Open water swimming is a rapidly growing discipline within organized aquatic sport. Although endurance swimmers have been challenged by oceans, rivers, and lakes for many years, the real understanding of the science of the sport is a new phenomenon. Similarly, the clinical problems of long-distance swimming in environments, frequently inhospitable, are now recognized and managed more effectively. At all times, the health and safety of athletes remains a shared prime concern.

By definition, open water swimming implies any event held outside the confines of a swimming pool. Over the past 30 years, there has been a proliferation of such events in lakes, rivers, reservoirs, and on ocean courses, particularly in temperate countries where water temperatures are more welcoming.

This article discusses the development of open water swimming as an international sport, describing its history, characteristics, and some factors that affect the performance of the open water swimmer. Particular emphasis will be placed on issues of special medical importance.

The first of several formal competitions in open water swimming was surf lifesaving, a competitive activity common to New Zealand, Australia, the west coast of the United States, and South Africa. Surf races are held over distances ranging from 300 to 1000 m. Competitors run from the beach into the surf, swim clockwise around a row of eight buoys, anchored behind the surf break, and return directly to the beach where they finish by running between two flags. The advent of the triathlon in the early 1970s stimulated a rapid growth in the popularity of mass-participation, open water events for multisport competitions. These events have lead to an increased regard for the safety of participants and a greater understanding of the demands of open water swimming. The medical supervision of such events continues to challenge aquatic sports medicine experts who must consider the safety of the athlete as their first priority.
AN HISTORICAL SNAPSHOT

The International Swimming Federation (FINA) has recognized open water swimming as an aquatic discipline since 1986. Although long distance, endurance swimming has been popular for many years, it was not until 1986 that FINA-sanctioned events were established, with the first long-distance swimming World Cup in Lake Windermere in England.³ In 1991 the first World Open Water Swimming Championships were held in Perth, Western Australia. Men and women representing over 25 countries competed in the 25-km race held on the Swan River. Under excellent stewardship and in good conditions, the event was without any significant medical mishap. The men’s title was won by Chad Hundeby (USA), and Shelley Taylor-Smith (Australia) won the women’s crown.

Among the earliest in a number of long distance open water swimming events was the famous Catalina Channel swim in California. The inaugural race took place in January 1927, when a field of 101 swimmers braved the chilly waters of the 21-mile crossing from the California coast to the island of Catalina. All but one of the contestants, a 17-year-old Canadian named George Young, succumbed to the conditions, but this young man became the first to conquer the Catalina Channel. Since then, another 113 attempts have been successful.⁴ In the ensuing years, many other famous stretches of international water have been conquered by intrepid marathon swimmers. The Bering Strait, the Cape of Good Hope, the Straits of Magellan, and Lake Windermere are among the more interesting.

But the event that epitomizes the lure of the open water is, undoubtedly, swimming the English Channel, a 20-mile body of water separating England from France. Of 4370 recorded attempts, by swimmers from throughout the world, 800 have failed.⁴ The formation of the Channel Swimming Association in 1927 occurred more than half a century after the English Channel was first swum.

On August 23, 1875, Captain Matthew Webb entered the waters off Dover for what was to be a history-making swim of immense courage. Pushed west, then east by currents, Webb’s final course took him to a landing on the beach at Calais 21 hours and 40 minutes after leaving the English mainland. His effort, without special training, exercise science, sport nutrition, and modern navigational technology, is still the standard by which many contemporary open water marathon swimmers set their goal.

The legacy of Captain Matthew Webb is carried on in the remarkable feats of today’s marathon swimmers who have reduced the Channel swim time—to 7 hours and 17 minutes for men by Chad Hundeby (USA), and 7 hours and 40 minutes for women by Penny Lee Dean (USA). In 1987 Philip Rush (New Zealand) established an amazing record of 28 hours, 21 minutes, and 20 seconds for a triple nonstop Channel crossing. His time has remained unchallenged and was a mere 7 hours slower than Webb’s original one-way swim. During his triple crossing, Rush set five world’s best records for triple crossing, for any double crossing, for England to France, France to England, and England to France return. But the veritable title of Queen of the English Channel must go to Great Britain’s Alison Streeter, who, by the end of 1987, had swum the distance an incredible 36 times. The English Channel remains the “Mount Everest” of open water swims.

Today, there is a better understanding of the demands of the sport of open water swimming, as coaches and athletes prepare for the unforgiving environment of the open water swim arena. FINA has a designated Open Water Swimming Committee that administers this sport and collaborates closely with the FINA medical committee to ensure athlete safety. Challenges to the athletes
and physicians include musculoskeletal injury, physical and physiologic preparation, environmental stressors, nutritional requirements, conditions of the skin and ears, and marine envenomation.

MARINE ENVENOMATION

The toxic effects of marine venoms from bites or stings range from localized pain and erythema, to allergic phenomena such as eczema and rhinitis, or more serious systemic anaphylactoid reactions. Myocardial depression, pulmonary edema, and acute shock are uncommon but potentially fatal sequelae of the entry of marine toxin through the skin or mucosal surface of a swimmer. This is the process known as envenomation.

Marine venoms, complex mixtures of polypeptides and enzymes, are produced by a number of marine organisms found most commonly in tropical waters (i.e., where water temperatures exceed 25°C). These include the blue-ringed octopus, jellyfish species (especially the box jellyfish, mauve stingers, bluebottles, and the Portuguese “man-o-war”), spiny fish (including stingrays), and certain corals. The latter may invoke local reactions through cuts and abrasions. Open water swimmers may unwittingly swim into shoals of jellyfish during competition. This phenomenon is documented in Australian surf lifesaving competition.

During marathon swimming events, the media focus is frequently on the use of cages to protect the swimmer from attack by sharks. Many authorities, however, agree that more preventive measures should be enforced to minimize the potential hazards of jellyfish and seasnakes, to which the shark cage is little deterrent. Contrary to popular belief, shark attacks during open water swimming competition are rare events.

Marine Envenomation in the Athlete

Should an open water swimmer be affected by marine envenomation during an event, he or she is likely to be aware that they have been stung, given that localized acute pain is a frequent associate. Clearly, the immediate management decision is to assess the extent of the trauma and to identify the marine organism responsible. In all cases, it is important to communicate with the athlete in a firm but helpful manner to assess the potential for serious clinical consequences. Support staff must then closely observe the swimmer for signs of inappropriate behavior or impending distress.

Preventive Strategies

By observing some simple precautions, the risks of open water swimmers being affected by marine envenomation can be reduced greatly. In the tropics it should be mandatory for athletes, coaches, and swim organizers to carefully survey the course or route. In addition, the local knowledge of fishermen, surfers, and other water users may prove very helpful. Should a swimmer be stung, each case of envenomation must be considered as potentially serious until the responsible marine animal has been identified, or the clinical status of the swimmer has been established accurately.
### Table 1. COMMON TROPICAL MARINE ANIMALS, THEIR MODE OF ATTACK, AND CLINICAL SEQUELAE

<table>
<thead>
<tr>
<th>Common Marine Animals</th>
<th>Means of Attack (Defense)</th>
<th>Signs and Symptoms of Envenomation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jellyfish</td>
<td>Sting by nematocysts</td>
<td>Localized pain and inflammation</td>
</tr>
<tr>
<td>Box jellyfish (sea wasp)</td>
<td></td>
<td>Brief symptoms in mild cases</td>
</tr>
<tr>
<td>Portuguese man-o-war</td>
<td></td>
<td>Severe cases:</td>
</tr>
<tr>
<td>Pacific bluebottle</td>
<td></td>
<td>Nausea and vomiting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Altered state of consciousness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>respiratory/cardiac arrest</td>
</tr>
<tr>
<td>Spiny fish</td>
<td>Sting by spines on body or tail</td>
<td>Acute local pain and swelling</td>
</tr>
<tr>
<td>Stingray</td>
<td></td>
<td>Intensified pain at puncture site</td>
</tr>
<tr>
<td>Stonefish</td>
<td></td>
<td>Risk of secondary infection if untreated</td>
</tr>
<tr>
<td>Sea snakes &amp; octopuses</td>
<td>Bite from sharp beak or mouth</td>
<td>Painless bite</td>
</tr>
<tr>
<td>Beaked sea snake</td>
<td></td>
<td>Myotoxicity—myalgia</td>
</tr>
<tr>
<td>Blue-ringed octopus</td>
<td></td>
<td>Myoglobinuria</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Neurotoxicity—paralysis</td>
</tr>
<tr>
<td>Corals</td>
<td>Cuts, abrasions, lacerations</td>
<td>Acute stinging pain</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Local inflammation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pruritis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Secondary infection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lymphadenopathy</td>
</tr>
</tbody>
</table>


### Common Dangerous Marine Animals

Following the studies of Williamson, and with reference to the marine life identified on the north eastern Australian coastline, a number of common organisms have been associated with swimming-related envenomation. Table 1 lists these, describes their modes of "attack," and identifies some of the significant signs and symptoms. It is not however, within the scope of this article to discuss the appropriate therapeutic intervention for each scenario.

### HYPOTHERMIA

Given the cooling effect of water, and the fact that many open water swims are held in some of the less temperate regions of the world, the risk of hypothermia must be considered always. For swimmers from equatorial countries, the unaccustomed exposure to water considered tepid by most others may result in significant cold stress with an attendant spectrum of physiologic consequences. Acclimation to cold water may be achieved through a process of gradual, supervised adaptation.

In classifying hypothermia, most contemporary authors acknowledge three grades—mild, moderate, and severe. With respect to the open water swimmer,
the factors that increase the risk of hypothermia include the temperature of the water, additional physical factors, such as wind chill, the ability of the swimmer to conserve body heat (somatotype and use of protective grease, a cap, or a body suit), the duration of exposure, and the state of stress (fatigue). Many open water events, particularly those in Europe, are swum in temperatures as low as 13° or 14°C. The current FINA regulation (Open Water Swimming [OWS] 5.5) recommends a minimum temperature of 14°C, adding that the water temperature "should be checked on the day of the race, 2 hours before the start, in the middle of the course, at a depth of 40 cm."

The Pathophysiology of Hypothermia

For an athlete to become hypothermic there needs to be an ambient temperature below that of the core body temperature (CBT). In addition, the ability to generate body heat (thermogenesis) must be less than the continuing body heat losses. Clearly, the aquatic environment has the potential to satisfy these prerequisites, and a fatigued open water swimmer may have impaired thermogenesis, with increased heat loss chiefly through conduction and convection. The physiologic balance then swings strongly toward a critical fall in CBT, often with disastrous consequences. Butcher and Gambrell list exhaustive exercise, cold water immersion, and windchill as three of the risk factors for accidental hypothermia. Open water swimming frequently extends an invitation to each.

The Clinical Presentation of Hypothermia

Accepting the definition of hypothermia as a CBT below 35°C, the further subdivision is proposed (Table 2):

- Mild hypothermia—CBT 32° to 35°C
- Moderate hypothermia—CBT 28° to 32°C
- Severe hypothermia—CBT <28°C

In the mildly hypothermic swimmer, few, if any, symptoms may be identifiable. There are a number of physiologic signs, including tachycardia, peripheral vasoconstriction, and increased shivering, which represent the body’s attempt to stimulate thermogenesis and minimize heat loss. In the aquatic environment, however, these signs are unlikely to be noticed. Perhaps the first indication of impending thermal distress occurs when the CBT of the swimmer drops below 32°C. Uncharacteristic behaviors, such as swimming off course or not responding to signals from support craft, are signs of altered cognition. If unnoticed and allowed to continue, these manifestations of deteriorating central nervous system function may rapidly progress to altered consciousness, weakness, apathy, stupor, and even coma. These signs are the direct result of reduced cardiac output, the consequence of hypotension and profound bradycardia leading to a diminution in cerebral circulation and renal perfusion. At temperatures of about 32°C, there is also an additional risk of cardiac arrhythmia. Quite clearly the aquatic athlete, compared with his or her terrestrial counterpart, is at risk of death from drowning even when the stage of moderate hypothermia is reached.

Severe hypothermia represents a critical stage for the open water swimmer. At a CBT of less than 28°C, loss of consciousness can be expected. Irrespective
Table 2. STAGES OF HYPOTHERMIA WITH ASSOCIATED CLINICAL FEATURES IN THE OPEN-WATER SWIMMER

<table>
<thead>
<tr>
<th>Degree of Hypothermia</th>
<th>CBT (°C)</th>
<th>Signs in Swimmer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>32-35</td>
<td>Few if any:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Shivering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Subjective awareness of cold</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Apathy</td>
</tr>
<tr>
<td>Moderate</td>
<td>28-32</td>
<td>Unusual behaviors:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Disorientation (e.g., swimming off course)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increasing confusion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Altered conscious level:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Stupor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Coma</td>
</tr>
<tr>
<td>Severe</td>
<td>&lt;28</td>
<td>Profound central changes:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Loss of consciousness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Coma</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Respiratory depression</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Myocardial irritability:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ventricular arrhythmias</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cardiac arrest</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Death</td>
</tr>
</tbody>
</table>


of this, serious cardiac arrhythmias are common because myocardial irritability increases with dropping CBT. There is also anecdotal evidence of fatal ventricular arrhythmias being precipitated by the physical manipulation of the profoundly hypothermic patient. These events are consequent upon slowed myocardial conduction and the establishment of re-entrant phenomena. For the distressed open water swimmer, this poses a very serious problem. In conditions of environmental challenge, and in the presence of exhaustive exercise, vigilant support staff must be alert to the early signs of hypothermia that precede the profound, life-threatening stages of myocardial dysfunction.

A widely accepted treatment algorithm for managing hypothermia has been produced by the American Heart Association. It presents a protocol based on the degree of hypothermia and the individual patient response. Passive rewarming strategies include means by which further body heat loss to conduction and convection are minimized. Such obvious things as the removal of the swimmer from the water, protection from the windchill, and the use of warm, dry insulation or “buddy warming” are simple yet very effective means. Should there be further concern for the swimmer, speedy evacuation for appropriate treatment is mandatory. Rewarming by active means requires experienced supervision and may take the form of external applications such as hot packs, radiant heat lamps, or warm baths. Internal rewarming may involve warmed oral or intravenous fluids or more advanced extracorporeal blood rewarming techniques in the severely hypothermic patient.

Of clinical concern in any rewarming procedure is the potential for CBT “afterdrop,” the phenomenon of worsening hypothermia in the presence of appropriate rewarming techniques. This is considered to be caused by the continued conductive and convective heat losses, as warm blood from core
tissues is cooled by that from the cold peripheries. Afterdrop may cause a worsening of the swimmer’s condition despite vigorous resuscitative efforts. Given the increase in myocardial irritability and the attendant risks of ventricular arrhythmia and cardiac arrest, the indications for cardiopulmonary resuscitation must apply at all times during the management of the hypothermic patient.2

Musculoskeletal Injuries

Competitive swimming of any nature carries the risk of musculoskeletal injury, which is the recognized consequence of repetitious biomechanical overuse.6,15 The shoulder is the commonly accepted site for swimming injury, followed by the knee and lower back.15

Shoulder Pain in Open Water Swimmers

The incidence of shoulder pain in all swimmers ranges from 40% to 80%.3,7,11,15 The pathogenesis may vary from impingement of soft tissue structures beneath the coracoacromial arch, to frank rotator cuff (supraspinatus) tendinitis, or irritation of the tendon of the long head of biceps. In addition, multidirectional, glenohumeral instability may be a complicating feature7,11 and the likely origin of chronic, exercise-related shoulder pain in the open water swimmer.

Given the well-described biomechanics of the freestyle swimming action, it is easy to understand the genesis of shoulder pathology. During the phase of hand entry and at again at arm recovery, there is compression on the rotator cuff muscles impinged by the overhanging constraints of the coracoacromial arch. This well-described mechanism causes a “wringing out” effect on the proximal supraspinatus tendon with its already compromised blood supply.17 Frank avascularity of both the supraspinatus and biceps tendons eventually follows, and this is thought to lay the foundation for degenerative changes in an area of tendon “watershed”, a phenomenon well described by early investigators including Rathbun and MacNab,17 Kennedy and Hawkins,11 and Richardson et al.19

Shoulder symptoms may advance progressively through phases of exercise-related pain, postexercise pain, disruptive persisting pain, and chronic recalcitrant pain that prevent further swimming.14,15

The accurate diagnosis of shoulder pain in swimmers is made by a process of clinical elimination beginning with the most commonly suspected etiology. Routinely, clinicians use plain radiology to rule out skeletal abnormalities including “beaking” of the acromion, ultrasound to visualize the real-time action of the rotator cuff tendons, and MR imaging to obtain a more accurate determination of the anatomic relationships about the shoulder.

Treatment begins with an accurate diagnosis and follows the accepted regime of conservative management, biomechanical correction, physical and medical therapy, and ultimate return to activity. Current surgical alternatives are widely accepted but also are recognized as the last lines of treatment. It is not the intention to provide further detailed discussion on the choices of treatment.

The Knee and Lower Back in Swimmers

The knee of the swimmer is frequently stressed as a consequence of the kicking action. This is a recognized associate of the breaststroke kick where
rotational forces, combined with the torque generated in the "whip kick" action, stress the medial joint compartment. Medial collateral ligament irritation is reported in addition to the frequent involvement of the pes anserinus, either through a mechanism of repeated traction or frank anserinal bursitis. Few open water swimmers spend time on breaststroke kicking, but it is worth reporting that the so-called breaststrokers' knee appears frequently in the sports medicine literature. So, too, is the well-documented patellofemoral compartment syndrome recognized in many aquatic athletes as a consequence of altered knee biomechanics. In particular, an increased Q angle, with hypermobility of the typically small, high riding, patella alta is of clinical significance.

In a similar vein, repetitious hyperextension of the lumbosacral spine from swimming the butterfly stroke may precipitate a chronic lower back ache. This is thought of as having its genesis in the mechanism of the butterfly swimming action that accentuates the lumbar lordosis and is possibly more provocative in the immature spine where there may be coexistent osteochondritis.

MISCELLANEOUS MEDICAL CONDITIONS

Skin Problems in Open Water Swimmers

Chronic exposure to sunlight and water may precipitate a number of discrete skin problems in open water swimmers. Sunburn is perhaps the most common environmental skin problem in any group of athletes constantly exposed to ultraviolet light (UVL) radiation. Acute exposure manifests as sunburning in susceptible fair-skinned individuals, whereas prolonged UVL exposure is linked to thickening of the skin, loss of elasticity, and an increase in the incidence of serious skin cancers. Basal cell carcinoma and malignant melanoma are the two most common forms. The use of wide spectrum sun blocks is advocated for long or frequent periods of sun exposure.

Photodermatitis represents a spectrum of sun-related skin responses that may be precipitated by coincidental ingestion of a number of different drugs. Medications such as tetracycline, griseofulvin, sulfonamides, some oral diabetic agents, and certain cosmetics or perfumes may hypersensitize some individuals to UVL.

Chronic fungal infections of the skin also may pose a problem to swimmers whose warm, moist skin surfaces provide a welcome environment for the trichophyton species. This group of fungi is responsible for tinea pedis ("athletes foot"), tinea cruris ("jock itch"), and tinea corporis. A range of topical antifungal agents is available to treat these conditions. However, the more recalcitrant conditions and those involving nail bed infection (onychomycosis) require longer term systemic treatment with one of the available oral antifungals. However, there is no substitute for education. All athletes should be aware of the potential for infectious diseases, particularly those spread through ignorance or neglect of personal hygiene. Another skin condition spread through communal showers and the sharing of footwear is the common verruca. These painful plantar warts can spread through the hyperkeratotic dermal layer of the foot and become difficult to eradicate. Destructive topical applications of podophyllin paint or liquid nitrogen are frequently necessary to eradicate the wart virus.

Recurrent exposure to cold water also may precipitate a number of skin conditions, including Raynaud's phenomenon, chilblains, and urticaria in those with a specific tendency. Similarly, in warmer waters, an annoying pruritic
dermatitis ("seabathers' eruption") has been described in ocean swimmers. Larvae of the phylum Cnidaria have been implicated as the causative organism.

The Ear in Open Water Swimming

The most common ear afflictions in swimmers are otitis externa, exostoses of the external auditory canal, and otitis media, which is frequently associated with upper respiratory tract infection (URTI).

Otitis externa ("swimmers' ear") is an infection of the external ear canal commonly seen in swimmers whose frequent exposure to water encourages the growth of organisms, including Pseudomonas aeruginosa and Proteus sp. The fungus species Aspergillus also may be implicated. The swimmer complains of pain and itch in the outer ear. In chronic conditions there also may be an accompanying purulent discharge. A topical combination of antibiotic and corticosteroid is frequently necessary to treat this condition, in association with the local application of a drying agent between swimming sessions. Such topical applications usually contain a mixture of isopropyl alcohol and glacial acetic acid.

Frequent exposure to cold water provides a stimulus for the development of exostoses in the external ear canals of open water swimmers. These small bony outcrops diminish the lumen of the external canal, causing water to become trapped, local skin to become irritated, and local infection to become established. The use of ear plugs and the wearing of bathing caps are simple prophylactic measures. A specialist's opinion should be sought for any painful, chronic ear problem.

DEHYDRATION

Any event involving prolonged physical activity carries the potential for dehydration. Levels of fluid loss as low as 2% of body mass can affect both mental and physical function.

Despite being immersed in an aquatic environment, open water swimmers are still exposed to the risk of fluid loss and potential dehydration. Endurance swimmers are mindful of the need to establish regular breaks for the replenishment of food and fluids. During long swims, techniques have been evolved to enable athletes to take frequent drinks and solid food from their support team. There are established procedures governing the permissible contact between swimmer and handler, and "feeding" from accompanying craft often entails bottled liquids or processed foods. Drink bottles and food on "paddles" are common techniques that comply with these regulations.

Open water swimmers should plan their nutritional requirements with the same scientific acumen as any endurance athletes. During ultra-endurance events exceeding 4 hours' duration, an account must be made for carbohydrate repletion as well as fluid losses. The potential for electrolyte imbalance, particularly hyponatremia, represents a critical concern. No less important is the need to replenish depleted blood sugar levels. The contemporary range of sports drinks offers open water swimmers fluid, electrolyte, and glucose requirements through any one of several commercial preparations. These are palatable products, effective during competition and for prolonged restoration of fuel and fluid balance after prolonged exertion.
FINA RULES FOR OPEN WATER SWIMMING

FINA has a legal responsibility for all open water swimming events conducted under its sanction. To this end there are several significant rules that regulate the safety of such events. They are clearly outlined in the FINA Handbook and include the following:

OWS 5.2 The course shall be in water that is subject to only minor currents or tide and may be salt or fresh water.

OWS 5.3 A certificate of suitability for use of the venue shall be issued by the local health and safety authorities. In general terms the certification must relate to water purity and to physical safety from other considerations.

The Safety Officer shall:

OWS 3.32 Be responsible ... for all aspects of safety related to the conduct of the competition.

OWS 3.36 In conjunction with the Medical Officer ... advise conditions unsuitable for staging the competition ... and make recommendations for the modification of the course.

The Medical Officer shall:

OWS 3.38 Inform local medical authorities of the nature of the competition and ensure that any casualties can be evacuated to medical facilities at the earliest opportunity.

OWS 3.39 Ensure that a medical inspection is made of each competitor ... and report any persons who in their opinion are unfit to compete.

CONCLUSION

Clearly, open water swimming has emerged as an aquatic discipline in its own right. Given the wide range of physical and environmental demands placed upon participants, there is a requirement for continuing medical interest in the sport. Despite these factors, the open water remains a lure to an increasing number of swimmers. The role of the physician is to ensure their safety.

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