Fifty years after the wreck of the *Torrey Canyon*

The work of the Marine Biological Association of the UK on acute impacts and subsequent recovery

The *Torrey Canyon* was wrecked on 18th March 1967 on the Pollard Rock of the Seven Stones reef, 15 miles (25 km) from Land's End, Cornwall, UK (Figure 1). The 970 foot (300 m) tanker was bound for oil refineries at Milford Haven with 117,000 tons of Kuwait crude oil. She struck the rocks at 17 knots, tearing open six of her 18 storage tanks and less severely damaging the others. Salvage attempts failed. The ship progressively broke up over the next six weeks due to storm damage and bombing on the 28th, 29th and 30th March in an attempt to burn up the oil. She finished a submerged, broken wreck, being officially declared to contain no more oil towards the end of April 1967.

At the time, the *Torrey Canyon* oil spill attracted much media attention and political intervention. The Prime Minister at the time, Harold Wilson, took a personal interest. He had a holiday home on the Isles of Scilly, seven miles to the southwest of the wreck. It was also the first spill involving the first generation of super-tankers. Furthermore, it was treated – excessively in many instances – by the first generation of dispersants. These were in effect industrial cleaning agents – euphemistically called detergents at the time (e.g. Smith 1968). More damage was done by the dispersant applied (10,000 tons) than by the oil itself (14,000 tons) that came ashore in west Cornwall.

All the staff of the Marine Biological Association of the UK (MBA) were mobilised to deal with the environmental impacts of the spill for six weeks (Smith 1968). The MBA's research vessel *Sarsia* was on the scene within a week or so after the wreck. MBA staff members Alan and Eve Southward were subsequently involved in long-term studies of recovery of rocky shores for the next ten years or so (Southward 1979, Southward and Southward 1978), continued in concert with Steve Hawkins since 1980 at one of the worst affected shores – Porthleven (Hawkins et al. 1983, Hawkins et al. 2002, Hawkins and Southward 1992, Hawkins et al. in press, in prep.) and more recently (since 2002) with Nova Mieszkowska.

A network of shores had been studied in the southwest of England for over a decade before the spill (Southward 1967), primarily to understand the influence of climatic fluctuations on intertidal species, particularly barnacles (Southward and Crisp 1954, 1956). These observations were subsequently maintained by the Southwards (e.g. Southward 1991, Southward et al. 1995) and continued by Steve Hawkins, Nova Mieszkowska and co-workers (e.g., Hawkins et al. 2003, 2008, 2009, Mieszkowska et al. 2006, 2014a,b, Mieszkowska and Sugden 2016) (Fig. 1). The trajectory of recovery following the *Torrey Canyon* oil spill was determined by interaction with climate fluctuations and other sources of chronic pollution such as Tributyltin from anti-fouling paints (Bryan et al. 1986, Spence et al. 1990).

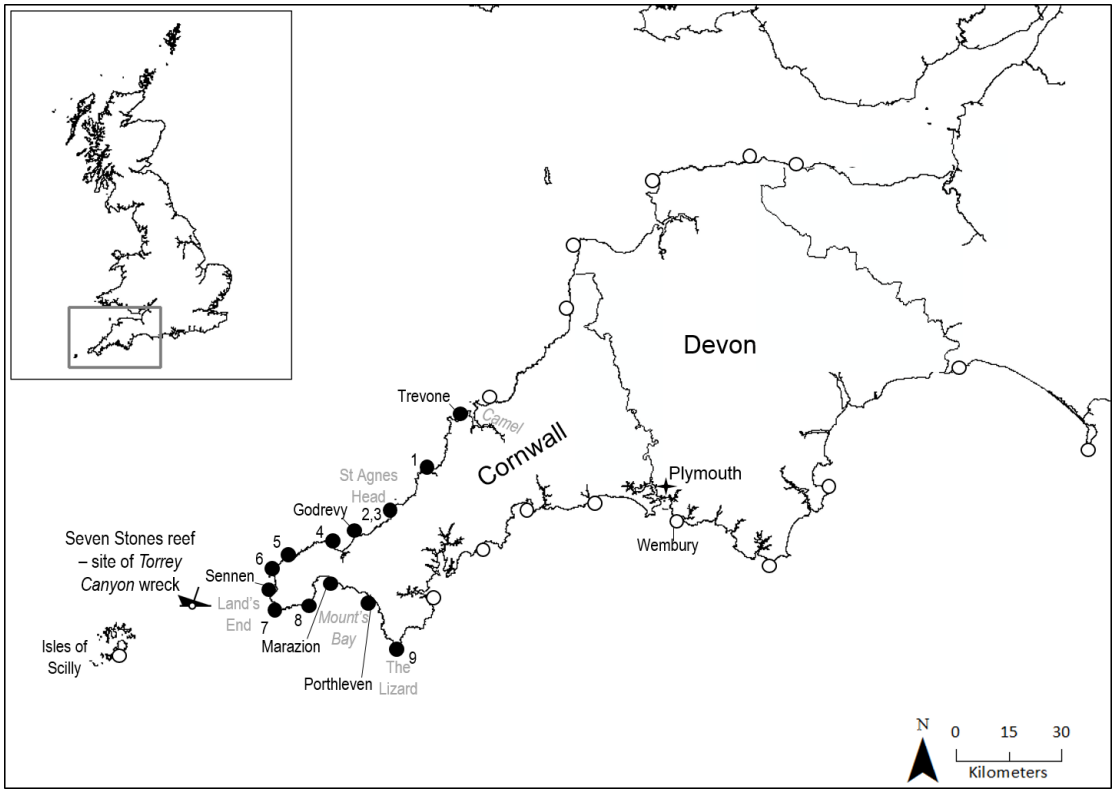

Figure 1: Long-term study sites in southwest England monitored since the 1950s by A. J. Southward and E. C. Southward, and more recently by S. J. Hawkins and colleagues from the MBA. Closed circles represent sites affected by the Torrey Canyon oil spill and clean-up operation. Open circles represent sites not affected by the incident.

Highly toxic dispersants, mainly BP1002 (Smith 1968), with several other proprietary products were also used. All contained between 66-85% organic solvent with a high proportion of aromatics (up to 85%), a surfactant (often an ethylene oxide condensate) and a stabilizer such as coconut oil diethanolamide (Smith 1968). The armed forces had been mobilised to deal with the oil coming ashore. The priority was to preserve the amenity value of the seashores around Cornwall, one of the UK's premier tourist destinations. There was much less concern about the consequences for marine life.

The dispersants killed the dominant grazer, limpets of the genus *Patella*, leading to massive subsequent colonisation by algae. The resulting canopy of fucoid algae ("rockweed" or "wrack") facilitated dense recruitment of limpets. These subsequently grazed the seaweeds down, before the starving limpets largely died off after migrating across the shore in search of food. This reduction in limpet numbers and grazing pressure then prompted a further bloom of algae. There was then a return to normal levels of fluctuations charted from the mid 1980s to date. At Porthleven sustained observations over five decades (1967-2016) revealed when return to the typically observed range of natural patchiness and fluctuations on rocky shores occurred after 13-15 years. In stark contrast, the shore at Godrevy that received no treatment by dispersants, recovered within two to three years. There was no major flush of ephemeral algae followed by massive fucoid recruitment. The shore swiftly returned

to normal appearance (Southward and Southward 1978, see also Hawkins et al. in press Marine Pollution Bulletin).

In subsequent spills, dispersants have been used largely at sea and much more sparingly on shores and in a more targeted and proportional manner (Table 2). Dispersants in use have increasingly been improved to become much less toxic than those used in 1967. What certainly emerged during the *Torrey Canyon* oil spill itself, and subsequently, is that on most wave-exposed rocky shores letting nature take its course and relying on natural dispersal by waves and microbial degradation ("doing nothing") is usually the best option.

Contact details:

Guy Baker

Prof Steve Hawkins – S.J.Hawkins@soton.ac.uk; + 44 777 5801853

REFERENCES

Hawkins, S.J., Gibbs, P.E., Pope, N.D., Burt, G.R., Chesman, B.S., Bray, S., Proud, S. V., Spence, S.K., Southward, A.J., Langston, W.J., 2002. Recovery of polluted ecosystems: the case for long-term studies. Mar. Environ. Res. 54, 215–222. doi:10.1016/S0141-1136(02)00117-4.

Hawkins, S.J., Southward, A.J., 1992. The Torrey Canyon oil spill: recovery of rocky shore communities, in: Thayer, G. (Ed.), Restoring the Nation's Marine Environment. Maryland Sea Grant College, Maryland, USA, pp. 583–631.

Hawkins, S.J., Sugden, H.E., Mieszkowska, N., Moore, P.J., Poloczanska, E., Leaper, R., Herbert, R.J.H., Genner, M.J., Moschella, P.S., Thompson, R.C., Jenkins, S.R., Southward, A.J., Burrows, M.T., 2009. Consequences of climate-driven biodiversity changes for ecosystem functioning of north European rocky shores. Mar. Ecol. Prog. Ser. 396, 245–259. doi:10.3354/meps08378.

Mieszkowska, N., Burrows M., Pannacciulli, F. & Hawkins, S.J,. 2014. Multidecadal signals within co-occuring intertidal barnacles Semibalanus balanoides and Chthamalus spp. linked to the Atlantic Multidecadal Oscillation. Journal of Marine Systems 133: 70-76.

Mieszkowska, N., Sugden, H. Firth, L. & Hawkins, S.J. 2014. The role of sustained observations in tracking impacts of environmental change on marine biodiversity and ecosystems. Philosophical Transactions of the Royal Society A, http://dx.doi.org/10.1098/rsta.2013.0339.

Smith, J.E., 1968. Torrey Canyon pollution and marine life: a report by the Plymouth Laboratory of the Marine Biological Association of the United Kingdom. Cambridge University Press, Cambridge, UK.

Southward, A., 1979. Cyclic fluctuations in population density during 11 years recolonisation of rocky shores in West Cornwall following the Torrey Canyon oil spill in 1967, in: Naylor, E., Hartnoll, R. (Eds.), Cyclic Phenomena in Marine Plants and Animals. Pergamon Press, Oxford, UK, pp. 85–92.

Southward, A., Southward, E., 1977. Distribution and ecology of the hermit crab Clibanarius erythropus in the Western Channel. J. Mar. Biol. Assoc. United Kingdom 57, 441–452.

Southward, A.J., Southward, E.C., 1978. Recolonization of rocky shores in Cornwall after use of toxic dispersants to clean up the Torrey Canyon spill. J. Fish. Res. Board Canada 35, 682–706. doi:10.1139/f78-120.

Southward, A.J., Southward, E.C., 1988. Disappearance of the warm-water hermit crab Clibanarius erythropus from south-west Britain. J. Mar. Biol. Assoc. United Kingdom 68, 409–412. doi:10.1017/S0025315400043307.