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Safety networks: fishery barometers and the outsourcing of judgement at the early Meteorological Department

SARAH DRY*

Abstract. In 1854 Admiral FitzRoy, acting as the first head of the Meteorological Department of the Board of Trade, initiated a project to distribute fishery barometers to poor fishing communities. Over the next eleven years until his untimely death in 1865, FitzRoy oversaw the distribution of dozens of barometers. The distribution continued after his death and many of the original barometers are still in place. FitzRoy's tenure at the Met Department is today remembered for his innovative and controversial development of weather forecasts, the first of their kind in Britain, which were telegraphed to coastal towns to warn of impending storms. Against the backdrop of this dramatic attempt to predict the weather using the tools of telegraphy and synoptic mapping, the barometer distribution project looks like an unexceptional piece of administration, a routine shuttling of correspondence and instruments. Closer inspection reveals a case study in Victorian governance that shows how individuals could contribute to elite forms of science by remaining independent of them in key respects. Rather than providing disciplined and trustworthy registrations of nature's language, the fishery barometers distributed by FitzRoy and the Met Department were explicitly excluded from the wider project to map British and global weather. By being thus excluded, they helped augment the autonomy of their intended users, the poor fishermen who were thereby made into better, more independent, interpreters of the Met Office forecasts. By revealing the potential for an instrument to be useful when not registering, this episode suggests that instruments could augment as well as replace the autonomous judgements of individuals.

The limits of experts

Most Victorian fishermen were illiterate. When writing to request a fishery barometer from the newly established Meteorological Department of the Board of Trade (Met Department), the men of Britain's poorest communities relied on a local gentleman to draft and write the letter; many signed their names only with a simple mark. When these letters were received at the government office in Whitehall, they were submitted to an efficient system of review and annotation. In the standard manner, Admiral Robert FitzRoy, the newly appointed head of the office, turned down a corner of the letter, on the back of which he noted to a secretary that the request should be acknowledged and, usually, an instrument supplied. Next to his notes the secretary duly recorded the date at which a barometer would be sent.

* Department of History, University of Sussex, Falmer, Brighton, East Sussex, BN1 9SH, UK.
Email: s.c.dry@sussex.ac.uk.

Petitions such as these represent a rare point of contact between a group of poor and uneducated fishermen, largely unable to write, and the new government office, preoccupied with written records of its own business and of the weather. This article assesses the context in which illiterate fishermen came into contact with Whitehall administrators: a project to supply fishery barometers to Britain's poorest fishing communities. In particular, it focuses on the fulcrum between these two worlds, the fishery barometer itself, an instrument that both FitzRoy and the fishermen believed could contribute to the safety of men at sea. Equipped with an easy-to-read porcelain scale and protected in a sturdy oak case, the fishery barometer was designed to survive a life of public exposure on the roughest parts of Britain's coasts. By faithfully observing the rises and falls of the barometer, local fishermen would be able to predict storms that might have otherwise taken them by surprise, keeping them safe in harbour when the worst of the weather hit. Significantly, fishermen were not encouraged to record the rise and fall of the mercury in these barometers. Unlike the standardized marine barometers that the Met Department distributed by the hundreds to Royal Navy and merchant marine ships, fishery barometers were not needed or intended to supply registrations to the central office. While the Met Department was obsessed with gathering the recorded traces of rainfall, pressure and temperature it was believed would eventually provide the key to the laws of weather, fishermen and their barometers were to be kept separate from that endeavour. But rather than simply diminishing the authority of such poor and powerless citizens as these illiterate fishermen, the fishery barometer project in fact served to heighten their autonomy. In so doing, it helped make them into better, more self-reliant users of official meteorological expertise when such elite forms of knowledge were based on seemingly shaky foundations. In this case, separate and alternative forms of expertise coexisted and served to strengthen each other.

On the face of it, both the fishermen and the government office were committed to the same thing: the safety of sailors at sea. The government office had been founded for the very purpose of keeping British mariners safe. In 1854, following the previous year's Brussels international meteorological congress, Parliament sanctioned a vote of £3,200 to the Board of Trade and £1,000 for the Admiralty to establish a 'uniform system of meteorological observations at sea' to help determine the 'very best tracks for ships to follow in order to make the quickest as well as safest passages'.[1] The Met Department was established soon afterwards. But while the safety of sailors and fishermen (as well as the efficiency of sea voyages) was paramount, the official remit of the office was to gather meteorological statistics – registrations of the rise and fall of temperature, wind and its current speed, and barometric pressure – which would eventually, but not immediately, lead to a better understanding of the laws of the weather. The bureaucratic

1 Parliament sanctioned a vote of £3,200 to the Board of Trade and £1,000 for the Admiralty to establish a 'uniform system of meteorological observations at sea' in order to help determine the 'very best tracks for ships to follow in order to make the quickest as well as safest passages'. Letter from James Booth, Committee of Privy Council for Trade, September 1854, in 'Report of the Met Department for 1857', Parliamentary Papers (henceforth PP) 1857 XX, 283–372. These annual grants would remain unchanged for the first five years of the office.

and scientific habits of registration combined in the Met Department, whose founders believed that the safety of British sailors would be achieved only by joining the two in a slow and painstaking process of extensive data collection and eventual reduction to universal laws. This process included the construction, verification and distribution of standardized meteorological instruments as well as the collection of vast amounts of data from ships' logbooks. It did not include the distribution of expensive instruments to illiterate fishermen.

While the Met Department lacked a formal founding directive, the advice of the Royal Society and several eminent foreign meteorologists was solicited in early 1855 and subsequent correspondence from the Royal Society functioned as a de facto charter.[2] This correspondence clearly outlined the aims to which a respectable government science office should be directed. Summarizing the conclusions in his capacity as president of the Royal Society, Edward Sabine stipulated that the new government department should be 'an office for the discussion of the observations on Meteorology to be made at sea in all parts of the globe' which will constitute

> an extension to the system of meteorological observations as may cause it to include, in addition to the information required for the purpose of navigation, such scientific desiderata as may be deemed best calculated for the investigation and establishment of great atmospheric and oceanic laws, and may be obtainable by observations either on land or on sea.[3]

The office would

> publish from time to time and circulate such statistical results, obtained by means of the observations referred, as might be considered most desirable by men learned in the science of Meteorology, in addition to such other information as may be required for the purposes of navigation.[4]

The emphasis the Royal Society placed on the collection of statistics was consonant with the society's view that the government office would help constitute a new scientific discipline. Securing a proper foundation for this newly made discipline was urgent for those scientists who saw themselves as spokesmen not simply for meteorology but for a larger scientific project that would require consistent and generous endowment by the government.[5] William Whewell's three-stage model of scientific progress provided the template for their ambitions. According to Whewell's schema, preludes marked by patient and extensive data collection eventually gave way to inductive epochs in which great men such as Newton and Faraday discovered the (preferably mathematical) laws

2 See Public Record Office, National Archives, Kew (henceforth PRO) BJ 7/4 iv for the letter from the Earl of Rosse and PRO BJ 7/4 v for replies from five foreign meteorologists: Adolphe Quételet, Matthew Fontaine Maury, Erman (of Berlin), Kreil (of Durazzo, Albania) and Heis (of Münster, Westphalia).

3 Royal Society letter from Earl of Rosse, 19 June 1854, PRO BJ 7/4 iv.

4 From a Royal Society letter of 22 February 1855, published as Appendix 2 in 'Report of a Committee appointed to consider questions relating to the Meteorological Department of the Board of Trade', PP1866 XLV, vii.

5 See G. L'E. Turner (ed.), *The Patronage of Science in the Nineteenth Century*, Leyden, 1976; M. Boas Hall, *All Scientists Now: The Royal Society in the Nineteenth Century*, Cambridge, 1984.

governing the once disordered mass of information, to be followed by periods of slower consolidation of the successes achieved.[6]

The fishery barometers and the illiterate fishermen for whom they were intended were not to be part of this inductive programme. The instant judgement that the fishermen exercised when reading the barometer had no obvious place in such a statistical project. The fishery barometers initially served to demonstrate FitzRoy's commitment to the 'safest passages' of British mariners. But after 1861 FitzRoy became embroiled in his own storm of controversy surrounding his innovative but often inaccurate weather forecasts. The fishery barometers therefore came to serve a different purpose for the Met Department. Rather than remaining simply extraneous to the Met Department's central project of fostering a reliable and respectable scientific discipline of meteorology, the fishery barometers in fact helped it. They contributed to a moral economy of expertise and judgement in which individual judgements could augment rather than undermine official prescriptions.

Such a symbiotic relationship between what might crudely be labelled centre and periphery has not previously been described in histories of either Victorian government or science. In histories of the period's modes of government, a dichotomy has persisted between local/individual forms of control and central/official forms. Foucauldian-inspired analyses have recently sought to break down such a strict division, but in so doing have tended to elide the structures of official government in favour of a deeply pervasive governmentality. In a sense, this story reverses the direction implicit in the Foucauldian insight that structural power relations can become internalized. Instead of describing how external relations of power can become embodied, this story describes how internalized forms of self-control can become features of an official system of government.[7]

At the same time as it seeks to contribute to the historiographic reframing of Victorian government, the fishery barometer case study also touches on the literature on Victorian scientific expertise. According to Frank Turner's influential 'scientific naturalism' thesis, a fight for cultural authority occurred in the 1850s and 1860s, as professionalizing scientists sought the right to arbitrate on matters once the sole domain of the clergy.[8] In this analysis, cultural authority is a limited and singular good: the more one group has, the less another. There is no room for differentiation between types of expertise, nor for an increase in the franchise. By describing how diverse forms of expertise could be governmental, this paper can be seen as part of a trend to widen the definition of what counted as a 'scientific authority' in the period, or, to use Cooter

6 W. Whewell, *History of the Inductive Sciences from the Earliest to the Present Time*, 3rd edn, Vol. 1, London, 1857.

7 The literature on Victorian government is large. The foundational article of the post-war era is O. MacDonagh, 'The nineteenth-century revolution in government: a reappraisal', *Historical Journal* (1958), **2**, 52–67. For a review of the extensive literature this article spawned see P. Mandler, 'Introduction: state and society in Victorian Britain', in *Liberty and Authority in Victorian Britain* (ed. P. Mandler), Cambridge, 2006, 1–21, 6–13; and R. MacLeod (ed.), *Government and Expertise: Specialists, Administrators and Professionals 1860–1919*, Cambridge, 1988, 1–26. *Liberty and Authority in Victorian Britain* is a collection that typifies the Foucauldian approach.

8 F. Turner, *Contesting Cultural Authority: Essays in Victorian Intellectual Life*, Cambridge, 1993.

and Pumphrey's phrase, to accept a 'greater plurality of signifiers of scientific activity'.[9] One key distinction should be made, however. A pitfall of such an approach, similar to that which befalls some studies of governmentality, is that in finding evidence of science (or governmentality) everywhere, it can be distinguished nowhere. The explanatory power of such a thesis can thus be somewhat disappointing. Bearing this in mind, this case draws attention to the limits both of scientific expertise and of tacit knowledge, as well as to the distinctions between the very different forms of governance in evidence.

Another unfortunate tendency of the literature on government science in this period is to fall into a Whiggish trap of associating increasing government intervention with steadily increasing scientific expertise within government.[10] A key moment identified in this literature is the passage of the Northcote–Trevelyan reforms of 1854, which aimed to create a scientific and impersonal civil service bureaucracy to replace a long-standing tradition of gentleman–amateur civil servants, and placed an increased expectation on government officials to provide an efficient service.[11] In this literature, the obverse of stories of growing expert power involves tales of the decreasing importance of inexpert, local or artisanal knowledge. When and where scientists in the period are seen to fail (as they quite frequently are), such histories identify a lack of system or control rather than a successful negotiation between alternative forms of authority. The power of the expert in this historiography is understood to be directly related to the ability to quell alternative forms of knowledge while simultaneously training those who would participate in a network of communication or apprenticeship.

The case of FitzRoy and the barometers displays a quite different moral economy of expertise. It suggests that expertise about something like the weather could be profitably divided, and thus shared, between scientific experts employed by government or acting as advisers to it and to the very poorest and most disenfranchised citizens of the nation. Assessed from the perspective of the literature of Victorian government, the Met Department appears as a chronically understaffed department from which four men sought to achieve the two impossible goals of discovering the laws of the weather and preventing the British from drowning at sea. Instead, this article demonstrates how the new government office combined two attitudes towards decision-making, or prognostication, which seem on the face of it to be opposed, but which in fact worked in tandem. By incorporating some forms of weather wisdom into the extended activity of the Met Department, the office was able to justify itself as worthy of government funds on two counts. It would bring glory to Britain in the international field of meteorological science and would bring safety to Britain by aiding navigation. Perhaps most importantly, it would do so with an admirable economy of means, which relied not on extravagant

9 R. Cooter and S. Pumphrey, 'Separate spheres and public places: reflections on the history of science popularization and science in popular culture', *History of Science* (1994) **32**, 237–67, 252.

10 See Turner, op. cit. (5); and MacLeod, op. cit. (7).

11 On the Northcote–Trevelyan reforms see J. Agar, *The Government Machine: A Revolutionary History of the Computer*, Cambridge, MA, 2003, 45–74; G. K. Clark, '"Statesmen in disguise": reflections on the history of the neutrality of the Civil Service', *Historical Journal* (1959) **2**, 19–39; and E. Cohen, *The Growth of the British Civil Service, 1780–1939*, London, 1941.

parliamentary grants but on individuals making decisions at the furthest extent of the nation with a modicum of government aids.

An experiment in lending barometers

FitzRoy's first experience with barometers at the Met Department came from his work in designing and distributing standard meteorological instruments for Royal Navy and merchant marine ships. One of the first tasks to which he turned his attention was the design and testing of what would become the standard Kew marine barometer. Careful calibration at the Kew laboratory, maintained by the Royal Society, was needed to make barometers tools for long-term scientific research. But apart from the problem of whether the barometers themselves could be meaningfully compared, FitzRoy faced a more basic concern. As the Astronomer Royal George Airy had noted, the distribution of instruments to merchant marine ships had the potential to 'to give more trouble than everything else relating to the observations'. Giving 'such fragile instruments' as barometers to merchant ship captains would lead to 'perpetual heartburning on account of broken instruments'. Airy's solution was to have the ship captains supply their own instruments, duly registered and inspected as if they were government property: 'If the ship-owners supply them, still the instruments must be treated as the property of Government: they must be marked with the Government-mark and with an ordinal number, and must be entered in the Government books, and must be examined by the Government officers.'[12] The key to responsible stewardship, Airy understood, was ownership. Hence arose the problem with expecting sailors to care for loaned equipment. On the other hand, for the meteorological project to work, privately owned instruments had to be integrated into the network of registration and inspection. Airy's plan was never taken up. John Washington, hydrographer to the Navy, approved of the new Kew standard barometers and acknowledged the pitfalls of introducing delicate equipment owned by the new government office into naval culture. 'We must endeavour to drill our rather fast captains into taking more care of them. I think you ought to write to each of those who return a broken bar.[ometer] a word of advice if you see no objection.'[13]

Despite continuing problems with barometers broken at sea, often by the powerful report of Navy guns,[14] the task of sending out these standardized instruments soon became routine. By 1855, just one year into his new position, FitzRoy had arranged for one hundred of the specially designed marine barometers to be sent via a system of coastal agents to Navy ships. When intact, these barometers were intended to furnish observations to be entered into the meteorological log carried on board ship. Regular

12 Airy to Cardwell, 11 November 1853, PRO BJ 7/114.

13 Washington to FitzRoy, 15 April 1858, PRO BJ 7/216; underlining in original.

14 See, for example, 'Notes of Admiralty and Board of Trade barometers sent out of and to places in London', 1 July 1857, PRO BJ 7/370; and 'Extensive correspondence of Capt Sulivan of HMS Merlin with Fitzroy, Washington, and Patrick Adie on broken barometer', 20–6 February 1856, PRO BJ 7/182. Barometers were broken in transit as well as on board ship. John Washington, hydrographer to the Navy, mentioned a breakage rate of twenty-one per cent in a 12 May 1858 letter to FitzRoy, PRO BJ 7/217.

registrations of a calibrated marine barometer would contribute to the project to uncover universal laws of the weather, including laws of storms. Such barometers were undoubtedly also used by sailors to foretell the weather. However, weather-watching practices were excluded from the project of meteorological statistics and no official mention was made of the use of standard Board of Trade barometers as prognosticators. In contrast, when FitzRoy turned to the fishery barometer project, the prognostic value of barometers was foremost in his mind.

FitzRoy wrote to the instrument-makers Negretti & Zambra on 7 December 1857 of his plan to 'place ordinary land barometers as weather glasses solely, at some of the more exposed Fishing stations, and coasting harbours, in Great Britain and Ireland', requesting that they visit him with a selection of sturdy, easy-to-read barometers.[15] Tellingly, in his initial correspondence on the project he referred interchangeably to barometers and weather-glasses. By referring to the fishery barometer as a weather-glass, FitzRoy was recalling a much older tradition of prognostic weather-watching. Justifying the project to his superior, T. H. Farrer, assistant secretary to the fast-growing Board of Trade, FitzRoy remarked that he had composed the 'concise instructions' that would accompany the barometers

> always remembering that the object of such instructions is, in the first place, the saving of valuable lives, on which, but too often, whole families depend … the more recent works as well as the earlier ones of the best scientific authorities have been consulted, in aid of the combined practical experience of those usually considered the most 'weather-wise'.[16]

FitzRoy was happy to blend expensive London-made instrumentation with homespun weather-glasses, but his correspondents consistently demurred from labelling the Board of Trade instruments with the folk term and FitzRoy soon restricted himself likewise to talking of barometers.

It mattered to Negretti & Zambra that the barometers FitzRoy was requesting would not be required for scientific observation. The accuracy of their scales would be less important, while their legibility and durability would be correspondingly more vital, were they to serve the rugged fishermen working the rough coasts of Britain. These were barometers made to be seen, rather than recorded. Negretti & Zambra's fishery barometers had clearly visible porcelain scales and a few basic instructions for interpreting the rise and fall of the mercury. They were proud of their contribution and showed off the device in an 1864 treatise on meteorological instruments.[17] FitzRoy also wrote a simple manual of instructions intended to explain the basics of the instruments to fishermen.[18]

Crucial to FitzRoy's success in securing support for the scheme was limiting what might be construed as inappropriate government charity. FitzRoy assured Farrer that the programme was intended expressly to aid the poorest and smallest villages, which

15 FitzRoy's 'copy of specification' in form of a letter to Negretti & Zambra, re: supply of land barometers, 9 December 1857, PRO BJ 7/615; underlining in original.

16 Notes on provision of barometers to poor local fishing towns that otherwise could not afford them, draft of a letter from FitzRoy to Farrer, undated, PRO BJ 7/19. On Farrer see T. H. Farrer, *DNB*.

17 Negretti & Zambra, *A Treatise on Meteorological Instruments: Explanatory of Their Scientific Principles, Method of Construction, and Practical Utility*, London, 1864.

18 R. FitzRoy, *Barometer and Weather Guide*, London, 1858.

would be lent the instruments, not given them outright. Even such loans would be strictly limited:

> It is understood that no such loan as that of a barometer, costing only four pounds (£4) should be made to towns, or large villages on the coast, however engaged in sea-faring pursuits their population may be: because such an instrument may be readily purchased by subscription if not provided by some generous benefactor (as in many places has been done).[19]

Towns large enough to raise the funds needed to buy a barometer would not be eligible for the loans and private benefactors would be sought whenever possible.

By January 1858 FitzRoy had obtained the permission of the president of the Board of Trade, Lord Stanley, for the barometer experiment.[20] He first turned his attention to Scotland because severe weather conditions there were thought to affect the fishing industry, especially the herring fishery, more than in England.[21] Before sending barometers to coastal towns, FitzRoy elicited some statistical guidance from Bouverie Primrose, secretary to the Board of Fisheries of Scotland, as to the places that 'have the largest amount of life and property risked afloat in their vicinity'.[22] By April FitzRoy had the Scottish returns from the singularly effective Primrose.[23] They indicated that while some villages already had a barometer (at Eyemouth the barometer was 'daily noted, and esteemed as a faithful monitor by the Fishermen, its warnings having saved them many tempestuous gales'), others strongly desired one (in Coldingham the fact that 'a number of the fishermen have the common weather glasses in their houses which they consider serviceable' was put forward 'as a proof of the value they would attach to a Barometer were one erected').[24] FitzRoy anticipated that certain members of the local community might be antagonistic; in particular he mentioned 'local feelings in respect of the Coast Guard, Ministers of Religion or private individuals which in some cases might operate inconveniently'.[25] Such local figures, FitzRoy feared, might resent the intrusion of new technologies for managing the uncertainty of seagoing, methods that might possibly curtail their own authority. The Coastguard might resent the intrusion of the Met Department in their management of coastal traffic, while ministers might fear that the prognostic qualities of the barometers would undermine religious faith. There is no evidence, however, to suggest that either the Coastguard or ministers felt this way.[26]

19 FitzRoy, op. cit. (15).

20 For indirect evidence, see FitzRoy minute to Farrer, further to Lord Stanley's approval in principle of the proposal to aid fisheries with weather-glasses, 28–9 January 1858, PRO BJ 7/616.

21 T. Burton, 'Robert FitzRoy and the early history of the Meteorological Office', *BJHS* (1986), **19**, 147–76.

22 FitzRoy to Primrose, 16 February 1858, PRO BJ 7/617.

23 Primrose to FitzRoy enclosing returns, 29 March 1858, PRO BJ 7/618.

24 Barometer return from Eyemouth, PRO BJ 7/622.

25 Fitzroy, op. cit. (15).

26 For debates over religious and scientific authority on board ships, see A. Winter, '"Compasses all awry": the iron ship and the ambiguities of cultural authority in Victorian Britain', *Victorian Studies* (1994), **38**, 69–98; and C. Smith, I. Higginson and P. Wolstenholme, '"Imitations of God's own works": making trustworthy the ocean steamship', *History of Science* (2003), **41**, 379–426. For a book-length study of how authority and trust for steam and telegraph technologies was established, see B. Marsden and C. Smith, *Engineering Empires: A Cultural History of Technology in Nineteenth-Century Britain*, Basingstoke, 2005.

By June 1858 Admiral FitzRoy was ready to commence 'the experiment of lending a barometer, belonging to the Board of Trade, to poor men, (Fishermen and other seafaring persons) whose lives are more or less dependent on weather, but who are unable to buy weatherglasses by which to be forewarned of impending storms'.[27] FitzRoy sent out the first batch of ten Negretti & Zambra fishery barometers to Primrose to be distributed to poor fishing villages, one going to St Ives in Cornwall, the rest to Scotland. Favourable weather permitted Primrose to deliver the barometers by boat. The response was immediate and positive. At Secretary's Hole, the 'fishermen and others mustered on the beach and headed by Mr Macintosh, Boat Builder, as Spokesman, warmly expressed their thanks for the barometer as it was being landed'. At Rosehearty the chief magistrate expressed thanks for the instrument and promised to find a suitable place for it. In Leith twenty-six of the town's chief fishermen 'entered very cordially' into the subject of where the barometer should be placed and who should take responsibility for it.[28]

Stewardship of the instruments was inseparable from their worth. Captain Walker reported to Mr Farrer, secretary of the Board of Trade,

> Within the last few years many lives and much property have been lost on the northern and Eastern coasts of Scotland owing to the fishermen proceeding to sea when a gale of wind was brewing which they were not aware of, but its proximity would have been indicated by a Barometer. These valuable instruments lose much of their worth if not placed under the management of some person who has some knowledge of their properties and who should attend to the range of the mercury and set the index, before sending them away we should know who is to have charge of them.[29]

Primrose complained to FitzRoy that despite the good weather 'it has been no easy matter to get them fitted up and it was impossible to do so at some of the places in more than a temporary manner'. Stone houses were erected to protect the barometers at some locations. All were arranged so that they were easily visible for public examination. Primrose concluded his report by stating that 'the people are much pleased and very grateful'.[30]

Fishermen considered the Met Department instruments to be highly desirable additions to their weather-wisdom toolkit, in addition to reading the skies, weatherglasses and almanacs.[31] The news of the Scottish 'barometers-for-fisheries' programme prompted an influx of requests for barometers from many fishing villages in England and Scotland. The fishermen of Beadnell, on the rough coast of Northumberland, sent a typical petition via their spokesman, Mr Walker:

> Understanding that public barometers are being placed in the fishing villages in the North of Scotland, and that Mr. Stebbing [the optician employed by the Met Department] is

27 FitzRoy, op. cit. (15); underlining in original.

28 Extracts from Fraserburgh fishery officer's letter to Primrose, 1 July 1858, and extract from Leith fisheries officer's letter, 'Primrose report on the distribution and location of first eight barometers and manuals, including letters of thanks from fisheries', 28 June 1858, PRO BJ 7/647.

29 Walker to Farrer, 2 June 1858, PRO BJ 7/644.

30 Primrose to FitzRoy, 19 July 1858, PRO BJ 7/645.

31 On the significance of such varied forms of weather wisdom see K. Anderson, *Predicting the Weather: Victorians and the Science of Meteorology*, Chicago, 2005, 41–82.

> superintending the setting of and adjustment of these instruments, the Fishermen of this village have applied to me to address you on the subject. This Coast (the neighbourhood of the Farne Islands), is particularly liable to violent gales, which frequently come without any warning + I need hardly remark how great a boon such an instrument would be to the Fishermen engaged in the white and Herring Fishery here.[32]

Matters of geography, circulation and responsibility were paramount. The inhabitants of Burghead, at the edge of the Moray Firth in Scotland, reminded the Met Office that their village was frequented by vessels connected with the foreign-export trade and that 'any improvement that tends to augment its safety, is calculated to be a benefit extending to interests beyond those of the mere locality'.[33] At Bridlington Quay on the Yorkshire coast a Mr Brambles referred to the 'exceedingly useful donation of Barometers recently made by your Admirable Board' and requested an instrument to protect the 'large number of Boatmen daily exposing themselves on the sea guided alone, as to the weather, by their own uncertain judgment'.[34]

The petitioners recognized the importance of finding an appropriate location for the barometers they requested. In their letter asking for a barometer, the fishermen and seamen of Burnham characteristically promised to 'undertake to place it in a good public situation and have every care taken of it'.[35] In the east Devon coastal town of Budleigh Salterton, seventeen men signed a petition, some with a mark rather than a signature, requesting 'a public Barometer' and suggesting the centrally located Coastguard station as a good place for it.[36] In Berwick, Henry Gates wrote that the watch house recently built on the quay could safely protect and display a weather-glass.[37] On Plymouth Sound, William Walker eagerly assured FitzRoy that he would go over to Cawsand Bay at once and look out for a suitable house where

> Pilots, Fishermen, and Coasters may view the Barometer and take note thereof … If you can get free access for fishermen to view the Barometers at Coast Guard Station houses where such station houses may be situated on the same side of the water as the residence of the Fishermen and others interested in the weather. Such station houses would be a better place than in either private or 'Public Houses'!![38]

Though the dangers of pub drinking threatened the barometer's authority, it was nonetheless still important to ensure that the barometers were publicly accessible, both their purpose and provenance requiring it. As FitzRoy soon discovered, even seemingly likely spots had hidden pitfalls. In a letter justifying the project to H. R. Williams, accountant for the Board of Trade, he explained,

> I once thought the Coast Guard a good means of forwarding this work – so did Mr Farrer – but I found, on close inquiry, that the Coast Guard and the Fisherman (for whose use the barometers are especially intended – do not associate (for obvious reasons) and that for a

32 Walker to FitzRoy, 7 July 1858, PRO BJ 7/659.
33 Petition from Burghead, 2 December 1862, PRO BJ 7/651.
34 Brambles to Secretary, Marine Department Board of Trade, 5 January 1859, PRO BJ 7/662.
35 Petition, signed by twelve men, sent to FitzRoy, 29 November 1861, PRO BJ 7/664.
36 Request for barometers from Budleigh Salterton, undated, PRO BJ 7/663; underlining in original.
37 Gates to FitzRoy, 20 October 1863, PRO BJ 7/660.
38 Barometers for Cawsand Bay, William Walker to FitzRoy, 12 August 1858, PRO BJ 7/665.

> fisherman to be seen near a Coast-guard house exposes him to the suspicion of being an informer (respecting some smuggling affair) – Beside which the Coast Guard premises are kept so very clean that Fishermen with dirty boots are not welcome – at any time.[39]

Five days later, Walker had solved the problem, reporting that the fishery barometer had been

> received and put up in the front parlour window of the house of Mr Isaac Pearse, a first class branch Pilot, and moreover a well-informed man of high character with a scientific turn of mind who volunteered to take charge of the instrument leaving it open for consultation by everybody. It is a Capital instrument for the purpose, easily read off and understood: the Cawsand people are much pleased with the Bd of Trade's liberality.[40]

This privately controlled but publicly visible space, superintended by a sailor with scientific and voluntarist leanings, was just the sort of space in which a 'liberally' supplied barometer sent from a government office in central London could serve as a weather-glass to local fishermen. The physical situation of the barometer captured the sense of carefully calibrated control and mediated responsibility that the Met Department strove to achieve. The spirit of voluntarism evidenced by Isaac Pearse and underlined by Walker testifies to a moral responsibility more trustworthy than a mere salary could secure. This was precisely the kind of trust that full-time government administrators and scientists struggled to establish for themselves.

Mr Walker gave a vivid account of how such matters were sensitive to time as well as to space. In a letter written on 12 July 1858 he reported having received FitzRoy's letter on the subject of barometers on 8 July:

> I called a meeting of the men the same evening who at once said they would subscribe among them the necessary funds £4 which you say is the price of a good barometer. The next day I went by sea with a deputation of the Fishermen to procure the cooperation and assistance of their landlord TN Craster Esq of Craster Tower in this neighbourhood who agreed to be at the expense of making a place of security for it in the wall of one of the houses equidistant from the Northern and Southern extremities of the village. Mr Craster agrees with me in selecting an old respectable Fisherman of the name of Ralph Dixon to be in charge of the instrument, and this selection meets also with the approval of the men, who are anxious to have it set up as soon as possible, as they are all preparing for the herring fishing – They are also anxious to have instructions in the adjustment of the instrument and in the use of the scale.[41]

The urgency of the men's desire for a barometer, with winter coming on, and their understanding of how constrained were the conditions under which such a device could work, are demonstrated by the immediacy of the meeting, the journey the next day to see the local landlord and the identification of a central location and respectable caretaker for the instrument. FitzRoy forwarded the Beadnell petition to Mr Bowring, registrar at the Board of Trade, noting that the letter 'may be considered more or less a type of others likely to follow on the same subject' and asking him to 'submit to the President my humble opinion that such a barometer (as understood to be available)

39 FitzRoy to H. R. Williams, Esq., accountant, 6 August 1858, PRO BJ 7/17; underlining in original.

40 Barometers for Cawsand Bay, Walker to FitzRoy, 17 August 1858, PRO BJ 7/665; underlining in original.

41 Barometers for Beadnell, 12 July 1858, PRO BJ 7/659 f3.

might be sent to Beadnell, in Northumberland, when opportunity offers – provided that £4 be paid (to the Accountant of the Board of Trade) on its establishment at Beadnell'.[42]

FitzRoy's internal memo received grudging approval. This did not conceal the bureaucratic resistance to what was, in FitzRoy's own terms, an experiment, an uncertain projection of government monies and authority into private, semi-private or even public spaces with loyalties to different authorities. Bowring reminded FitzRoy that the

> Barometers that have been sanctioned are, I understand, in the way of experiment only and it is not intended to carry the experiment any further until some experience has been had of the advantage expected to result from it. In the present case, the parties propose to pay for the Barometer and to put it up at their own expense. We might properly I think point out the kind of Barometer that Admiral FitzRoy would recommend and inform the parties where it is to be got at the price that it is suggested we should charge – But I think it would be undesirable that we should furnish the Barometer at a price to be paid for to us.[43]

Bowring's desire to distance the Board of Trade from the sale of barometers to fisheries is an indication of the general distaste for government intervention. His awkward grammar marks his complex reasoning: not only should the Board of Trade definitely avoid granting barometers to fishermen, but it should also avoid the risk to government disinterest posed by simply facilitating the supply of cut-price barometers. The barometers-for-fisheries programme shows how important it was, even in the relatively simple matter of lending out barometers, to draw the line between, for example, suggesting an appropriate price for a barometer and facilitating the sale of one at that price. Such fine distinctions were required to protect the government from the dangers of excessive intervention. Such dangers could lead to an undesirable weakening of British citizens' self-reliance.

Storm circulars

The correspondence surrounding the distribution of Met Department fishery barometers demonstrates that local control was key to their successful operation. But while local superintendence was appropriate in the small coastal villages in which norms of personal authority were well understood, in the Met Department itself such personal control could seem highly dangerous. FitzRoy found this out when he began an ambitious project to forecast the weather. He was prompted to start his forecasting project following a series of devastating gales that hit British coasts in late October 1859. Dubbed the *Royal Charter* storm, after the largest of the 223 ships it left wrecked by

42 Barometers for Beadnell, Board of Trade Marine Department Minute Paper, undated (July 1858), PRO BJ 7/659 f5. Edgar Alfred Bowring (1826–1911), the son of Sir John Bowring (Jeremy Bentham's literary executor and later governor of Hong Kong) served as librarian and registrar at the Board of Trade from 1848 to 1863 and was secretary to the Royal Commissioner of the Exhibition of 1851. He kept a journal in which he recorded daily weather observations. See Edgar Bowring journal (1841–57), 14 vols., William Perkins Library, Duke University.

43 Barometers for Beadnell, Board of Trade Marine Department Minute Paper, undated (July 1858), PRO BJ 7/659 f5.

high winds and seas, the storm claimed the lives of more than seven hundred people.[44] Observations of the *Royal Charter* storm sent to his office from all over Britain convinced FitzRoy that the cyclonic (or rotatory) theory of storms, which held that storms displayed characteristic counter-clockwise rotation in the northern hemisphere and clockwise rotation in the southern, could be used to predict their movements up to two days in advance.[45] 'I was turning round two half crowns on a piece of paper (for cyclones) when your packet arrived. Tomorrow I will send a draft for a Circular – (letter not storm)', FitzRoy quipped in December 1859 to John Washington, hydrographer to the Navy.[46] Though informed by several decades' worth of storm studies that preceded it, FitzRoy found in the storm the final incentive he needed to push the government office out of the safe waters of meteorological statistics and into the much murkier realm of prognostication.

FitzRoy soon established a telegraphic system of coastal observers to enable him to gather real-time observations and, more radically, to reverse the system and transmit information back from London to the coastal stations where it was most needed. Starting in February 1861, his initial project to issue storm warnings was authorized by the Council of the British Association for the Advancement of Science (BAAS), based on a suggestion first made in Section A (Mathematical and Physical Science) at the 1859 meeting of the BAAS in Aberdeen.[47] FitzRoy's impatience may have been related to the system of weather telegraphy recently established by Urbain Le Verrier, director of the Imperial Observatory in Paris, by which reports on current weather (including any storms) at various points in France and elsewhere in Europe were telegraphed to Paris. Such warnings were significantly limited to communications of the 'actual state of the weather'; they were not predictions of future storms. Le Verrier himself had warned FitzRoy not to get ahead of himself.[48] But FitzRoy was not content to wait. In May 1861 he took the significant step of predicting, rather than simply reporting, poor weather in what he called a weather 'forecast'. He telegraphed his coastal observers with forecasts based on their previously telegraphed observations; coastal stations with poor forecasts were also sent cautionary notices, advising them to raise a series of flags or night lanterns signalling the direction of any dangerous winds or gales to nearby ships.[49] This innovation was entirely FitzRoy's, unsanctioned by the Board of Trade or the Council of the British Association.

44 For number of wrecks caused by *Royal Charter* gale see 'Abstract Returns of Wrecks and Casualties on Coasts of United Kingdom, 1859', PP1860, LX, 501. Of the 223 wrecks, 133 were total wrecks and ninety were casualties that resulted in serious damage and loss of life.

45 FitzRoy to Washington, 23 December 1859, HO Misc 29 f15.

46 FitzRoy to Washington, 15 December 1859, Hydrographic Office Archives, Taunton (henceforth HO) MLP 29 f14.

47 'Report of a Committee Appointed to Consider Questions Relating to the Meteorological Department of the Board of Trade', PP1866 LXV, 18; correspondence between Airy and FitzRoy, 6–9 June 1860, Royal Greenwich Observatory Archives, Cambridge University Library, 6/702/19/230.

48 'Report of a Committee Appointed to Consider Questions Relating to the Meteorological Department of the Board of Trade', PP1866 LXV, 18–19. On Le Verrier's weather forecasting system see F. Locher, 'Le Nombre et le temps: La Météorology en France (1830–1880)' (EHESS Ph.D. dissertation, 2004).

49 On forecasting see Burton, op. cit. (21), 161–4; and Anderson op. cit. (31), 110–15.

FitzRoy's daily forecasts were based on a collection of rules and maxims relating to the law of rotatory storms that had been confirmed by the *Royal Charter* storm. Telegraphs from coastal observers were received in the Whitehall office daily at 10 a.m. FitzRoy drew up the forecasts from west to east, in the order in which the weather tended to move. Irish regional forecasts were drawn up first, followed by forecasts for the western, central, south-western and south-eastern coasts of Britain. Writing these short abstracts took just thirty minutes. From over two hundred stations FitzRoy also quickly selected a list of those places to be immediately telegraphed cautionary notices in addition to forecasts. These notices were signalled by raised flags in harbours throughout Britain within thirty minutes of receipt. By 11 a.m. forecasts had been sent to *The Times* for its second edition of the day, to Lloyd's, the Shipping Gazette, the Board of Trade, the Admiralty and the Horse Guards, and then to other afternoon papers. Later in the day reports modified by additional observations sent in by telegraph in the afternoon were sent out for the next morning's early papers.[50] FitzRoy and one other assistant (probably Mr Babington) were solely responsible for the forecasts. FitzRoy was proud that few written rules were consulted or recorded: 'An outline chart, with wind-markers, is useful; likewise a transparent horn, or a glass, with circles; but a certain amount of practice enables one to dispense with such assistance, and work out the questions mentally (like a chess-player who need not look at the board.)'[51]

Almost as soon as he had begun the forecasts in 1861, FitzRoy came under a great deal of pressure. His combination of the tools of local weather-watching, rules of thumb and individual judgement with the synoptic technology of telegraphy and a central office was highly controversial. Some saw evidence that meteorology had finally matured. When the Met Department issued warnings about an 1861 gale in which nearly an entire lifeboat crew lost their lives, *The Times* considered that 'the event was predicted with as much certainty as an eclipse … Meteorology now rests upon evidence as palpable as that which confirms our theories of astronomy'.[52] Others were far less sanguine. By their nature the forecasts were imprecise.[53] In addition to possible damage to the scientific status of meteorology, they threatened to burden the government with excessive responsibility. What if fair weather were forecast and ships went to sea only to be beset by an unforeseen storm? Equally unacceptable for the commercial vessels was the possibility that they might heed a warning of poor weather and stay in harbour, only to find sunny skies and money wasted through needless inactivity. Would the government repay lost income?

50 R. FitzRoy, *The Weather-Book: A Manual of Practical Meteorology*, London, 1863, 194.

51 FitzRoy, op. cit. (50), 218.

52 *The Times*, 13 February 1861, 8–9.

53 FitzRoy correlated changes in pressure indicated by barometrical observations with the movements of two postulated contrary currents of air, one warm and moist from the south or southwest, the other cold and dry from the north or northeast, based on Heinrich Dove's theory of rotatory storms. FitzRoy's internal verification of the forecasts consisted of a list of warnings used, observations made at coastal stations and an informal collection of extracts on weather from local newspapers. An external committee set up to monitor the forecasts reported to Parliament in 1864. See 'Tables of observations by Board of Trade for recording Actual Weather Corresponding to Admiral FitzRoy's Daily Forecasts and Warning Signals', PP1864 LV, 341.

Criticism of the forecasts came from a diverse company: astro-meteorologists and lunarists who viewed them as competition; Royal Society Fellows who thought the shaky forecasts were far less accurate than eclipse predictions and brought science into disrepute; and Parliament, which responded to a suggestion that the weather might be predicted twenty-four hours in advance with laughter.[54] As such episodes suggest, the forecasting controversy was an extremely public demonstration of the limits (and perhaps the failures) of scientific expertise at a moment when the fight for cultural authority was fiercely contested.[55] The taint of the fairground and the fortune-teller clung to the would-be weather prophet and provided a vocabulary for mockery of FitzRoy's programme. Prediction was a slippery thing. It could mark the highest science, astronomy, and the tawdriest sham, palm-reading.

In this light, FitzRoy's knowledge could seem dangerously tacit. The Royal Society Committee, headed by Francis Galton, would later note with disapproval just the feature of which FitzRoy had boasted: that, like a chess-player, he worked out his forecasts in his head without the aid of explicit formulae or rules. Their report concluded that 'it is the custom of the Department to perform the whole of the foregoing operations, and to determine the forecast, after a simple inspection of the list of weather returns [received from coastal observers]. No notes or calculations upon paper are made. The operation occupies about half an hour, and is conducted mentally.'[56] By dint of his position at the centre of what some judged had become a dangerously synoptic system, FitzRoy represented and broadcast the authority of the government along with his forecasts. Errors could be propagated with dangerous speed and disastrous consequences.

While as a government official FitzRoy risked making his department liable for the lives of others, fishermen were accountable only to themselves. Indeed, FitzRoy's forecasting system was not very different from what he expected the fishermen to do with their fishery barometers: to make individual judgements based on instrumental readings. Based on simple rules of thumb and not requiring data-intensive reduction but day-to-day comparison, their methods were largely similar. Both FitzRoy's forecasts and the forecasting he was encouraging the fishermen daily to perform contrasted with the slow, long-term and largely theoretical official programme of government meteorology. FitzRoy could have enlisted weather-watchers as contributors to the great project in meteorological registration alongside the vast workforce of the Royal Navy, but did not. Despite their expense and the high standard of their construction, the fishery barometers were not conceived as part of the Met Department's formal programme of gathering comparable meteorological observations from sea and coastal observers – they were mere weather-glasses. Fishermen were not and should not be subject to the same discipline that existed in the Royal Navy.

54 On the response of astro-meteorologists and the Royal Society to FitzRoy's weather forecasts see Anderson, op. cit. (31), 83–131. On laughter in Parliament see Burton, op. cit. (21), 151.

55 On the claims made by scientific naturalists for authority see Turner, op. cit. (5). On meteorology in particular as a feature of the contest for cultural authority see Anderson, op. cit. (31), 285.

56 'Report of a Committee Appointed to Consider Questions Relating to the Meteorological Department of the Board of Trade', PP1866 LXV, 20.

Knowledge that was dangerously tacit in one area could be safe precisely because it remained informal and unregistered in another. Asked in 1861 by the secretary of the Royal National Lifeboat Institution if he had considered the possibility of having fishermen register the rises and falls of the barometer on a special chart, FitzRoy replied that the matter had

> had due discussion here, before the first instrument reached its destination. Having weighed well the objects of registry, the construction of the 'Fishery Barometer,' and the qualifications of those persons entrusted with its care, it was decided to refrain from asking for any formal registration … The register returned from an ordinary Fishery Station might not be required for official or scientific objects, because near other, and superior places of observation and record; while its character, for a certain time of inexperience, might not be so reliable as would be requisite. There must be a limit to accumulations of paper, however well filled, if practical conclusions are to be drawn from them as, otherwise, they would overwhelm.[57]

Fishermen were not wanted to supply the registrations of barometers that were issued to them by the Met Department. Neither they nor their barometers were meant to contribute to the official project of meteorological statistics. Instead, the fishery barometer project relied on the absence of certain registrations. But rather than remaining simply irrelevant to the Met Department's central project of fostering a reliable and respectable scientific discipline of meteorology, the fishery barometers in fact helped it.

Kept safely within appropriate domains, prophecy was not simply acceptable but desirable. Though the barometers-for-fisheries programme pre-dated FitzRoy's forecasts, the former soon became an important counterweight to the latter. While fishermen lacked certain qualifications, their practice of making daily judgements about going to sea and their self-responsibility made them ideal participants in FitzRoy's forecasting programme. Their role as voluntary observers operating at a local level offered a corrective to the risks of the universal project. Such a role was predicated on their separation from the official project of meteorological registration. Precisely by not registering the weather, such instruments contributed to scientific administration by helping to create autonomous users of its weather forecasts. Designed, constructed and calibrated in the capital, the barometers became instruments of local autonomy.

Corrective vision

While he struggled to maintain his authority in the face of challenges from Royal Society scientists and astro-meteorologists alike, FitzRoy was successful in supplying dozens of coastal villages with barometers. His office responded very quickly to requests for barometers. Many requests were annotated on the day of receipt with FitzRoy's efficient 'Ack. Barometer to be sent'. Extant correspondence suggests very few instances where requests for barometers were rejected. Annual reports from the Met Department listed a steady rise in the number of fishery barometers supplied to small fishing communities. Even the directive to lend barometers only to the smallest and poorest towns and to require larger towns to raise a subscription themselves seems

57 FitzRoy to John Street Adelphi, secretary of National Lifeboat Institution, 14 January 1861, PRO BJ 9/8.

to have been relaxed. In 1858 a request from the people of Filey in Yorkshire for a barometer was annotated (by a hand other than FitzRoy's) with a note suggesting that given the size of the village, ninety-five married and seventy-nine unmarried fishermen, 'those interested fishermen should get one at their own expense. It would not be more than 1/6 a boat and if the Fishermen would not subscribe such a small sum for such a purpose I cannot think they have a claim of the Gov't'.[58] A barometer – it is unclear whether it was loaned or sold – was eventually shipped to Filey. By 1863, in contrast, good-sized towns such as Berwick on the Northumberland coast and Devoran in Cornwall were regularly lent the instruments. In his 1863 Met Department report FitzRoy published a list of eighty-nine fishery stations in Britain supplied with barometers, of which twenty-five were private gifts and the rest Board of Trade instruments.[59]

FitzRoy's barometer project was supplemented by contemporary programmes situated firmly and more comfortably within the British tradition of philanthropic and voluntary organization. In 1859 the Duke of Northumberland supplied fourteen barometers to poor fishing villages along the Northumberland coast between the Tweed and the Tyne.[60] In 1860 the National Lifeboat Institution announced that it would endeavour to supplement the barometrical philanthropy of FitzRoy and the Duke of Northumberland by attempting to supply 'every life-boat house in the system with a barometer and to train the coxswain how to use it'.[61] In June 1874 the Marquis of Tweeddale, president of the Scottish Meteorological Society, presented twenty sea thermometers to the society for the use of the fishermen for observations of the temperature of the sea, to be taken by them on the fishing grounds.[62] These projects underlined the links between self-help and safety in the matter of weather forecasting. In an 1862 article published in the *Lifeboat*, the journal of the National Lifeboat Institution, FitzRoy suggested that the independent judgement of the fishermen could act as a corrective to the shortcomings of the forecasts:

> Objection has been taken to such forecasts, because they cannot be always correct, for all places in one district. It is, however, considered by most persons that general, comprehensive expressions, in aid of local observers, who can form independent judgments from the tables and their own instruments, respecting their immediate vicinity, though not so well for distant places, may be very useful, as well as interesting; while to an unprovided or otherwise uninformed person, an idea of the kind of weather thought probable cannot be otherwise than acceptable, provided that he is in no way bound to act in accordance with such views, against

58 Request for barometer for Filey, Yorks, February 1858, PRO BJ 7/670.

59 'Report of the Meteorological Office of the Board of Trade for 1863', PP1863 LXIII, 27.

60 'Report of the Meteorological Department of the Board of Trade', PP1864 LV, 125; 'Report of the Meteorological Office of the Board of Trade for 1863', PP1863 LXIII, appendix 2.

61 'Barometers for Life-Boat Stations', *Lifeboat*, 1 October 1860, 336.

62 A. Buchan, 'Third report on the relations of the herring fishery to meteorology', *Journal of the Scottish Meteorological Society* (1879), **5**, 240–51; M. Deacon, 'Some 19th-century research on weather and fisheries: the work of the Scottish meteorological society', in *British Marine Science and Meteorology: The History of their Development and Application to Marine Fishing Problems*, Buckland occasional Papers No. 2, Buckland Foundation, 1996, 117–32; and 'Report of the Meteorological Department of the Board of Trade', PP1864 LV, 125.

> his own judgment. Like the storm signals, such notices should be merely cautionary, to denote anticipated disturbance somewhere over these islands, without being in the least degree compulsory, or interfering arbitrarily with the movements of vessels or individuals.[63]

Forecasts would not impair the judgment of those who used them, argued FitzRoy; they would improve it when used alongside tools such as barometers and weather wisdom. British sailors would be at liberty to pursue their livelihoods free from excessive government interference:

> But, say some, and justly, are ships to remain waiting to avoid a gale that, after all, may not happen? Are fishermen and coasters to wait idle and miss their opportunities? By no means. All that the cautionary signals imply is, 'Look out.' 'Be on your guard.' 'Notice your glasses and the signs of the weather.' 'The atmosphere is much disturbed.'[64]

Extending this reasoning, in another *Lifeboat* article James Glaisher, meteorologist at the Royal Observatory in Greenwich, pointed out that both coastal and marine barometers could be considered part of the heroic technologies of life-saving:

> I am sure that every assistance will be cheerfully rendered by the National Life-Boat Institution to save life – whether by life-boats, ships' life-boats, seamen's life-belts, fishing life-boats; or, lastly but not least, in its great and good work, by helping the sailor on board ship to possess a truthful and cheap barometer – a scheme which is indeed only an extension to the sea, of the coast barometer system of the Institution; and thus prevent, as far as possible, by timely warnings on board ship, the necessity of calling into use the last but most glorious assistance – the services of the life-boat itself.[65]

Only by combining the barometric readings with their own individual judgements of the weather could lifeboatmen successfully forecast the weather. Though it would be 'folly' to neglect the 'cautions given by the barometer', Glaisher noted the 'absolute necessity which exists for combining instrumental indications with their own local weather estimates, drawn from natural and familiar sources'.[66]

A questionnaire circulated by the Met Department in 1863 evaluating the utility of the fishery barometers confirmed that the instruments sharpened rather than dulled the faculties of local fishermen. In Kingsdown, Thomas Sydenham Clarke noted that the barometer there was consulted over five hundred times a day ('I believe no boat goes to sea without the glass being consulted in the first place') and 'forms quite a topic of conversation amongst the men, which naturally engenders thought, and reflection, and renders barometers and their use more familiar to the men and boys'. He added that 'the men are very fond of comparing the appearance of the clouds, sea, atmosphere, &c., with the glass, and seeing how far their natural observation harmonizes with the

63 Rear-Admiral Fitz-Roy, 'Weather reports and forecasts in the daily newspapers', *Lifeboat*, 1 October 1862, 147.

64 Fitz-Roy, op. cit. (63), 148.

65 J. Glaisher, 'On the variations of the reading of the barometer and the weather in the months of September, October and November, 1865', *Lifeboat*, 1 January 1866, 14.

66 J. Glaisher, 'On the connection between the recent gales of wind and the readings of the barometer', *Lifeboat*, 1 January 1864, 355.

variations of the glass, and this sharpens their observation and corrects many an idle myth and vulgar notion'.[67]

The advantage from this increased observational expertise accrued to the local fishermen, but FitzRoy benefited indirectly. He was freer to make forecasts because he would be less liable for incorrect prognostications if the fishermen were seen to be more responsible for themselves. By rendering fishermen more self-reliant FitzRoy could be seen to be making them safer. FitzRoy attempted to make the Met Department look like a project characterized by restraint on the part of the government and calculated to increase self-reliance on the citizen's part. In the context of Victorian governance, this is not news. But histories of British science in the period (notably histories of electrotechnical metrology and standardization) have emphasized how the success of such systems depended on their ability to reproduce centrally delimited conditions which by definition erased or overwrote local conditions.[68] The story of FitzRoy and the barometers provides an interesting counterpoint to George Airy's attempt to introduce sophisticated metropolitan instrumentation on board naval and merchant marine ships and to establish robust methods for adjusting the compasses on ironclad ships.[69] In contrast to what Alison Winter has argued was Airy's attempt to subdue the authority of ship captains,[70] FitzRoy (a retired sea captain himself, after all) sought a way to make the self-sufficiency of the mariner congruent with the success of a disciplined scientific network. Airy was opposed by William Scoresby, who waged a popular campaign to limit the intrusions of distant and elite natural philosophers into matters that were to remain under local control. On the other hand, FitzRoy faced no significant opposition to his project to bring metropolitan instruments to local fishermen, though he wondered at one point if he would. The barometer story is an example of how enhancing the individual authority of local actors could help sustain centralized liberal governance.

Rather than resembling a pyramid at the top of which a few experts dictated the rules for many, the Met Office's fishery barometer programme can be seen as a network. Authority based on FitzRoy's forecasting expertise flowed outwards from Whitehall to the recipients of his forecasts. But at each node of the network supplied with a barometer, fishermen were enabled to contribute their own expertise in predicting the weather. Such expertise did not flow back to Whitehall, but in sustaining those users at the periphery it provided a greater field of action for FitzRoy and his office. In this sense this episode provides a complement to those histories of electrotechnology that posit a command-and-control model of technoscientific government.

67 'Kingsdown House, near Dover, March 23rd, 1863', 'Report of the Meteorological Office of the Board of Trade, 1863', PP1863 LXIII, 65.

68 S. Schaffer, 'Late Victorian metrology and its instrumentation: "a manufactory of Ohms"', in *Invisible Connexions: Instruments, Institutions and Science* (ed. R. Bud and S. Cozzens), Bellingham, WA, 1992, 23–56; S. Schaffer 'Accurate measurement is an English science', in *The Values of Precision* (ed. M. N. Wise), Princeton, 1995, 135–72.

69 Winter, op. cit. (26).

70 Winter, op. cit. (26).

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Local signs

The forecasting controversy ended dramatically, when FitzRoy took his own life in April 1865. Following his death, it became clear that the Met Department had become dangerously synonymous with FitzRoy himself. The lack of written rules made the forecasting system almost irrecoverable following his death, despite his assistant Babington's extensive experience. Under the heading 'This practice not carried on according to any definite rules', the Royal Society Committee reported that Babington 'does not think that the grounds on which the Department acts in foretelling weather are capable of being stated in the form of Rules or Laws'. All of the knowledge of government forecasting existed solely in the heads of a few government employees. 'Were the gentlemen now of the Department to leave it, no rules would be found in the Office for continuing the duties on their present basis.'[71] The committee recommended that the storm warnings continue but that forecasts be suspended from 28 May 1866. The barometer programme continued. Management of the newly renamed Met Office was transferred to a meteorological committee of the Royal Society (largely made up of members of its Kew Committee).[72] R. H. Scott, translator of Dove's *The Law of Storms* in 1862, was appointed head of the reorganized office, a post he held for thirty-three years under the watchful eyes and increased authority of a Meteorological Committee of the Royal Society.

The debate over the utility of barometers in relation to weather forecasts continued. In 1876 the Meteorological Committee was charged by the Treasury with reviewing the 'results obtained' from the by then considerable annual grant from Parliament of £10,000. The committee pondered whether the signals and forecasts should be reinstated. Henry Lindsay, collector of the Custom House in Shields, shared his views on storm signals. He began by noting that the warnings were not as useful on the east coast as they were on the west, since the falling barometer on which they were based usually indicated a strong offshore wind that became fair for most boats leaving the Tyne. He did acknowledge, however that 'when first hoisted in the Tyne, their novelty, and the new science they evidenced caused them to be carefully observed, and I am aware that they did, in many instances, deter masters from putting to sea'. But simple deterrence was not in itself proof of the utility of storm signals. Fishermen, sailing-ship masters and steam tug owners alike made their living from the sea and staying in port in fine weather was bad business. If working sailors simply took the signals at face value, they would quickly find themselves overly dependent on a dangerous form of universalized knowledge that did not, for example, take into account the different meanings of falling barometric pressure on the east and west coasts of England. Such signals could easily let them down.[73]

71 'Report of a Committee Appointed to Consider Questions Relating to the Meteorological Department of the Board of Trade', PP1866 LXV, 20.

72 Burton op. cit. (21), 173; and 'Return of Establishment and Cost of Meteorological Department of Board of Trade, 1862–66', PP1867 LXIII, 497–512. The Met Office was run by the meteorological committee of the Royal Society until 1877 when it was renamed a meteorological council, with similar responsibilities. See Anderson, op. cit. (31), 144.

73 'Return of Establishment and Cost', op. cit. (72), 68–70.

Rather than rendering the ship captains more reliant on information from without, however, Lindsay suggested the signals made them more self-reliant. 'Masters of vessels,' he wrote,

> who had in this temperate zone paid little attention to the indications of the barometer, content to be weather-wise from their observations of atmospheric or other natural phenomena, began first to study their instruments for evidence of the forecasts as signified by the signals, and then to rely greatly on their own capacity to judge of the coming weather. They practically, therefore, depend very much on themselves.

Rather than robbing autocratic captains of their personal authority, according to Lindsay, the introduction of storm signals spurred them to a reappraisal of their own skills, a kind of continuing education in which the captains tested their capacity to 'judge of the coming weather' against that of the government meteorologists responsible for storm warnings. The implications were that ship captains who relied on themselves were better off than either those captains who took storm signals literally or those who disregarded them completely, and that storm signals would have the effect of stimulating the captains into fuller self-reliance.[74]

Lindsay's emphasis on locally differentiated responses to storm warnings was largely ignored by a committee concerned with the bigger question of whether meteorology should be pursued by a government body at all and, if so, in what form. Storm signals were central to the continuing identity crisis suffered by the government meteorological office in the twenty years since its foundation. The debate over forecasting and prediction in which they figured tended to be polarized through a contrast between practical, local and empirical weather wisdom as opposed to scientific, universal and theoretical meteorology. Scott worked hard to distinguish warnings about existing weather from forecasts relating to future storms. Warnings could be safely incorporated with local readings and tools:

> It seems to me ... that this office may without attempting to forecast weather, place outstations in possession of such meteorological information as it may have received on any day. It must be clearly understood that any telegraphic message of a warning nature is merely meant to imply that there is a storm existing along a certain region of coast, say the S.W., and consequently that there is or *may be* danger impending at other districts. Accordingly vessels bound southwards will know what they have to expect, but the crews of local craft, such as fishermen, must be guided as to the immediate risk which they incur by their own observations of the look of the sky, etc, and also by the behaviour of the local instruments, such as fishery barometers with which the coast has been so liberally supplied by the Government.[75]

Eventually the forecasts themselves were reinstated. Always popular with fishermen and seamen, with FitzRoy gone they no longer looked as dangerously personal to the Royal Society committee as they once had.

Initially thought to be reducible to instrumental traces, local knowledge proved to be both more intractable and more valuable. The Met Committee included a section

74 'Return of Establishment and Cost', op. cit. (72), 68–70.

75 'Report of the Meteorological Committee of the Royal Society for 1867', PP1867–68 LXIII, 297; original emphasis.

on 'local signs' in their ten-year report on the progress of the office since FitzRoy's death:

> These are really among the most important indications of coming change; but practically they can scarcely be utilized by us. They cannot be reduced to rule, and they depend almost entirely on personal experience. It is impossible in a telegram to convey the entire line of reasoning which leads one, in the absence of instruments, to know that a storm is impending. The character, elevation, and motion of clouds, the colour of the sky, the clearness or the contrary of the air, the appearance of the aurora, and numerous other signs are well known to every one who studies the weather; and from these helps the cabinet meteorologist is entirely debarred. He is like a physician dealing with a case by correspondence, without the chance of a personal interview with his patient; for what can a resident in an inland town like London, on any given day, know of the look of the weather on the sea-coast on the same day.[76]

By the 1870s and 1880s this appreciation of local signs grew to include an interest in indigenous customs and traditions. While Victorian fishermen left few traces of their own, in contrast to the hundreds of thousands of ships' logbooks that remain from the period, their habits were increasingly considered worthy of registration by a growing English folklore movement.[77] While inspecting coastal barometer stations in 1883 for the Scottish Meteorological Society, H. N. Dickson met with fishermen to teach them the law of storms and how to use the barometers. 'The method followed in conducting these meetings was to suggest generalizations on facts already known to the men; and it thus became necessary to ascertain, in each case, what facts were to them most important in forming opinions about probable weather.'[78] Registration of this kind of information was hard. Dickson struggled to elicit 'definite information' that he could include in his report. 'The cloud observations made by fishermen are of great interest, but there is considerable difficulty in getting accurate descriptions of them – the men know the weather by the "look of the heavens", but it is not easy to get them to explain *how*.'[79] A tantalizing doggerel verse on tides was incomplete:

> When the loon begins to cry
> Anchors and cables you stand by,
> …
> Never trust the second flood.
> (Third line had been forgotten and could not be recovered.)[80]

Some things completely defied the will to record them. Of a prognostic believed to have been common in the villages between Aberdeen and Stonehaven, by which the severity of the early months of the year could be foretold by the state of the upper clouds during the previous November and December, Dickson was 'unfortunately unable to find any trace'.[81]

76 'Report of the Met Committee to the Royal Society on work done in the Met Office since their appointment, 1866 to 1875', *Proceedings of the Royal Society* (1875–6), **24**, 189–210, 202–3.

77 R. Dorson, 'The great team of English folklorists', *Journal of American Folklore* (1951), **64**, 1–10; W. Gregor, 'Some folk-lore of the sea', *Folk-Lore Journal* (1885), **3**, 52–6.

78 H. Dickson, 'Weather folk-lore of Scottish fishermen', *Journal of the Scottish Meteorological Society* (1889), **8**, 349–55, 349–50.

79 Dickson, op. cit. (78), 351; original emphasis.

80 Dickson, op. cit. (78), 353.

81 Dickson, op. cit. (78), 355.