modelling the dynamics by which plasma moves from the tail into the magnetosphere. It showed that substorms have little effect on storm intensity, compared with IMF-driven plasma circulation (R. Wolf, Rice Univ.)[6]. This model had previously been used successfully to predict magnetic storm intensity, without the presence of substorms. So the Chapman conference produced a surprising convergence of evidence that the solar wind and the IMF cause storms. But what of substorms? Might they be mere by-products of the process, having no essential part to play?

A possible role for substorms, and a consolidation of the ground gained at the Chapman conference, were the main outcomes of Brazil 5. A plot of Dst averaged over many substorms showed no increase in storm intensity with a sudden increase in substorm activity (R. McPherron, UCLA). Nonetheless, substorms might play an essential supporting role. IMF-driven circulation produces high plasma pressures where plasma leaves the tail and enters the inner magnetosphere, which should choke the flow and stop the circulation[7]. Substorms may solve this pressure problem by releasing magnetic stresses, and so allow IMF-driven circulation to complete its job (M. Hesse, Goddard Space Flight Center). This has implications for substorm prediction, because Dst is generally easier to predict than AL from solar wind and IMF measurements.

Brazil 5 replaced the traditional Chapman picture with the Kamide picture, but a version amended to give substorms an essential role. The term substorm, meaning a small version of a storm (as a raindrop is a subpuddle) is now something of a misnomer. A term in the Chapman mould (with a Latin or Greek prefix) more fitting to the Kamide picture would be 'synstorm', meaning 'together with'; but no one suggests changing names. □

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Conservation biology

Poor prospects for oiled birds

Chris Mead

Two reports on the fate of seabirds cleaned and released after being caught in oil slicks make it clear that such rescue attempts largely fail. Both studies are of guillemots, *Uria aalge*, which are especially prone to oiling because they spend most of their time swimming on the sea surface. Wernham *et al.*[1] and Camphuysen *et al.*[2], who report on experience in Britain and the Netherlands, respectively found that only about 1% and 20% of the birds survived their first year after release. Healthy breeding guillemots have annual survival rates of over 90%[1].

Treatment of oiled birds varies from species to species, and with the type of oil[3]. Typically, in Britain oiled guillemots are thoroughly cleaned externally with a warm 2% solution of Fairy Liquid, a household washing-up liquid. This procedure takes two people 45 minutes or more. Waterproofing is restored by thorough removal of all oil residues using pressure rinsing with warm water. The birds are also given a rehydration mix including salt and glucose, with activated charcoal and fine kaolin, to purge ingested oil. They are then kept on a pool with surface drainage to remove even the thinnest sheen of oil. Provided their buoyancy and body weights are satisfactory, and the weather is good, birds may be released within a week of the initial incident.

Both studies[1,2] involved ringing the birds on release after rehabilitation, and comparing the subsequent reports with those of healthy, wild birds ringed as part of a British national scheme. Wernham *et al.*[1] had 77 recoveries (subsequent reports) from 2,912 rehabilitated guillemots since 1985, which could be compared with 113 recoveries of full-grown wild birds out of 11,844. The median times survived were 7 days and 599 days, respectively. The best estimate was that 0.6% of the rehabilitated birds survived their first year — which is between 0.7% and 1.3% of what would be expected for healthy birds. There seems to be no significant difference between the survival of rehabilitated birds since 1985, when records started to be kept in more detail, and those ringed before then.

Camphuysen *et al.*[2] report 108 recoveries of 1,723 rehabilitated guillemots ringed in the Netherlands, mostly since 1988, and compared these figures with 2,176 birds ringed as adults at the colony on the Isle of May in the Firth of Forth, Scotland. The median recovery time for the former group was 12 days and for the Isle of May birds 671 days. The authors conclude that 22% of the rehabilitated birds survived their first year. But the only measure of ultimate success is for rehabilitated birds to rejoin the breeding population. Here at least there are signs of success, stemming from the work of Harris

100 YEARS AGO

As is well known, Chinese tea is mainly made from *Thea chinensis*, whilst that from India is the produce of *T. assamica*. Mr. Crole calls the former variety "a poor, scrubby-looking shrub" and "a wretched plant." From his remarks it would appear that the only service that Fortune rendered to the Indian tea industry by the introduction of the Chinese plant was the deterioration of the indigenous seed, giving rise to quantities of hybrids of various qualities, "from very rank stuff to fairly good." According to the author, the most that can be said in favour of the China plant is that it is distinctly more hardy than the Assam variety. We are disposed to believe that Mr. Crole's prejudices affect his judgement. There is no question whatever that some of the finest and most wholesome tea the world produces is to be met with in China. … Mr Crole is of opinion that the value of a tea should be in direct proportion to the theine it contains. This is surely no more true than that the value of a wine depends upon its alcoholic strength.
From *Nature* 2 December 1897.

50 YEARS AGO

Robert Liston (1794–1847), who died in his prime of an aortic aneurysm on December 7, 1847, is chiefly remembered as the first surgeon in Europe to operate under ether anæsthesia. He remarked at the time: "This Yankee dodge beats mesmerism hollow". He was not a good writer or speaker, and he contributed little to the science of surgery, but he was unsurpassed as a lightning and dexterous operator, whose methods of crushing stone and amputating thighs were the envy and despair of other surgeons.

'Cultivation of the cricket bat willow' – In the past, a number of private owners have tried to undertake the production of this high-quality willow timber, with the object of selling it as material for cricket bat production, and considerable failures have resulted. It is not that the cultivation of the willow itself is actually difficult, but a great deal of close attention is necessary, and more especially during its early life, and the right variety must be obtained at the start. It is for this reason that the Forestry Commission has had drawn up and issued this bulletin on the cultivation of this valuable product.
From *Nature* 6 December 1947.

and Wanless[4], who have thoroughly searched the ledges of part of the Isle of May colony for ringed birds. Over 1,000 of their own have been identified, together with 72 individuals from other colonies and four ringed outside Britain. One of these was not identifiable as an individual, but the other three were rehabilitated oiled birds, two from the Netherlands and one from Germany.

These results[1,2] are the first from extensive and long-term data in Europe. In an analysis of records in the United States, however, Sharp[5] came to the same conclusion for guillemots (median survival of 6 days for cleaned guillemots, as against 216 days for healthy birds), and for two other species: western grebe *Aechmorphorus* sp. (11 and 624 days) and a sea-duck, the velvet scoter *Melanitta fusca* (7 and 466 days). Sharp was also able to assess the chances of oiled birds being cleaned and released for different incidents, and found that they varied widely (from 9% to 60%). Such data are not readily available from the European sources — given the chaotic circumstances when enthusiastic volunteers rally together in the face of an environmental disaster, it is impossible to find out how badly affected and what treatment birds that survived to release had undergone. However, Camphuysen (personal communication) considers that the Dutch birds had probably benefited from a longer period of recuperation than those from Britain, which may partly explain their better survival rates.

These results show that the best efforts to clean up oiled birds are not very successful. Nonetheless, bird welfare organizations would claim that it is their job to do what they can and that, even if only 1% survive, the work is worthwhile. Wernham *et al.*[1] also point out that there are happier cases. In Britain, mute swans (*Cygnus olor*) are often treated successfully, as are the penguins *Sphensicus demerus*, with up to 84% of rehabilitated birds later being seen in their South African colonies[6].

ENVIRONMENTAL IMAGES

Figure 1 **What hope? A victim of the *Sea Empress* disaster.**

Much may depend on the type of pollutant, for various sorts of oil have various effects on seabirds and waterfowl, and different treatments may be appropriate. The long-term toxic effect of oil ingested after preening from the plumage may be responsible for many deaths; other birds may not have regained fully effective waterproofing — the bird may perform well over a two- or three-hour test but not really be fit for continuous swimming. The oils involved in the incidents affecting *S. demerus* may account for the apparently better success rate with these birds — the oils are usually not as thick as those at higher latitudes, and they are quickly degraded as the warmer weather evaporates light fractions. Penguins also have particularly robust plumage.

What else can be done? The oil that causes the problem in the first place comes from illegal release or accidental spillage from ships. Better detection of covert tank cleaning operations, of the fuel tanks of ordinary vessels as well as tankers, should be an international priority (perhaps involving better use of satellite technology to identify and track the guilty ships). Recommendations for the improved management of accidents should come from the enquiry into the *Sea Empress* disaster, which occurred in South Wales in spring 1996; double-hulled tankers, the design of which contains oil after a collision, are also being phased in by international agreement.

The new results[1,2] could be taken to mean that cleaning programmes are simply not worth it, and it is true that the conservation value is minimal for the guillemot population of more than a million birds in the North Sea. But while volunteers are prepared to put in the time and effort to try to save oiled birds, they will continue. Procedures could be improved. Accurate records of individual birds need to be kept from the moment they are found, so that the efficacy of different treatments can be properly assessed. Each bird thought to be suitable for release should then be identified with long-lasting metal rings, and annual ringing of wild, healthy birds should also continue — in part for comparative purposes, in part to identify the colonies involved in the oiling incidents that will sadly continue to occur. □

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Daedalus

The ultimate Sun-block

A solar eclipse, the passage of the Moon across the face of the Sun, is a rare and exciting event. The Moon's shadow brings a sort of momentary night; the blue of the sky vanishes as sunlight is no longer scattered by the atmosphere; the stars come out. Daedalus now suggests a way of making an artificial solar eclipse.

His idea is to obstruct the Sun's disk with a high-flying circular shutter. To block most of the blue atmospheric scattering above a given point, it needs to be about 20 km across. It would subtend the Sun's diameter at some 2,000 km altitude — its upper limit of height. Clearly, it has to be in orbit. Daedalus recalls the scheme for a 'solar sail' spacecraft deploying a vast sail of aluminized polymer film. The pressure of solar radiation on its sail would propel it. His 'Eclipsat' will draw on much the same technology.

Eclipsat will resemble the inner tube for a bicycle tyre 20 km across, folded up small and immersed in a special viscous monomer fluid. Released in orbit, the toroidal tube will inflate under its internal pressure, and will slowly unfold into true circular form. The viscous monomer will be spread out like a soap-film as the tube unfolds, ultimately forming a perfect disk within it, 20 km across and a few micrometres thick. Solar radiation will soon polymerize it to a solid film. Sadly, no dye in the polymer could make such a thin film opaque. It will have to be coated with metal, possibly from a nearby pyrotechnic evaporator released from the same rocket.

The ideal orbital height for Eclipsat is perhaps 1,000 km. It will then produce a solar eclipse every 105 minutes along a track about 5 km across and maybe 8,000 km long. At any point on the track, each eclipse will last only 2 seconds; but their steady repetition will soon yield detailed information on solar prominences and their evolution with time, starlight shifts, and so on. Observers will see a giant shadow racing towards them at about 7 km per s, engulfing them in a brief night.

At other points of its orbit, the metallized disk of Eclipsat will act as a mirror. It will reflect the Sun down onto a narrow track on the dark side of the Earth, giving the novel phenomenon of an 'anti-eclipse'. Observers will see a band of brightness racing through the night towards them; for 2 seconds it will be bright, dazzling, sunlit day; then darkness will descend again. It will be an awe-inspiring spectacle.

David Jones