THE RYA'S POSITION ON OFFSHORE RENEWABLE ENERGY DEVELOPMENTS: PAPER 3 (OF 3) – TIDAL ENERGY
MARCH 2012

Executive Summary

This paper sets out the RYA position in relation to the development of *offshore renewable tidal energy*. It is intended to enable developers accurately to take account of recreational boating concerns when developing their Environmental Statements and Navigational Assessments.

In summary, the RYA believes that the impact that offshore renewable tidal energy has on recreational boating can be minimised provided developers fully consider the following key points which are drawn from the paper below:

- **Collision risk**. The RYA believes that the collision threat to recreational yachts can be minimised by specifying:
    - A minimum underwater clearance of 4 metres below chart datum for submerged tidal energy converters, assuming flat water conditions. However, given the nature of these devices and the high tidal energy environments that they will be located in, the RYA proposes that an underwater clearance of 8 metres below chart datum would give an appropriate safety margin for submerged devices.
    - Appropriate location, charting and marking of devices.
    - Zoning of navigation in areas in close proximity to barrages and lagoons.

- **Marking and Lighting**. The RYA supports the guidance provided by the General Lighthouse Authorities and works with them to identify site specific issues that may occur.

- **Navigational and communication equipment**. Any proposed development should account for the effect on small craft navigation and communication equipment in detail.

- **Location**. Recreational routes, general sailing and racing areas must be accounted for when examining the impacts of offshore tidal energy developments. Barrages and lagoons should have convenient small craft locks created to facilitate safe transit.

- **Sailing and racing areas**. A tidal array, barrage impoundment or lagoon that encroached into a racing or sailing area would increase the risk of accidents occurring and could discourage visitors, therefore having the potential to have an adverse effect not only on the visitors but also on the local economy.

The Royal Yachting Association – who we are

The RYA is the national body for all forms of recreational and competitive boating. It represents dinghy and yacht racing, motor and sail cruising, RIBs and sportsboats, powerboat racing, windsurfing, inland cruising and personal watercraft. The RYA manages the British sailing team and Great Britain was the top sailing nation at the 2000, 2004 and 2008 Olympic Games.

The RYA is recognised by all Government offices as being the negotiating body for the activities it represents; as such, it takes an active role in influencing policy and has been a voice for recreational boating for more than a century.

The RYA currently has over 100,000 personal members, the majority of whom choose to go afloat for purely recreational non-competitive pleasure on coastal and inland waters. There are an estimated further 500,000 boat owners nationally who are members of over 1,500 RYA affiliated clubs and class associations.

The RYA also sets and maintains an international standard for recreational boat training through a network of over 2,200 RYA Recognised Training Centres in 20 countries. On average, approximately 160,000 people per year complete RYA training courses. RYA training courses form the basis for the small craft training of lifeboat crews, police officers and the Royal Navy and are also adopted as a template for training in many other countries throughout the world.

The RYA Position

The RYA supports the UK Government's and devolved administrations' efforts to promote renewable energy[1]. We note that it is Government policy that wind farms should not be consented where they would pose unacceptable risks to navigational safety after mitigation measures have been adopted[2]. We consider that a similar policy should be adopted in relation to tidal energy installations. Our primary purpose in engaging in consultation regarding the development of offshore energy developments is to secure navigational safety and to ensure that recreational boating interests are not adversely affected. As more issues have come to light, we have reviewed our position on offshore energy development. We recognise that some marine renewable schemes may provide opportunities to benefit recreational sailors, e.g. active breakwater types of power generation can provide areas of sheltered water.

This position paper sets out our concerns from a general perspective regarding tidal energy and should enable developers accurately to take account of recreational boating concerns in their environmental impact assessments. This paper is one of three position papers discussing renewable energy, with the other two addressing wind and wave energy.

In summary the concerns of recreational boating and offshore renewable energy developments relate to:

1. Navigational safety
    a. Collision risk
    b. Risk management and emergency response
    c. Marking and lighting
    d. Effect on small craft navigational and communication equipment

[1] The UK Renewable Energy Strategy 2009
[2] National Policy Statement for Renewable Energy Infrastructure (EN-3)

2. Location
    a. Loss of cruising routes and impact on offshore racing
    b. Squeeze into commercial routes
    c. Effect on sailing and racing areas
    d. Cumulative and ‘in combination’ effects

3. End of life
    a. Dereliction
    b. Decommissioning

4. Consultation

The MCA has developed guidance[3] on the issues that need to be taken into consideration when assessing the impact on navigational safety and emergency response (search and rescue and counter pollution) caused by offshore renewable energy installation developments, proposed for United Kingdom internal waters, territorial sea or in a Renewable Energy Zone beyond the territorial sea. The RYA expects this guidance to be used by offshore renewable energy developers seeking consent to undertake marine works. Furthermore, the RYA expects to be consulted on matters that may affect recreational craft during any type of assessment on proposed marine works.

Tidal devices

Tidal energy converters (TECs) capture energy carried by the tide. These types of devices, exploit the natural ebb and flow of tidal waters which are often powerful around the coast of the UK. The fast sea currents are often magnified by topographical features, such as headlands, inlets and straits, or by the shape of the seabed when water is forced through narrow channels. The tidal stream devices which utilise these currents are broadly similar to submerged wind turbines and are used to exploit the kinetic energy in tidal currents. Because water is far denser than air, turbine blades can be smaller and turn more slowly to deliver similar power output to wind turbines. There are many types of TECs and these can interact in different ways with recreational and other small craft.

Tidal Impoundment

The largest tidal power station in the world (and the only tidal barrage power station in Europe) is in the Rance estuary in northern France and has been generating 240MW per year since 1966. This barrage works like a hydroelectric scheme using the huge volumes of water flowing through the tidal estuary to drive turbines built into the barrage. Particularly on an ebb tide, the barrage traps water behind it releasing it slowly as it generates electricity.

Although there are a number of sites in the UK such as the Humber, Dee, Severn and Solway estuaries with enough tidal flow, estuaries are amongst the world’s most productive and sensitive ecosystems, and the flooding by these barrages may cause great disruption to their natural processes. The environmental impact is enormous and projects of this nature may struggle for approval. Developers have, therefore, been looking at other more environmentally friendly ways of capturing tidal energy.

Tidal Bridge

A variation of impoundment, tidal bridges are created by placing linear arrays of tidal turbines across waterways with significant tidal flows to form a bridge which can also be used to support road and rail links. Unlike impoundment, a tidal bridge does not require a flood pond but will create

[3] (MGN 371(M+F) Offshore Renewable Energy Installations (OREIs) - Guidance on UK Navigational Practice, Safety and Emergency Response Issues, MGN 372(M+F) Offshore Renewable Energy Installations (OREIs): Guidance to Mariners Operating in the Vicinity of UK OREIs.

a static and a kinetic head along the “upstream” or “flood” side of the tidal bridge that will range from one to two metres.

Submerged Turbines
Alternatively submerged turbines, modelled on wind turbine technologies, can be mounted underwater on the sea bed or estuary floor. There are a number of designs, some with horizontal axis and some with vertical axis turbines.

The European Marine Energy Centre (EMEC[4]) defines 4 main categories of TEC plus a fifth ‘catch-all’ category for designs that cannot be classified as belonging to one of the 4 main types:

Horizontal axis turbine: This device extracts energy from moving water in much the same way as wind turbines extract energy from moving air. Devices can be housed within ducts to create secondary flow effects by concentrating the flow and producing a pressure difference.

Cross-axis turbine:
- Vertical - This device extracts energy from moving in a similar fashion to that above, however the turbine is mounted on a vertical axis.
- Horizontal - This device is essentially a vertical cross axis turbine orientated horizontally. This turbine configuration allows for deployment in shallow water.

Oscillating Hydrofoil: This device consists of a hydrofoil attached to an oscillating arm, and the motion caused by the tidal current flow either side of a wing results in lift. This motion can then drive fluid in a hydraulic system to be converted into electricity.

Enclosed Tips (Venturi): By housing this device in a duct, it has the effect of concentrating the flow of water past the turbine. The funnel-like collecting device sits submerged in the tidal current. The flow of water can drive a turbine directly or the induced pressure differential in the system can drive an air-turbine.

Clearly, it is submerged devices located in shallower tidal streams around the UK coast that cause the RYA the most significant concern.

1 Navigational Safety

Prior to departure, mariners are required to make a passage plan based on assessments of weather, tides, limitations of the vessel and crew, and navigational dangers. Offshore renewable energy developments are an additional navigational hazard to the mariner. However, if sited sensitively, designed well and managed effectively these developments can satisfy the safety issues of concern to recreational boating.

Collision risk
The RYA believes that poorly designed tidal energy developments could pose a significant risk of collision to recreational craft. Navigation around well marked and clearly visible static hazards is a part of sailing. However, as is pointed out in MGN372, '*Unlike wind farms, systems using wave or tidal energy may not be clearly visible to the mariner.*' The consequences of collision with the mechanisms, particularly when parts are moving and when they are deployed as an array are serious.

[4] European Marine Energy Centre (EMEC), 2010. Available at www.emec.org.uk

The RYA believes that the threat to recreational yachts can be minimised by specifying:

- **a minimum underwater clearance of 4 metres below chart datum for submerged TECs, assuming flat water conditions. However, given the nature of these devices and the high tidal energy environments that they will be located in, the RYA proposes that an underwater clearance of 8 metres below chart datum would give an appropriate safety margin for submerged devices.**
- **appropriate location, charting and marking of devices**
- **zoning of navigation in areas in close proximity to barrages and lagoons**

The RYA has developed its position on minimum clearances on the available data. These data are taken from the Royal Ocean Racing Club (RORC) Rating Office's database. For more detail see the final section on *Developing RYA policy on minimum clearance depth*.

Risk management and emergency response

A particular issue with TECs is the risk of damage which may result in semi-submerged debris floating into areas where small vessels navigate. Vessels and lives have been lost through collision with shipping containers washed overboard and collision with TECs is likely to pose a similar risk. We recognise that this risk can be reduced by following industry standards and having effective maintenance and monitoring schedules.

Risk management provisions should be formulated from the results of a site specific risk assessment that accounts for small craft of less than 24m LOA recognising the significant differences between small and large vessels. This distinction is important when it comes to equipment and other requirements for small and large craft. Furthermore, it must be understood that the total number of vessels is not necessarily the important factor during any traffic survey; it is the number in the area during adverse conditions that may have the predominant impact on hazard and risk. Guidance was developed in 2005 to outline the requirements for assessing the navigation impacts of offshore wind farms[5]; however, TECs present a different set of hazards.

For recreational craft, such an assessment should take into account the following parameters:

- The number, size and type of local vessels
- The number, size and type of national and international vessels
- Annual events that are not covered in a short term monitoring
- Wave height and sea state conditions
- Seasonal variations including weather conditions
- Proximity to ports of refuge
- Physical impoundment barriers created by barrages and lagoons
- A range of possible incidences including loss of propulsive power and failure of navigational systems

Risk assessment consists of an objective evaluation of concrete and potential hazards and subsequent evaluation of any associated risks, during the assessment, assumptions and uncertainties must be clearly considered and presented. Part of the difficulty in risk management is that measurement of both of the quantities in which risk assessment is concerned - potential loss and probability of occurrence - can be very difficult to measure and the chance of error in measuring these two concepts is large.

As the number of vessels using an area varies with the season, any monitoring should be carried out in the high season. However, it is not the number of vessels passing through an area that is

[5] Guidance on the Assessment of the Impact of Offshore Wind Farms: Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms. 2005. DTI.

important but the number passing through in adverse conditions. Moreover, local vessels will quickly gain experience of tidal energy arrays and the biggest risks are likely to be to visitors.

General information on areas is given in the *UK Coastal Atlas of Recreational Boating* (mentioned later) and RYA can provide additional more detailed information about particular sites on request. The degree of hazard will vary according to the type of device. Some types are no more hazardous than existing reefs and buoys. The major hazards are likely to be from TECs located near to the surface.

Experience learned from wind farms should be factored into any navigational risk assessment to provide an accurate and realistic predicted level of risk and to enable proportionate and practical measures to be implemented where a risk is shown to be intolerable. Local weather conditions must be examined in the risk assessment and measures to reduce the effects of poor weather conditions, low visibility, and fog should be included in the risk management plan. By their nature, tidal energy arrays will be located in areas where tidal streams are expected to be powerful which has a significant effect on speed over the ground making small craft navigation more challenging.

In order to effectively manage the risk of a vessel in distress drifting towards a tidal energy array, there needs to be an effective *Emergency Response System* in place. This will require the ability to shut down the moving parts when an emergency call is reported. In some cases, where traffic is high, a stand-by safety vessel may be required.

Safety zones

The RYA's opinion is that the creation of a safety zone around a tidal energy array by itself is not effective mitigation of the hazard, as the nature of these arrays means that it is easy to breach the zone inadvertently. In principle the RYA has no objection to the creation of *advisory or precautionary zones* but such zones must be designed and implemented on a case-by-case basis and with due respect to the right of navigation. The RYA believes that the purpose of any *advisory or precautionary zones* should be to warn vessels to navigate with particular caution but they should not permanently restrict navigation or exclude recreational vessels. It is however recognised that this may be necessary in the case of large barrages with large commercial vessel locks.

In our view, such a restriction on the small craft's right of navigation is not justifiable in terms of safety alone and it must be recognised that there is little possibility of enforcing such zones. In some locations, a safety zone may increase risk of collision if small craft are consequently forced to use commercial shipping lanes.

The RYA does, however, foresee occasions when it may be prudent to impose short-term temporary restrictions, for example during engineering, maintenance or construction works. Such temporary restrictions should be promulgated through Notices to Mariners and locally. When conditions become hazardous to small craft, consideration should be given to broadcasting a securité message on VHF channel 16. Many vessels visit the UK from continental Europe and this should be taken account of in any communication.

Cables and anchoring

In emergency situations arising in wind and wave farms, it may be perfectly possible to safely anchor a drifting vessel to ensure no damage is done provided that cables are buried to a sufficient depth to avoid being uncovered. However, it would appear to the RYA that anchoring in a tidal energy array is not an option as there will be unseen rotating components below the surface that could 'snag' anchors and anchor cables.

Marking and lighting

The requirements for marking and lighting offshore energy installations should be consistent with IALA requirements and guidelines. This has been achieved for offshore wind and should be replicated for wave and tidal devices. There appear to be no precedents that can be drawn on from around the world.

IALA Recommendation O-139 on *The Marking of Man-Made Offshore Structures* was written before the advent of tidal or wave farms. Some types of device can be marked in the same way as existing offshore hazards but there is as yet no experience with large scale TEC arrays. Clearly submerged TECs will remain unseen no matter how benign conditions are and the RYA therefore strongly supports the need for stakeholders to work with the General Lighthouse Authorities to develop appropriate guidelines for marking TECs by day and by night.

The RYA supports the guidance provided by the General Lighthouse Authorities and works with them to identify site specific issues that may occur.

Charting tidal energy arrays

Unlike wind farms, submerged TECs will be difficult if not impossible to see from the height of eye in a small vessel. Effective charting of tidal energy arrays is thus essential. However, charts used by the majority of recreational sailors are updated less frequently than Standard Navigational Charts and there is no easy way to amend electronic charts until a new edition is published. For that reason it is important that information about tidal energy arrays is widely promulgated, for example at marinas and harbours from which departing vessels might navigate near the tidal energy site, and by publishing information in the relevant pilot guides, almanacs and sailing directions. With the increasing reliance on electronic navigation there is also concern about the vulnerability of Global Navigation Satellite Systems. The General Lighthouse Authorities are promoting eLoran to allow users to retain GNSS-levels of navigational safety even when satellite services are disrupted but these are still in the trial stage.

Effect on small craft navigational and communication equipment

TECs are unlikely to have an adverse effect on VHF, GPS and mobile phone reception, although large quantities of steel, cabling and the transmission of electrical power may interfere with magnetic compasses. Submerged TECs will be undetected on radar unless marked by Racons. This causes particular concern when large developments are sited close to commercial shipping lanes and recreational craft may be squeezed between the lane and the tidal energy array.
However, the effect of farms of attenuators on radar clutter and thus the visibility of small craft to large or search and rescue vessels is unknown. This causes particular concern when large tidal developments are sited close to commercial shipping lanes and recreational craft can be squeezed between the lane and the tidal energy array.

Any proposed development should account for the effect on small craft navigation and communication equipment in detail.

2 Location

The location of offshore energy installations may well lead to the potential loss of amenity for recreational craft. It should also be noted that commercial routes and shipping lanes do not represent those routes taken by the vast majority of recreational craft. The RYA, has collated recreational routes into the *UK Coastal Atlas of Recreational Boating* which is available from the RYA. The lines in the atlas represent corridors of varying width that are used as cruising routes. In addition, the atlas marks sailing areas, racing areas and the location of marinas, RYA affiliated clubs and RYA Recognised Training Centres. The *UK Coastal Atlas of Recreational Boating* should be used to inform decision making when planning the location of offshore energy developments. When writing an Environmental Statement, local knowledge should be sought through the RYA.

Recreational routes, general sailing and racing areas must be accounted for when examining the impacts of offshore tidal energy developments. Barrages and lagoons should have convenient small craft locks created to facilitate safe transit.

Loss of cruising routes and impact on offshore racing

When examining the routes and location of tidal devices it is important to recognise that sailing boats behave differently to power driven craft and that their actual line of travel may 'zigzag' across their intended direction of travel upwind as they are dependent on the wind direction. The *UK Coastal Atlas of Recreational Boating* should be consulted together with other available information to inform the siting of the developments and individual installations and the potential provision of navigation routes through the larger sites.

Along many stretches of coast, recreational craft may need to seek shelter in poor weather. Sheltered harbours and anchorages and routes to these harbours of refuge should be protected. These are identified as essential routes in the Coastal Atlas.

The loss of routes will also lead to an increased distance of travel. This has environmental implications for powered craft and safety implications for all craft. Some routes, typically narrow channels or strong tidal flows, may already be hazardous at times to navigate through and creating additional obstacles in these areas may seriously compromise navigational safety.

Squeeze into commercial routes

Recreational routes differ from commercial routes as recreational craft essentially aim to keep out of the major commercial navigation routes by travelling in the shallower adjacent waters or taking entirely different routes. As a result, the examination of commercial routes through AIS plotting alone will not ensure the safe positioning of OREIs; recreational boating must also be taken into account when assessing the impact on navigational risk. This may require routes through large developments to be identified or inshore routes for smaller craft to be safeguarded, particularly where there is a farm of one type of tidal device close inshore and another of a different type further out. Marking the channel rather than the farms should be considered. The cumulative impact of all marine developments is becoming increasingly important when assessing these issues of squeeze.

Effect on sailing and racing areas

Most of the general day sailing and racing areas are close to the shore and in sheltered waters. The Netherlands and Germany have already excluded any development within 12nm of the shore in order to retain 'open space' for its amenity and recreational value. Recreational activity is important to the health and wellbeing of the community as well as providing economic support for the local coastal economies. Retaining the undisturbed remoteness of some waters will be important in terms of its wilderness and amenity value.

A tidal array, barrage impoundment or lagoon that encroached into a racing or sailing area would increase the risk of accidents occurring and could discourage visitors, therefore having the potential to have an adverse effect not only the visitors but also on the local economy.

Cumulative and in-combination effects

As a result of the large increase in the number and scale of projects, it has been recognised that the cumulative effects of offshore wind projects have potential implications for small and large craft alike. Existing and future offshore wind farms developed by other EU Member States may also add to the cumulative effects. There is an awareness that the intended development of offshore tidal arrays could also lead to in-combination effects (effects arising from these developments with other activities; e.g. wind and wave renewable installations, fishing and offshore oil and gas activities and those associated with UK and European Marine Protected Areas, including Marine Conservation

Zones) that might impact all mariners. The *cumulative and in-combination effects* of offshore energy installations on navigation routes will be increasingly significant and must be taken into account in future siting proposals and plans.

3 End of Life

Dereliction

Whilst we would hope that these installations remain economically viable for the lifetime of the structures, the RYA would support measures taken by Government to secure the financial provision for removing the structures, prior to consents being given. This will ensure that after the installation ceases to produce electricity for whatever reason, derelict structures that are not marked or lit and remain a hazard to navigation or anchoring are removed from UK waters.

Decommissioning

Equally, any decommissioning plan needs to ensure that the structures are completely removed. Any parts of the structure remaining after the commercial operation of the installation may pose a hazard to navigation and should be avoided. However, we recognise that secondary uses may be identified for these structures once energy generation ceases. If structures are to remain in the water, navigational safety must be taken into account and structures should be appropriately marked and lit.

4 Consultation

The RYA's main office in Hamble is a primary point of contact for matters concerning the development of Offshore Renewable Energy Installation sites and the recreational boating sector. Throughout the English regions, RYA Hamble maintains a network of Regional Planning and Environmental Co-ordinators (RPEC) who are able to provide more detailed site specific information for developments that fall within an RPEC's area of responsibility. Developers may find this a useful resource for timely site specific information, particularly at the start-up of any project.

In addition, the RYA's main office maintains close links with its Scottish, Welsh and Northern Irish offices, which work with the relevant jurisdictions and they can provide detailed site-specific information in the same way as the RPECs do for England.

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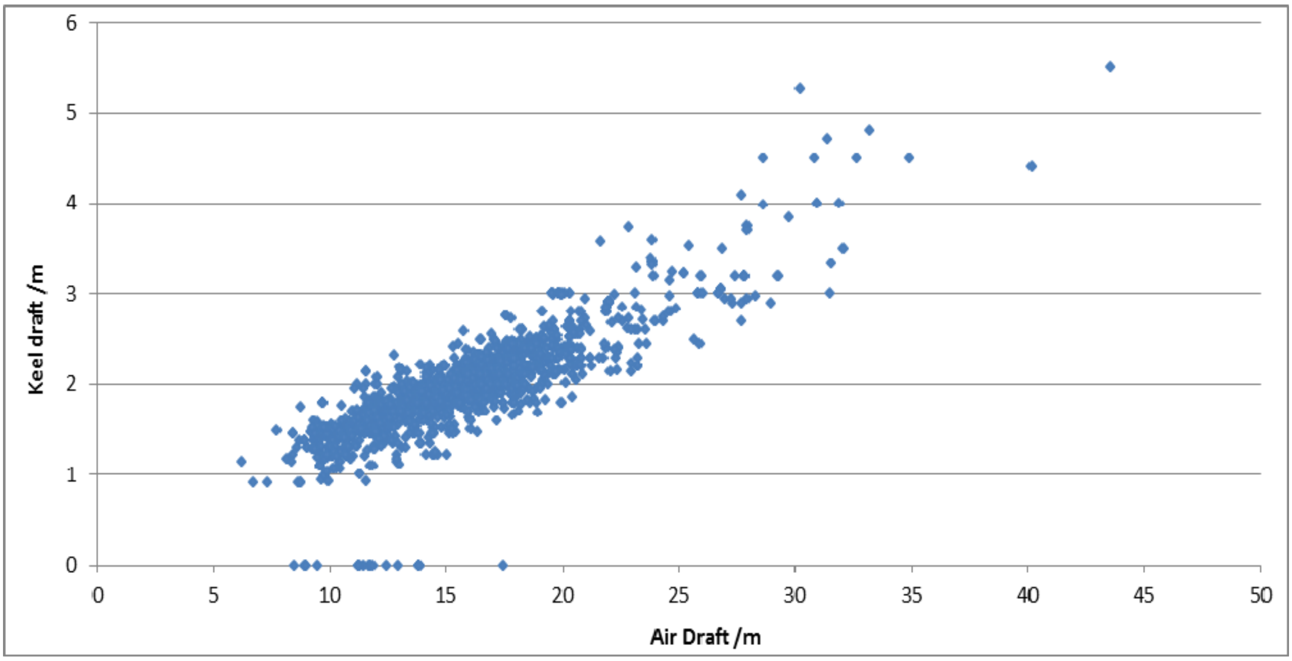
Development of the RYA policy on minimum clearance depth

The RYA originally developed its position on clearance depth on the available data in 2003. This was based on data taken from the Royal Ocean Racing Club (RORC) Rating's Office database which is representative of the types of yachts that are found in common use in UK Waters. Since then the 'Arkenford' survey[6] carried out by Arkenford, a market research and modelling company, has shown that usage and participation data have remained remarkably stable, which would suggest that the data used for development of the RYA policy on minimum clearance is still valid. The graphs shown below are based on RORC data from 2011.

Although there are other rating systems in use, the RORC system is widely accepted and applied worldwide. Rating is a technical handicapping process that enables adjustments to be made to yacht racing results so as to allow a wide range of different boats to be raced on equal terms. The boats contained in the database are mainly cruisers and yachts. Many yachts taking place in club races are registered with the RORC Rating Office. The RYA believes this data, containing in excess of 2500 records, is a good representation of the type of yacht to be found sailing around the shores of the UK. Although the total number of yachts around the UK has not been specifically quantified because there is no single database that records this information, it is estimated that this represents more than 6% of the total number of boats owned in the UK according to the data on boat ownership and usage supplied by Arkenford and by the British Marine Federation.

The graph below illustrates the range of keel drafts, i.e. the depth of water required for clearance below the vessel's keel, of the yachts registered on the RORC database (Figure 1). Figure 1 shows that the vast majority of yachts have a keel draft of 3 metres or less. Allowing for a safety margin, therefore, the RYA specifies a minimum underwater clearance of 4 metres below Chart Datum to provide a tolerable level of risk.

Figure 1: Graph showing the relationship of keel draft in metres and air draft in metres of the IRC fleet (data collected 2009-2011, sample size = 2543)



6 Annual Watersports and Leisure Participation Survey carried out on behalf of RYA, BMF, MCA and RNLI