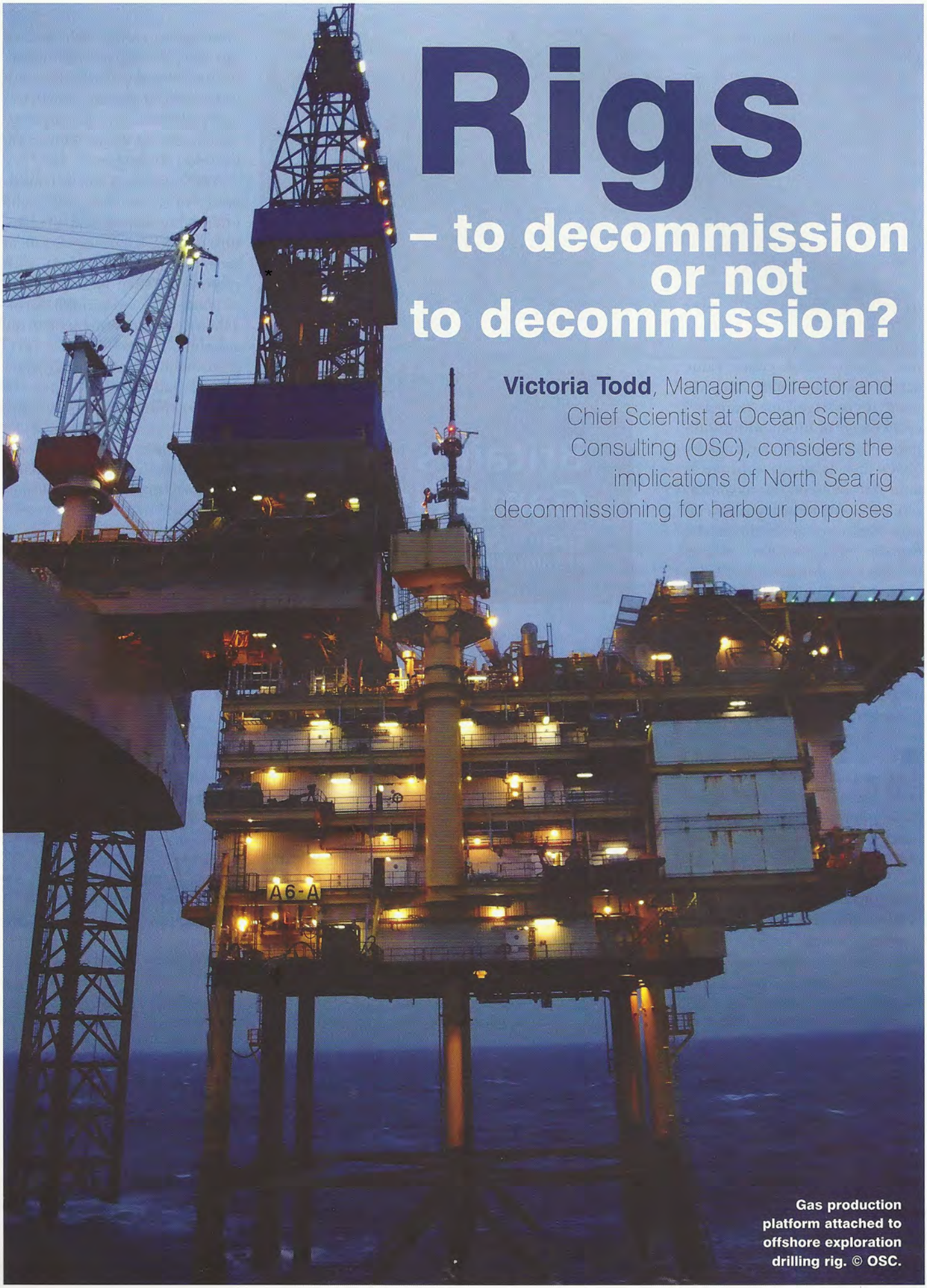

Rigs
– to decommission or not to decommission?

Victoria Todd, Managing Director and Chief Scientist at Ocean Science Consulting (OSC), considers the implications of North Sea rig decommissioning for harbour porpoises

Gas production platform attached to offshore exploration drilling rig. © OSC.

Whether 'tis nobler in the mind to suffer the slings and arrows of outrageous fortune, or to take arms against a sea of troubles. The dilemma Hamlet faced in the 1600s is strikingly similar to the one faced today by oil and gas companies, regulators, policy-makers and Non-Governmental Organisations (NGOs) when it comes to decommissioning offshore oil and gas installations at the end of their operational lifetimes. There is no doubt that the 'outrageous fortune' generated by oil and gas firms sustains the economy, drives industry and fuels technological progress, but what happens after reserves are spent and the 'sea of troubles' manifest themselves potentially as environmental consequences thereafter?

Marine life encrusting a North Sea jack-up rig. © OSC.

Waning oil and gas reserves

In recent years, larger firms, such as BP, have been selling waning and unprofitable North Sea fields to smaller and more specialised oil and gas firms able to extract the remaining reserves more cost-effectively. In the long term, however, the prospect of unknown and potentially spiralling costs to retire North Sea oil and gas installations is discouraging smaller firms from bidding for older fields, which, in turn, is threatening the development of the region's remaining resources and increasing the likelihood of North Sea decommissioning.

Decommissioning

Offshore rig-decommissioning is a very complicated, multidisciplinary, costly and energy-consuming process, involving about eleven discrete phases: initial project management, engineering and planning, permitting and regulatory compliance (including environmental impact assessment), installation preparation, well plugging and abandonment, conductor removal, mobilisation and demobilisation of derrick barges, installation removal, pipeline and power cable decommissioning, materials disposal and site clearance. In the well-developed fields of the Gulf of Mexico (GoM), it can cost operators up to $10 million to decommission a single platform. In the North Sea, however, there is currently little history of decommissioning. According to the trade organisation Oil & Gas UK: 'the total cost of decommissioning existing and sanctioned infrastructure [is likely] to be £28.7 billion from 2012 onwards. If all potential developments currently reported to Oil & Gas UK were also to be developed, this sum could rise to £35.9 billion and there would be decommissioning activity in the UKCS as late as 2060'.

Harbour porpoise around a drilling rig. © OSC.

Rigs-as-reefs

One controversial solution is to convert offshore oil and gas drilling rigs and production platforms (known collectively as 'installations') into artificial reefs for wildlife. The three-dimensional structures of bottom-founded installations extend vertically down the entire water column, and are effective in aggregating benthic, demersal and pelagic fish, along with a great diversity of other marine life. Moreover, in the North Sea, commercial fishing is not permitted within a 500m exclusion zone around each installation, further enhancing the properties of these 'reefs' as refuges for marine life.

In 1986, the US National Marine Fisheries Service (NMFS) developed a Rigs-to-Reef (RTR) policy in the Gulf of Mexico based on the creation of artificial reefs from decommissioned offshore installations left in situ. Those rigs now support thriving fisheries industries, and are supported largely by various marine stakeholders.

The RTR concept has not been implemented in the North Sea, yet there have been a few isolated studies there to show that, for fish at least, it is a viable concept. Fishers are observed regularly trawling marine life overspill from the near-vicinity of installations, but also occasionally opt for the more risky strategy of deploying gear within the exclusion zone (usually at night, to avoid detection by installation personnel), where nets can be snagged on subsea structures. Clearly, the benefits of fishing around installations outweigh the obvious risk of losing fishing gear or worse.

Worldwide, RTR studies have focused mostly on quantifying aggregations of marine life such as fish and invertebrates. Since 2004, however, scientists at OSC have been undertaking research into the potential of offshore installations as foraging habitats for marine mammals. It is entirely conceivable that areas in the near vicinity and between the legs of such structures serve as reefs for potential prey of cetaceans such as harbour porpoises (*Phocoena phocoena*) in otherwise significantly overfished or disturbed parts of the North Sea.

Deploying a T-POD from a jack-up rig in 2004. © OSC.

Rig noise

Offshore oil and gas installations generate underwater sound and vibration from a plethora of activities such as operational machinery, drilling, conductor hammering, associated shipping, diving and ROV operations. Using a variety of hydrophone systems optimised to record over a broad frequency range, OSC undertook proximate measurements of acoustic emissions associated with installation and operation of exploration jack-up drilling rigs in the North Sea. Sound Pressure Levels (SPLs) generated by rigs were similar to published studies of measurements from other metal-legged bottom-founded rigs, both in level (120dB re 1 Pa) and in frequency range of dominant tonals (2–1400Hz). The rigs' high frequency SPLs drop rapidly above 8kHz (doi: 10.1007/978-1-4419-7311-5_104).

Harbour porpoises

Like many other odontocetes (toothed whales), harbour porpoises not only have excellent underwater hearing, but also use sound actively for navigation, communication and prey capture (echolocation). Porpoises produce sound on average every 12s in the form of short ultrasonic clicks (130kHz peak frequency, 60–300μs duration) which makes them ideal candidates for acoustic monitoring. Of relevance to offshore drilling, it is important to note that porpoise vocalisations are some five orders of magnitude higher than the lower frequencies produced by drilling rigs; therefore, while porpoises can almost certainly hear some rig activities, the dominant drilling sounds are unlikely to cause any hearing discomfort or mask the main frequencies that porpoises utilise for routine foraging activities.

Porpoise activity around installations

Since 2004, OSC has been making both visual and acoustic observations of porpoises from jack-up rigs on-tow to various locations around the North Sea. Initial results indicate the animals may be following rigs as they

Three tonne buoy used to moor T/C-PODs at a control location in the open sea. © OSC.

move from location to location. Moreover, recordings taken by autonomous underwater click detectors (T and C-PODs) show that porpoises are detected invariably less than two minutes after a jack-up's legs have touched the sea floor (which actually represents the time taken to deploy these instruments), further supporting the possibility that animals remain with rigs as they relocate. Longer-term T/C-POD acoustic studies from stationary rigs and platforms have shown that there is always a pronounced diel (24-hr) pattern in echolocation activity. Of interest is that the number of porpoise acoustic encounters (visits) are greater at night than during the day, and a greater proportion of those clicks at night are likely associated with feeding behaviour (doi: 10.1093/icesjms/fsp035).

The crucial issue is whether these animals are targeting rigs as feeding stations compared to the open sea. Scientists at OSC therefore recently placed PODs around another jack-up rig and at a control (open-ocean) location away from the rig and, unsurprisingly, recorded greater acoustic activity of porpoises around the rig compared to the open sea. While the results are only preliminary at this stage (and would require replicated studies to put the theory to bed), there is now reasonable evidence to suggest that porpoises rely on rigs as feeding stations compared with other areas.

Will decommissioning affect porpoises?

This research has only considered the potential effects of operational rigs and platforms on porpoises in the North Sea; however, based on research to date, scientists at OSC believe strongly that for porpoises, cleaning-up and leaving installations in situ at the end of their operational lifetime would be beneficial. Installation removal could potentially reduce temporo-spatially predictable and protected feeding stations for porpoises.

While the peer-reviewed scientific community has advocated this research, the oil and gas industry has remained strangely silent on the subject,* and further research funding has been withdrawn.* Oil and gas companies have also not promoted the results in any of their press releases or newsletters, despite worldwide press coverage of the research outside the industry. Additionally, the Convention for the Protection of the marine Environment of the North-East Atlantic (the 'OSPAR Convention') – the body responsible for rig-decommissioning in the North Sea – have also been slow to take-up the results. As a result, despite this, and other North Sea rig research studies, there is currently no movement in the direction of an RTR programme the North Sea.

The general reticence of these organisations to promote this research may well be because of their chequered history with various NGOs, many of which argue that artificial reefs alter the seabed from one type of 'natural' habitat to another; however, the majority of shallow-water North Sea rigs are located in fisheries trawling zones, where the scoured seabed can no longer be considered as natural habitat anyway. Of further discussion is the issue of who pays and manages decommissioned installations after they are converted into reefs; however, the legislation has already been thrashed-out in the GoM, so these problems are not unsolvable for a North Sea RTR programme.

Considering past effects of overfishing in the North Sea and elsewhere, scientists at OSC believe that this research needs to be addressed whenever offshore installations reach the end of their operational lifetime and decommissioning is scheduled. Porpoises are threatened currently with unsustainable rates of fisheries bycatch, pollutant accumulation in tissues and starvation due to overfishing of their prey species. Furthermore, as a recent article in this journal pointed out ('Marine Conservation Zones – the £47,000 question', Marine Scientist Nov/Dec 2012), hardly any UK waters have been set-aside as marine conservation zones. Offshore installations, therefore, may well be the last vestiges of hope as feeding oases for harbour porpoises in the North Sea. ◎

*Since publication, there has been a press release on the research from the client
**Further funding has now been obtained, and studies are ongoing