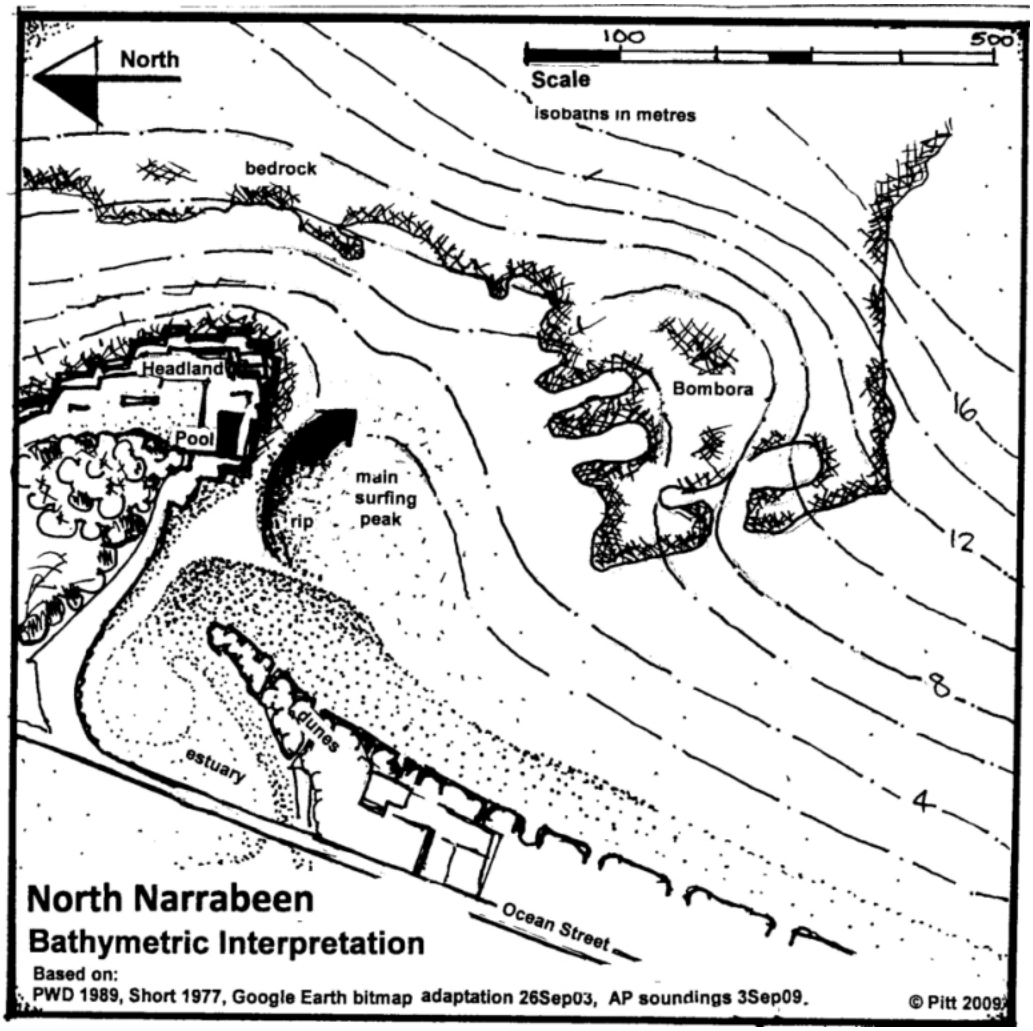
The bathymetric features of both bomboras encourage wave refraction and wave amplification to 'pre-condition' (Mead & Black 2001) breaking waves. This is consistent with findings by Beamsley & Black (2003) who studied the effects of offshore reefs on inshore surfing conditions at Gisborne Pipe, New Zealand.

Dependent on wave period, Beamsley & Black (2003) estimate wave height at Gisborne Pipe is larger by a factor of two, longer the period, bigger the factor. They also observed refraction and focusing around the offshore reef system to cause a zone of relatively reduced wave height on either side of the wave focal point. North Narrabeen and The Peak are recognised as 'swell magnets', wave height is always larger than surrounding beaches.



Bombora controlled beaches are popular with surfers because:

1) ‘certainty’, the bomboras focus advancing waves to a more certain location on the beach
2) ‘swell magnet’, wave height is larger by a factor of 1.25 to 2, depending on wave period and swell angle
3) ‘length of ride’, a wave is more likely to break as a ‘peak’ (rather than ‘closeout’) and therefore offer a longer length of ride
4) ‘safety’, at North Narrabeen and The Peak, surfing action takes place over a sand foundation, the deep outer reefs are rarely surfed, except on days with extra large waves, it is safer to wipeout on a sandy beach than a stone reef



North Narrabeen peak, bombora controlled beach

Significance

A greater understanding of bombora controlled beaches can assist in the development, planning, design, location, scale and form of artificial surfing reefs. Website www.surfingramps.com.au provides an overview of existing artificial surfing reefs at Cables (WA), Narrowneck (Qld), Mount Maunganui (NZ), Opunake (NZ) Bournemouth (UK) and the renovated surfing reef at Bargara (Qld); all rely on the concept of modifying the seafloor in the wave breaking zone. Proposals to develop artificial surfing reefs at beaches in Geraldton (Rafanelli 2004) and Albany (Jackson 2003) also rely on modifying the seafloor in the wave breaking zone.

An alternative method to improving local surf quality and quantity on a beach would be to modify the seafloor in the pre-conditioning zone. The advantages of developing bombora's in the pre-conditioning zone include;

1) 'budget', cheaper to construct because less accuracy is required in the placement of materials in deeper water and risky shallow water construction is avoided
2) 'safety', in the majority of instances surfers would not be riding over the bombora reef materials, instead they would be riding and wiping out on a sandy seabed, this would be on message with the surf tourism marketing campaigns of government
3) 'consistency', beachbreaks are surfable from knee height to overhead, under a broad range of climatic conditions and accessible to a variety of skill levels.

Developing bombora controlled beaches provides benefits for the broader community, particularly in regional towns on the coast. Improving local recreational facilities increases a regions ability to attract regional and national surfing contests, particularly weekend events in autumn and winter, which provide massive boosts for the local tourism industry and help stimulate job creation. Developing bombora's are local community decisions. The consultation process must be transparent and involve key stakeholders. There must be benefits for the broader community.

Conclusion

Surf and beach lifestyle defines Australian culture. Surfing is a stimulus for industry, job creation and tourism. Surfing locations are limited to a fraction of the coast.

Bombora controlled beaches combine the best features of reefbreaks; certainty, swell magnetism and length of ride, with the best features of beachbreaks; safety and consistency.

A greater understanding of bombora controlled beaches can assist in the development, preservation, conservation and management of surfing reefbreaks, beachbreaks and bombora controlled beaches.

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Bio - Andrew Pitt

Andrew Pitt is the principal surfing reef architect at *Surfing Ramps,* a consultancy with a niche in Surfing Reef development, management and preservation. Andrew approaches the coast from an environmental perspective, designing with nature.

Andrew has a degree in Landscape Architecture from the University of New South Wales. His undergraduate thesis was on Submerged Coastal Landscapes. Andrew was a masters candidate at the Coastal Studies Unit, University of Sydney researching Surfing Reefs: the role of bathymetry.

Andrew has served as president of UNSW Surfriders Club, committee member of Maroubra Beach National Surfing Reserve. He is the event founder of the 1st International Surfing Reef Symposium in 1997 and is organising the 7th International Surfing Reef Symposium in 2010.

Andrew lives in Maroubra on Sydney's eastern beaches, has more surfboards than shoes and enjoys surf travel, surfing in every state of Australia, New Zealand, Indonesia, Europe, Morocco, South Africa and twelve Polynesian islands.