

The Ecologist

Journal of the Post Industrial Age Vol. 13 No. 6 1983 £2



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OR CALLOUS DETACHMENT?**



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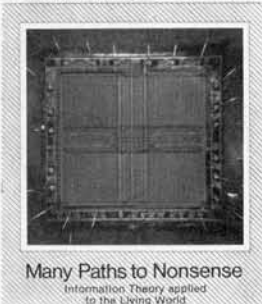
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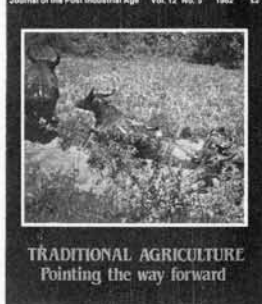
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For sanity and self-protection, feelings and events, as Freud recognised, get separated in the mind. Psychopathology results from a complete dissociation where emotional content gets buried beyond recall. The scientific method depends precisely on such an attitude, with the observer detached emotionally from the object of his study. The scientific method and the technology it spawns have brought power and control, together with cold-blooded self-detachment.

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With the aid of two case studies, one carried out in the Sudan and the other in Senegal, the authors show the importance of the Acacia tree as a means of retaining soil fertility in such arid zones. Many of the problems caused by the droughts over the past decade are a direct consequence of eradicating the Acacia. Its replanting must be a first step in soil restoration.

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- Clive Jenkins* Risk Assessment and Control of Toxic Substances in the Workplace 225

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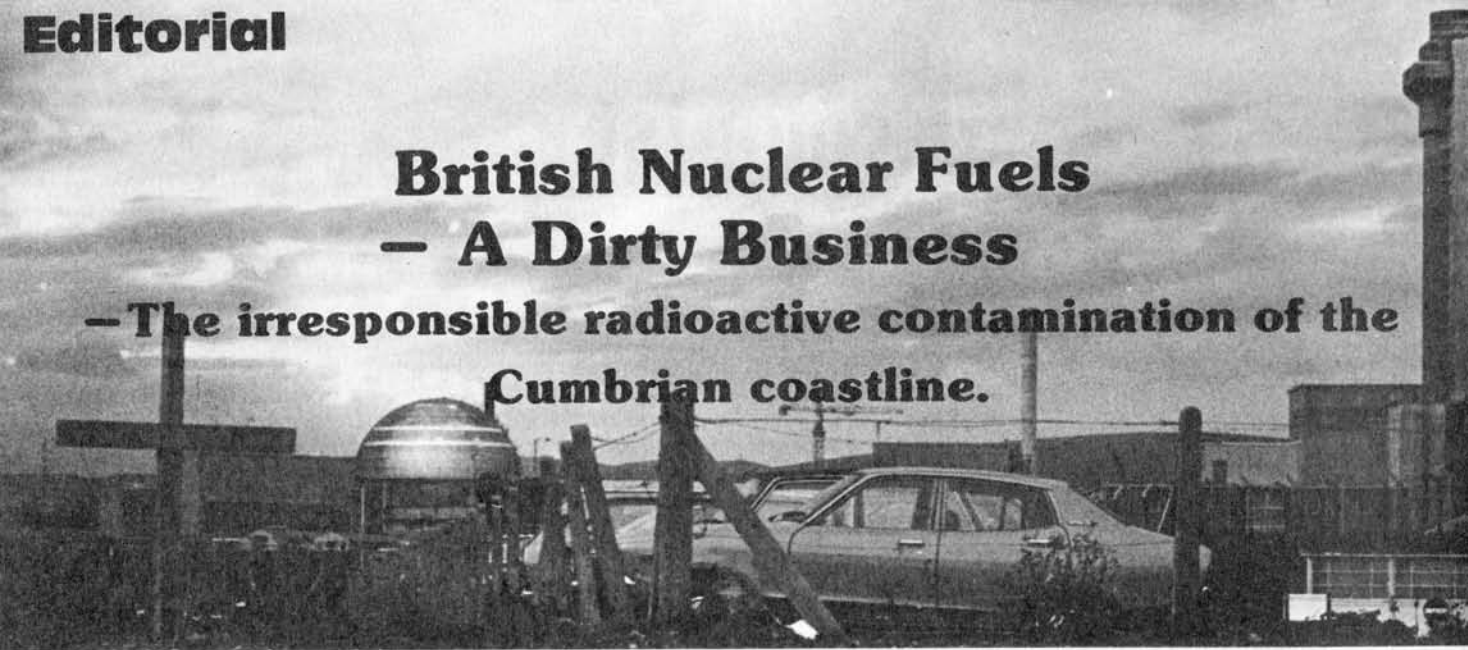
Cover picture: Herbert Bayer, Lonely Metropolitan.

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The cover picture of issue No. 5 was ascribed to Lynn Margulis, in fact it was by Stan Awramik. We regret the error.

British Nuclear Fuels — A Dirty Business

— The irresponsible radioactive contamination of the
Cumbrian coastline.



The Yorkshire Television programme on British Nuclear Fuels' Sellafield reprocessing plant at Seascale in Cumbria, which was shown on November 2nd, was probably an eye-opener for many people, and in particular for those who, unquestioning, had previously accepted official assurance that the discharges from the plant were safe, in as much as they were well within government authorisations. But in effect there was nothing in the film that could not have been predicted. All the signs were there as well as voiced, by the time of the Windscale Public Inquiry of 1977, that the Cumbrian coastline was becoming seriously and permanently contaminated with radioactive material, not least with extremely radiotoxic plutonium and americium. At that stage all that was missing was actual evidence that cancer rates, especially among children, were going up in the locality. Now, through investigative work that should have been carried out by the authorities, whether the regional medical officer or the National Radiological Protection Board, but was actually carried out by a television company, childhood cancers in Seascale and in nearby villages have been discovered up as much as ten times compared with the national average.

All that the authorities have to say with regard to such devastating findings is that they are "chance happenings" and not to be confused with real evidence of a link between the radioactive discharges from Sellafield—originally known as Windscale—and induction of disease. Indeed they still vigorously deny any such connection. Nevertheless, public disquiet since the film's showing has at least prompted the government to instigate an official inquiry under the chairmanship of Sir Douglas Black, former president of the Royal College of Physicians. Meanwhile British Nuclear Fuels can and will continue discharging and polluting.

In brief, Yorkshire Television revealed that dust contaminated with plutonium could be found not only in houses in the vicinity of the reprocessing plant but as far away as 40 miles in Scotland; that animals were grazing in the fields bordering the Ravenglass estuary with up to 100 times natural background radiation; that a farmer whose land bordered the plant had a succession of calves born with deformities including lack of ears, and tongues, and

with deformed feet. Furthermore the tiny villages of Bootle and Waberwaite which should have had no more than one case of cancer in children under 18 over a 30 year period, instead had had four in 20 years; hence six times the national average. Seascale, 1½ miles from Sellafield had had 11 cases of childhood cancer since 1950, seven being of leukaemia of which five cases were in children under five years of age. The cancer rate among children in Seascale was therefore ten times the national average. In effect, the chances of 14 childhood cancers being found in the three villages instead of the expected three was no more than one in 50,000: a very low probability indeed.

In repudiating absolutely the implications, British Nuclear Fuels, together with its champion, Professor John Fremlin of Birmingham University, claim that overall background radiation levels will have to be generally raised between 10 and 100 times above normal to bring about the observed cancers. According to their investigations as well as those of the National Radiological Protection Board (NRPB) and the Ministry of Agriculture Food and Fisheries (MAFF), the increase on average in the area around the site is no more than a few per cent of natural background; hence far below maximum permissible levels for the public as laid down by the International Commission on Radiological Protection (ICRP). True to his performance at the Windscale Inquiry where he indulged in a much publicised eating of local fish, Professor Fremlin insists that the dangers to the inhabitants of South West Cumbria brought about by the Sellafield plant are no greater than that incurred by smoking a cigarette or going into a smoke-filled crowded pub. As for the plutonium-contaminated dust found in houses near the Ravenglass estuary, BNFL's rejoinder is that each child would have to eat 20lbs of it a year to exceed the maximum permissible limit.

In effect, BNFL, as well as official bodies such as the NRPB, MAFF, and the Department of the Environment that have the responsibility of keeping a check on the discharges and of protecting the public, have lost all credibility when it comes to public concern over the effect of radiation. People in the area, especially those with children, have become afraid: they no longer feel safe inside their

houses, knowing that plutonium plus a host of other radionuclides will still find their way in; nor can they or their children avoid being irradiated when they walk and play on the beaches; and if they consume local products whether from the land or from the sea, they do so in the realisation that they are adding substantially to the radioactive burden under which they have to lead their lives. Nor is such a reaction one stemming from fearful ignorance: according to Professor Edward Radford, from the University of Pittsburgh and a leading epidemiologist in the United States, "The worst has happened, and contamination is potentially much more serious than anyone would have realised twenty years ago." He stated that he would be worried for his children if he had to live there. Peter Taylor of the Political Ecology Research Group went even further. For the people of that area there was nothing left to do but to "evacuate".

In fact Professor Radford was halfway to realising the dangers when he gave evidence at the Windscale Public Inquiry in 1977. Then, he told the inspector that the danger from inhaled plutonium had probably been underestimated by a factor of 200, partly because the lungs were considered the critical issue when the bronchial epithelium was proving far more radio-sensitive, and, as important, because the cancer-inducing effects of plutonium were proving to be at least 20 times greater than previously estimated. Justice Parker rejected Professor Radford's evidence, despite his being a prominent member at that time of the US National Academy of Sciences Advisory Committee on the Biological Effects of Ionising Radiation (BEIR).

Equally consistent, Justice Parker gave no credence to the evidence of Professor Vaughan Bowen who had worked as an analytical chemist in the Manhattan Project, tracing impurities in uranium metal, and who at the time of the inquiry was at the Marine Biological Station at Wood's Hole in Massachusetts. Bowen was particularly concerned with the movements of radionuclides through the Irish Sea both in the sediments and in the food chain itself. His own investigations indicated that the findings of MAFF's Fisheries Radiobiological Laboratory (FRL) were seriously at variance with his own, the implications being that the hazards from the radioactive discharges were far greater than was officially appreciated. He found scallops caught off the Isle of Man had a plutonium burden that was at least 40 times higher than that to be found in Windscale plaice. His finding was enough in itself, Bowen argued, to contradict the claim of scientists at the FRL and particularly of Hetherington, that transuranic nuclides which were incorporated into the sediments of the Irish Sea were not biologically available and therefore would not become part of the food chain. Should Isle of Man scallops be consumed at anything like the rates assumed for Windscale plaice, then, according to Bowen, individual consumers would get as much as 10 per cent of their maximum permissible levels of plutonium from that one source alone.

Six years later, on October 6th 1983, BNFL announced that it would spend £10m on a programme to reduce plutonium and americium discharges from the present 1000 curies per year to no more than 200 curies. Curiously the factors involved in BNFL's decision were that the NRPB had come to

the conclusion that the absorption rate of plutonium by shellfish, including scallops was five times higher than it had maintained previously; that more shellfish were eaten than was previously thought; and that analytical methods for measuring plutonium contamination in shellfish had improved. Professor Bowen was thus absolutely vindicated, yet the Inspector in his report cast aside Bowen's evidence on behalf of the Isle of Man.

Dr Bowen was not only concerned with radioactive contamination of sea-food. The main body of his evidence was concerned with ways in which transuranics such as plutonium and americium might find their way ashore. He suggested three pathways: plutonium contaminated dusts that escape the filter systems in the exhaust stacks; the sediments that wash up on the beaches, dry out and blow away; and the atomization of transuranic particles by the action of waves along the shoreline. Bowen was amazed that the British authorities only began their examination of the inhalation pathway associated with the resuspension of the contaminated sediments in 1976, even though the Department of the Environment had known of such an eventuality in 1969. Indeed, rather than tightening its control over BNFL in the early 1970s the government relaxed its authorisations on the discharge of alpha-wastes allowing them to go up threefold to 6000 curies per year. When in the mid 1970s the Department did carry out somewhat perfunctory tests it found that the mean air concentration of plutonium particulates in the Ravenglass estuary was some ten times higher than that to be found in the immediate environment of the Windscale works. Its conclusion, based on minimal evidence, was that the Ravenglass estuary alone was affected.

Experiments which mimic the action of surf show that in water droplets containing no sediment the concentration of plutonium may be up to 800 times greater than that of the seawater from which the droplets have formed. The concentration of americium — also a bone seeker may be 10,000 times higher. The Environmental and Medical Services Division of the Harwell Atomic Energy Research Establishment reported its findings in November 1983. Dr. Bowen reported in 1977 at the Windscale Public enquiry. His evidence was cast aside by the Inspector.

The other big deception concerned the real level of alpha discharges rather than that accounted for in the authorised discharge. Thus until recently, the discharges of plutonium 241 were not taken care of within the alpha waste category, the logic being that plutonium-241, as distinct to other plutonium isotopes was a beta rather than alpha emitter. However, plutonium-241 with a half life of just under 14 years, disintegrates into americium-241 which is both an alpha emitter and of considerably higher radio-toxicity than plutonium-239. In 1978, for example, BNFL discharged some 48,000 curies of plutonium-241, half of which in 14 years would have transformed into americium. That same year the total authorised alpha wastes discharged amounted to 1,837 curies; hence in reality, in one year, BNFL

was discharging the equivalent of 50,000 curies of alpha and admitting to less than 2000. In his evidence at the Windscale Inquiry Dr Bowen suggested that even on the most conservative basis the estimated plutonium exposures as given by MAFF should be multiplied by a factor of ten or more to take account of the contribution of americium.

Equally important, Bowen disputed the contention that inhaled plutonium was insoluble and therefore poorly absorbed into the lung epithelium. On the contrary, he said, the evidence suggested that plutonium would become soluble when interacting with organic compounds in the lung fluids. At that time—prior to ICRP 26 which gave greater weighting to certain alpha emitters than it had hitherto—the ICRP maximum permissible levels for soluble plutonium in air were only one fifteenth those for the insoluble form of the substance.

New evidence suggests that a far higher proportion of ingested plutonium gets absorbed across the gut than had previously been thought. Pregnant women in particular may have absorption rates that are one hundred times higher than at other times, with the result that the foetus in particular becomes a target for alpha radiation. One hardly needs reminding of Alice Stewart's discovery in the 1950s of the dangers to the unborn child of X-raying the pelvic region of pregnant women. Since verified by others, in particular Professor McMahon of Harvard University, Dr Stewart found that such X-rays would bring about a 50 per cent increase in childhood leukaemias.

Furthermore the dose of radiation required to bring about a doubling of the incidence of such radio-sensitive cancers as multiple myeloma and other bone marrow cancers may well be far lower—no more than 5 rems—than the 25 rems or so officially recognised to date. When all such factors add together, even without taking account of the

synergistic actions of different radionuclides and of other environmental poisons, then the levels of plutonium in household dust in the Seascale area—levels which BNFL and Professor Fremlin find of negligible significance—take on a different dimension altogether. Indeed the thousandfold increment required by BNFL to make such pollution credible as a cause of the extra cancers may well have been surpassed.

Cover up

There has been deception all along the line ever since Windscale came into operation as the site of Britain's plutonium producing plant. The first major cover up was over the Windscale fire of October 1957 and its aftermath. It was many years before the public came to know that as much as 20,000 curies of iodine-131 had been released. But that any deaths should be ascribed to the radioactive plume were vehemently denied; that is until Peter Taylor's (PERG) assessment of last year that the fire may have contributed to the deaths from radiation induced cancers of several dozen people. After Peter Taylor's announcement, the NRPB agreed that his figures were essentially correct, and there the matter rested until in September 1983 the NRPB published a new report on the fire which indicated that as much as 240 curies of polonium-210 had also escaped into the atmosphere. The NRPB suggests that the polonium may have killed up to 12 people. John Urquhart of Newcastle, using official figures of polonium contamination of milk from cows in the Windscale area, believes that as many as 1000 people may have been affected.

Aside from accidental releases within the plant site—the ruthenium blow-back incident of 1973 for example, the leaking magnox cladding silo, the long undetected leak from an overfull high active waste



Divers return to the Greenpeace inflatable, after examining the pipeline pumping "low-level" nuclear waste into the Irish Sea.

tank—there have been no accounts since the 1957 fire of unauthorised releases of radioactive material into the environment beyond the site boundary. In that light the recent incident involving Greenpeace is particularly worrying, for not only did Greenpeace's divers stumble into a radioactive slick discharged into the Irish Sea, it appears that they stumbled into one which contained far higher levels of radioactive waste than should officially have been released on a per diem basis. According to senior process workers in the reprocessing plant, besides the release of 500 curies of beta activity—hence just over twice the permitted daily emission rate—it seemed that 7000 curies which had been transferred to buffer tank B 211 had also been released. "There is no trace of the solvent," said one worker, "all the footsteps lead to the sea." (*Guardian*, November 21).

For a number of years Greenpeace has been campaigning against BNFL's discharges into the Irish Sea, and indeed had commissioned Peter Taylor to carry out research into excess cancer incidence in South West Cumbria. The finding of excess childhood cancer in the vicinity of Sellafield clinched the matter and Greenpeace decided that if the government refused to act in closing down the plant until radioactive discharges could be substantially reduced, it would have to go in and cap the discharge pipe thus forcing BNFL to shut down. As its director Peter Wilkinson pointed out after BNFL had issued a High Court injunction against tampering with the discharge pipe "Ignoring this injunction in no way exhibits our contempt of the British Courts. No other course is open to us after five years of lobbying and providing scientific papers which clearly show that the Windscale discharges are responsible for deaths locally and gross contamination of the Irish Sea . . . We are here to protect and not to pollute, yet it is us who end up on the wrong side of the law."

In the end, Greenpeace had to give up its attempt to cap the pipe, BNFL had apparently anticipated the Greenpeace action and had secretly sent divers down to weld two metal rods to the diffuser at the end of the pipe. Since BNFL had had the work done before Greenpeace made its attempt on the pipe, Wilkinson believes Greenpeace's phones must have been tapped and information on its plans passed on to BNFL.

Greenpeace fined £50,000 after failing to give pledge on pipeline.

Guardian, December 2nd 1983

But if Greenpeace failed to cap the pipe, its operation was highly successful—although at the risk of serious radioactive contamination of its divers—in pinpointing the dangers to the public of BNFL's radioactive discharges. Few surely would have missed the irony that an area in Whitehall had to be cordoned off after radioactive silt taken from the Ravensglass Estuary—to which the public have access—was dumped outside Downing Street. Far more serious were the implications that the oily slick first discovered by Greenpeace had come ashore. BNFL had then to seal off the beach, until according to its spokesman, the radioactive residue had been washed away. A few days later beaches had again to

be closed when seaweed with radioactive levels 100 to 1000 times higher than normal were washed up.

But what if Greenpeace had never ventured out, would the slick have been noticed? And on how many other occasions have similar contaminations occurred without anyone taking a blind bit of notice? Given the stream of 'cover-ups' that have emanated over Windscale, the public can no longer seriously believe that the Greenpeace slick was just a one-off chance finding.

Over the years different scientists have discovered radioactive 'hot spots' on Cumbrian beaches, but heaven help them if they work for the government. Three years ago, Dr Barry Matthews, an experienced soil scientist working with the Agricultural Research Council on a soil mapping programme, discovered an area on the beach close to the Drigg discharge pipe which was intensely radioactive. He then not only made 'unauthorised approaches to BNFL' informing the company of his findings, he had the temerity to warn visitors to the beach that the area was unsafe for their children. As a result of his 'anti-social' actions he was hauled before a tribunal in April 1981 and summarily dismissed from his job—one that he had been in for 20 years. Later, as a result of action by his union he received compensation but was not reinstated.

As we have pointed out elsewhere ('Nuclear Power—the Grand Illusion', *The Ecologist* No 4, 1980) BNFL has had an appalling record at Windscale, and that based solely on information that has been officially released. Its discharges, both liquid and gaseous, are by far the worst in the western world, and despite warnings by eminent scientists it has basically ignored the consequences of its activities. Unfortunately the contamination of the Irish Sea that has taken place over the past 15 years, is irreversible; such is the legacy that BNFL has left in less than a generation for the generations to come.

The public has a right to be protected and before BNFL pollutes any more, the government has no alternative but to close the plant down. In the meantime Sir Douglas Black will be able to complete his investigations into the excess cancers both in children and in adults in the area around the reprocessing works. New clusters of cancers are coming to light all the time, such as the recent discovery of a doubling of the incidence of myeloma around the town of Fleetwood in Lancashire close to the Cumbrian border. Such clusters cannot be written off as mere chance happenings, as certain district medical officers have suggested. To do so would make a complete nonsense of epidemiology.

As for the future of reprocessing spent reactor fuel, that must surely be in doubt. A recent government commission in France—the Castaing Commission—came to the conclusion that reprocessing should be tolerated only if all discharges, including those of krypton and tritium, are reduced by a considerable factor, no doubt at considerable cost. The Commission was concerned with French reprocessing technology, which in its present state, is far less polluting compared with BNFL's. Reprocessing is one of the many weak links in a weak nuclear chain. It is time for the entire chain to be chucked onto the scrap heap.

Peter Bunyard

The Pathology of Objectivity*

by Ashis Nandy

The human has a capacity to isolate feelings from the events that generated them so as to attenuate their effect. That ability, as Freud recognised, was an essential mechanism of ego-defence. In this article, Nandy argues that the same basic separative mechanism operates in scientific analysis with the observer detaching himself dispassionately from the object of his studies. Science therefore provides a distorted world view, as extreme in its way as the psychopathology of schizophrenia in which feelings and events can become totally disconnected. The danger to society derives from the dominance of scientific thinking over all domains. Self-detachment has thus become a collective disease and the cold-blooded violence it spawns is increasingly given justification in the light of cold reason.

Every age has its typical forms of social pathology. The pathology of one age may be based on religious fanaticism or tribal blood-feuds, that of another on secular, objective, dispassionate pursuit of personal and collective interests. History, therefore, is usually an inadequate guide to its victims. It draws attention to forms of violence and greed which have often already become marginal to the problems of human survival and social transformation.

Every age has also a cut-off point when self-awareness catches up with the organising principles of that age, when for the first time shared public consciousness begins to own up to or rediscover—often through works of art or speculative thought—what seers and lunatics have been saying outside the earshot of 'sane', 'normal', 'rational' beings who dominate the public discourse of the time.

It was the mindless blood-letting of the First World War which created a new awareness of an old psychopathology. As the range of human violence and the role of science in that violence began to weigh on the social conscience, a number of European intellectuals woke up to the dangers caused by the human ability to separate ideas from feelings and hence to pursue ideas without being burdened by feelings. With the advantage of hindsight one can trace the cultural sanction for this ability to the change of spirit of European cosmology in the Sixteenth and Seventeenth Centuries, when the anthropomorphic world view first began to give way to a mechanomorphic view of nature and society.

Ashis Nandy is a well known psychologist and a fellow of the Centre for the Study of Developing Societies at Delhi. He is the author of 'Alternative Sciences' and 'At the Edge of Psychology'.

Sigmund Freud first gave a name to that splitting of cognition and effect: he called it isolation, and described it as an ego-defence, a psychological mechanism to help the human mind cope with unacceptable or ego-alien inner impulses and external threats. According to Freud, the individual would sometimes isolate an event, an idea or an act by cauterising it emotionally, so preventing it from becoming a part of his significant experience. The event, the idea or the act was not forgotten; it was reincorporated into consciousness after being deprived of its affect.¹ That mechanism did not, Freud granted, really free ideas or actions from feelings. It merely replaced conscious associations by unconscious ones and displaced the affect to other ideas or events.

Afterwards two second-generation psychoanalysts, Anna Freud and Otto Fenichel, were to define isolation more formally. Here is Fenichel on the subject;

The most important special case of this defence mechanism is the isolation of an idea from the emotional cathexis (load of feelings) that originally was connected with it . . . In discussing the most exciting events, the patient remains calm but may then develop at quite another point an incomprehensible emotion, without being aware of the fact that the emotion has been displaced . . .

*Extracted from a revised version of the M. N. Roy memorial lecture, 'Science, Authoritarianism and Culture: On the Scope and Limits of Isolation Outside the Clinic', delivered at the Gandhi Peace Foundation, New Delhi, 1980. The full version will be published in the author's forthcoming book, *The Politics of Awareness: Traditions, Tyranny and Utopias*.

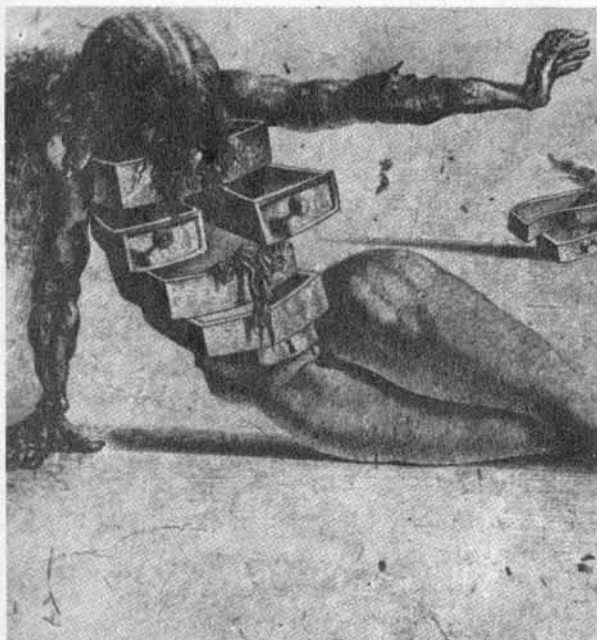
The normal prototype is the process of logical thinking, which actually consists of the continued elimination of affective associations in the interest of objectivity . . . Compulsion neurotics, in their isolation activities, behave like caricatures of normal thinkers . . . they always desire order, routine, system.²

Such a definition, however clinical it may seem, already verges on social criticism. It implies that order, routine and system are not absolute values; any over-commitment to them is an illness. It also implies that objectivity, and the separation of the observer from the observed, is not an unmixed blessing; it can sometimes hide fearsome passions.

Psychoanalysis was not alone. At about the same time that the young discipline was forging the concept of isolation, the surrealist manifestos of André Breton and his associates were tilting against conventional rationality and indirectly attacking the growing use of isolation in modern life. Salvador Dali, for instance, 'absurdised' in his art and life exactly that pathology. His watches that melted and his men who refused to be fully human were but instances where the lost affect was made to reenter social perceptions, to shock or entertain. Many years afterwards George Orwell was to be scandalised when middle-aged Dali put into his memoirs, with obvious relish, the following incident, which took place when he was six:

While crossing the hall I caught sight of my little three-year-old sister crawling unobtrusively through a doorway. I stopped, hesitated for a second then gave her a terrible kick in the head, as though it had been a ball, and continued running, carried away with a 'delirious joy' induced by this savage act.³

Orwell correctly guessed that Dali's pathology tied up with the pathology of a period and quoted a rhyme popular around 1912 to make his point:



Salvador Dali's. The City of Drawers



Ordered environment — a kind of illness?

Poor little Willy is crying so sore
A sad little boy is he,
For he's broken his little sister's neck
And he'll have no jam for tea.⁴

As if to prove Orwell right, Dali's naughty book dutifully became a best-seller.

Within a decade or two, a number of movements in literature and the arts caught up with the same pathology, often brilliantly, though rarely self-consciously. For instance, many of the comic devices of Bertolt Brecht can be read as attempts to tear away the mask which isolation allows the industrial society to wear. When one laughs with Brecht one also laughs at the subversion of the defence of isolation. If one pierces isolation by looking at it from the outside, Brecht seems to say, one confronts either psychopathic hypocrisy or sheer self-deceit. Those of you who have seen or read his *Mr Puntilla* (1940) will know that it is the story of a businessman whose personality is split. He is a heartless, calculating machine when sober, humane and lovable when drunk. When sober, pathological isolation is the main feature of his self. When drunk, the feelings he has dissociated from ideas and actions re-emerge into his consciousness and get re-attached to his ideas and actions. That this only happens when he is drunk is Brecht's final comment on the psychopathology of modern society.

Charles Chaplin's *Monsieur Verdoux* (1947), a black comedy set against the collapse of values in inter-war Europe, makes subtle use as well as criticism of the mechanism of isolation. The movie tells the story of a lovable psychopath who marries and then charmingly kills his wives for money. Chaplin off-sets that isolation against the larger isolations taking place in European society and against the isolation that the movie induces in the viewers. As we isolate the acts of murder from the emotions they should arouse, we laugh at Chaplin's murders and sympathise with his hero, who does on a small scale what societies do on a far grander scale.⁵

That awareness in Chaplin's folk philosophy found its clearest expression in Orwell's essay on the use of the English Language to sterilise thinking and to cover up violence and cruelty:⁶

In our time, political speech and writing are largely the defence of the indefensible. Things like the continuance of British rule in India, the Russian purges and deportations, the dropping of the atom bombs on Japan, can indeed be defended, but only by arguments which are too brutal for most people to face... thus political language has to consist largely of euphemism, question-begging and sheer cloudy vagueness. Defenceless villages are bombarded from the air, the inhabitants driven out into the countryside, the cattle machine-gunned, the huts set on fire with incendiary bullets: this is called *pacification*. Millions of peasants are robbed of their farms and set trudging along the roads with no more than they can carry: this is called *transfer of population* or *rectification of frontiers*. People are imprisoned for years without trial, or shot in the back of the neck or sent to die of scurvy in Arctic lumber camps: this is called *elimination of unreliable elements*.⁷

Orwell wrote that in the mid-forties. Erich Fromm, meanwhile, described the authoritarian person not only as sado-masochistic but as having a mechanical, rigid mode of thinking characterised by heavy use of isolation. Fascism, he said, thrives on the objectification of persons and groups.⁸ Theodor Adorno and his associates, too, wrote about the '... empty, schematic, administrative fields' in the mind of the fascist and about the constriction of his inner life.⁹ The fascist, they said, partitioned his personality into more or less closed compartments. He had a narrow emotional range and he rejected emotional richness, intuitions and the softer side of life in general. He admired organisations and their formal hierarchies and he sought security in isolating hierarchical structures.¹⁰

The psychological description of post-war Germany by Alexander and Margarete Mitscherlich fits the same pattern:

The most important collectively practiced defence is to withdraw cathectic energies from all processes related to enthusiasm for the Third Reich, idealization of the Fuhrer and his doctrine, and, of course, actual criminal acts... the community of those who had lost their ideal 'leader', the representative of a commonly shared ego ideal, managed to avoid self-devaluation by breaking all affective bridges linking them to the immediate past... had it not been counteracted by these defence



Bertolt Brecht — a master at revealing the psychopathology of society

mechanisms—of denial, isolation, transformation into the opposite, and above all withdrawal of interest and affect, that is to say of rendering memories of the whole period of the Third Reich devoid of feeling—a condition of extreme melancholia would have been inevitable for a large number of people in post-war Germany.¹¹

Operating from a different position, Hannah Arendt was later to enrich that description through her portrait of Adolf Eichmann, a plain-thinking, non-ideological, hard-working, bureaucratic killer who saw his genocidal responsibility as a problem of efficiency, organisation and objective planning.¹² Arendt recognised that Eichmann was the final product of the modern world, not because he established a new track-record in monstrosity but because he typified the evil that grew out of everyday isolation rather than the satanic psychopathy which comes from unbridled emotions. Moreover, the great majority of his victims too were 'utterly unable to comprehend what had happened to them... they had no consistent philosophy which could protect their integrity as human beings, which could give them strength to make a stand against the Nazis. They had obeyed the law handed down by the ruling classes, without ever questioning its wisdom.'¹³ Thus, mechanical, bureaucratic, unaffected acceptance faced a mechanised, bureaucratic feelingless death machine.

Hence, ever since the First World War, sensitive minds had been warning the modern world of the dangers of sanitised cognition, the same which many years later novelist Robert Pirsig was to call 'a kind of noncoalescence between reason and feeling.'¹⁴ And, by the early fifties it had become clear to many that fascism was the typical as well as the ultimate pathology of the modern world, for it merely took to its logical conclusion that which was central to modernity, namely the ability to partition away human cognition and pursue that cognition to its deadly extreme.

Only one area of modern life escaped the full thrust

of the critique of isolation: modern science. There were reasons for that immunity, for modern science was none other than structured isolation. The values of objectivity, rationality, value-neutrality and intersubjectivity were by definition the values of the modern scientific worldview. And those values drew heavily upon the human capacity to isolate. Moreover, there was a latent awareness in society that science was, at times, isolation at its best and at its most exciting; that somehow the abstractive and generalising capacities of science were closely related to the process of isolation. Theodore Kroeber, a relatively unknown psychologist, once perspicaciously described objectivity as a coping mechanism that was the healthy counterpart of the defence of isolation.¹⁵ Science as a personal search for truth and as a means of human self-realisation seemed to be a form of that creative objectivity. Moreover, the attacks of artists, writers and of fashionable mystics, were in contrast, bound to wash off as eccentric responses to the creative isolation of modern science.

One part of the attack on science was diverted to technology. As the dehumanising and mechanomorphic aspects of technology became obvious after the First World War, the view emerged that questions of ethics applied mainly to technology, not to science. Such was certainly the argument of the major social critics who shaped the popular response to science. Take for instance the two literary figures who helped bring us up in the first half of this century: George Bernard Shaw and H.G. Wells. Shaw wrote savage indictments of modern technology in *Major Barbara* and *The Doctor's Dilemma*. But he also wrote fiery tracts pleading for increased modern scientific management of societies. Wells' science fiction could be read as a trenchant critique of a science contaminated by human greed and violence. *The Island of Dr Moreau*, he implied was only geographically far away; psychologically it was in the midst of the modern world. But when it came to social problems, Wells

became a votary of scientism.

Probably the most touching example of such ambivalence was Bertrand Russell, one of the first to sense the full destructive power of modern science and technology. In his *Icarus*, an essay on the future of science, as well as in a number of his other works, Russell touched upon the relationship between authoritarian control, science and technology, and the instrumental use of isolated rationality. As a corrective he wanted both reason and love, not isolated reason.¹⁶ Nevertheless, in his system, reason had an intrinsic legitimacy; love did not. Love had to be reasoned love; reason did not have to be feeling reason.

Rational Love—an instrument of oppression

At least two millenia before modern psychology was born, the Kaushitaki Upanishad advised one to try to understand the speaker behind the spoken word and the doer behind the deed.¹⁷ I therefore hazard the crude *ad hominem* argument that Russell's own life provides clues to the disjunction between ideas and feelings that his philosophy endorsed. His love life showed that he never sensed the subtle exploitation in a two-person situation where one operated according to the principle of rational love and the other had faith in reasons of heart. He never imagined that what Freud might have dubbed a rational transference could become—with its built-in bias for impersonal, negotiable, part-objective relationships—an instrument of oppression. The simple, non-intellectual biography of Russell by his daughter Katherine Tait recognises that danger. It unwittingly reveals how Russell's children rebelled against the oppression of rational love. Katherine herself found religion and missionarism, both as a means of de-isolating and as a means of defying her aggressively atheistic father, while her brother found madness, of a kind which generally has the split between ideas and feelings as its main symptom.¹⁸ Indeed Mrs Tait's naive comment in the context of her brother's illness turns out to be *intellectually* the most challenging; in effect she wishes her father had been more influenced by the open-ended, easily criticisable, more holistic and less scientific psychology of Sigmund Freud than by the positivist, rational, progressive and ultra-scientific system of J.B. Watson.

The crux of the argument is this: the intellectual and moral challenge facing us is nothing more than updating our older sense of evil by including within it a new sensitivity to bureaucratised violence, made possible by the ego defence of isolation on the one hand, and legitimised by the ideology of scientific objectivity on the other.

The challenge can be met only if we take courage to affirm that the main civilisational problem is the way of thinking associated with the modern concept of rationality and to recognise that modern science has already built a structure of near-total isolation where human beings themselves—including all their suffering and moral experience—have been objectified as things and processes, to be vivisected, manipulated, controlled or corrected. According to that view, the irrationality of rationality—as Herbert Marcuse might



Paul Klee's caricature of Hitler — the supreme psychopath.

have described the pathology—in organised normal science—as Thomas Kuhn might have described the system—is no longer an empty slogan. It is threatening to take over all of human life, including every interstice of culture and every form of individuality. We now have scientific training in modern sports and recreations; our everyday social relations and social activism are more and more guided by pseudo-sciences like management and social work and by fourth-rate pseudo-technologies like transactional analysis and T-groups. Our future, as we all know in our one-dimensional society, is being conceptualised and shaped by the modern witchcraft called the science of economics. If we do not love such a future, scientific child-rearing and scientific pedagogy are waiting to cure us of such false values, and the various schools of scientific psychotherapy are ever ready to certify us as dangerous neurotics. Another set of modern witch-doctors has taken over the responsibility of making even the revolutionaries among us scientific. In fact, the scientific study of poverty has become more important than poverty itself. Even in bed, our performance is now judged according to the objective criteria of some highly scientific, how-to-do-it manuals on love-making.

Such a process has continuously justified our ability to freeze or fix a subject for study and to place it at a distance to evaluate. Those acquainted with Bettelheim's account of human beings facing arbitrary torture and murder will know why I have used the word 'distance' here. Distancing is a psychological device which both the victim and his oppressor have to use, one to ward off the reality of his fate and the other to reduce his victim into an object.¹⁹

It is the latter use which is pertinent to my argument here; that prompts Aimé Césaire to write the quaint formula 'colonisation = thingification'.²⁰ In its extreme form such objectification becomes necro-philia, the passion to kill so as to freeze, place at a distance, and love.²¹



A victim of scientific objectivity

The warning against the rationality from which such objectification comes is best given in the words of Fromm:

Logical thought is not rational if it is merely logical . . . (Paranoid thinking is characterised by the fact that it can be completely logical . . . logic does not exclude madness.) On the other hand not only thinking but also emotions can be rational . . .

Reason flows from the blending of rational thought and feeling. If the two functions are torn apart, thinking deteriorates into schizoid intellectual activity, and feeling deteriorates into neurotic life-damaging passions.

The split between thought and affect leads to a sickness, to a low-grade chronic schizophrenia, from which the new man of the technetronic age begins to suffer . . . there are low-grade chronic forms of psychoses which can be shared by millions of people . . .²²

The separation of ideas from affect has been strengthened by a second split in human consciousness, that between the subjects and objects of research. In the modern western knowledge systems, it is that second dichotomy which is seen as the pathway to power through knowledge and knowledge through isolation.²³

In the biological and social sciences, the split has necessarily led to a further endorsement for mechanomorphism and has secularised, in the worst sense of the term, the old European concept of a 'world machine'. The older concept of world machine included the idea of God the clock-maker which, however retrogressive it may sound to modern ears, did provide a check on the extremes of isolated cognition implied in the idea of the world as a machine. The new concept of world machine represents a desacralised mechanomorphism which admits no limit on itself. Behaviourists J.B. Watson and B.F. Skinner have only taken to its logical conclusion that process of objectification. How far they derive their legitimacy from the promise of scientific control over human fate is obvious from the fact that behaviourism remains the official ideology of both western modernism and Soviet Marxism.

It is often said that the dichotomy between the subject and object is not absolute in modern science, the examples of Werner Heisenberg in natural sciences and those of Freud and Marx in the social sciences being popular in that context. But here we are not discussing theoretical possibilities but the mainstream culture of science. In fact, modern science, as we know it, will collapse if it gives up the dichotomy between the observer and the observed. The difference maintained between the expert and the non-expert and between the scientist and the layman are but special cases of that basic dichotomy.

The dichotomy inherent in scientific study is the other side of the pathology that many psychologists have identified as a basic feature of modern authoritarianism. The latter, too, cannot do without all-round

objectification and without the idea of a leadership or vanguard representing both the true interests of the masses and the superior cognition of those interests. At its most benevolent, political authoritarianism sees citizens as subjects whose subjecthood is no difference from that imposed on the laity by science.

The sometimes-creative distance between the scientist and his subject of study becomes here the vulgarity of distance between a self-declared elite and their increasingly voiceless objects of manipulation: the reportedly immature masses, underdeveloped, primitive, and carrying the heavy baggage of false consciousness. Thus the culture of modern science becomes a part of a more general theory of imposed liberation: material, cultural and spiritual. From this point of view, modern science is no longer an enemy but a new ally of authoritarianism.

Traditional Culture versus Scientism

It is therefore not a paradox of our times that to contain science we might have to fall back on what has been directly or indirectly one of the main targets of modern science, namely cultural traditions. It would be a natural consequence of the attempt to protect the plurality of human consciousness and to provide a critique of modernity from outside. Likewise, to contain authoritarianism, especially within the framework of a participatory system, we may have no other alternative but to provide a critique of the modern industrial society which will not be an internal critique of modernity and yet makes sense to the contemporary man who lives with modernity. Insofar as the various versions of scientism cannot provide such criticism and insofar as modern science is inextricable from modern consciousness, we may have to fall back on the traditional worldviews and theories of life. At least the latter have tried to protect, at the margins of the 'civilised' world, the crucial insight that the battle against isolation is joined when the concept of the fully autonomous observable is given up as the unit of analysis and, instead exchanged for the dyad of the observer and the observed as the basic unit of analysis.

A number of non-modern systems of thought have sought freedom and understanding in deliberately seeking a continuity between the observer and the observed and in greater identification and empathy for the latter. Here, for example, Toshihiko Izutsu speaks of Islam:

The problem of the unique form of subject-object relationship is discussed in Islam as the problem of *ittihad al-alim wa-al-ma'lum*, ie. the 'unification of the knower and the known.' Whatever may happen to be the object of knowledge, the highest degree of knowledge is always achieved when the knower, the human subject, becomes completely unified and identified with the object so much so that there remains no differentiation between the two. For differentiation or distinction means distance, and distance in cognitive relationship means ignorance.²³

I do not dispute that traditional philosophies generally place such unity of the knower and the

known outside everyday life, instead seeing the relationship as unavoidably dualistic. Nonetheless the awareness of the need for unity means that the limitations of modern science as one of many possible finite systems of knowledge may be realised so that its role in the world may be even more limited and the worldview it implies corrected. Furthermore that awareness allows us to use traditions, too, as a legitimate vantage ground for social criticism, something that both Shankara and Nagarjuna do so elegantly through Advaita and Madhyamika in Hinduism and Buddhism respectively.

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Traditional Agriculture in Sahelia

— a successful way to live —

by Peter H. Freeman and Tomas B. Fricke

Peter Freeman and Tomas Fricke have considerable experience of western attempts to introduce capital-intensive modern agriculture into the Third World, seeing at first hand the terrible problems resulting from the systematic replacement of traditional practices by modern ones. When studied carefully in the field, traditional methods are generally found to be ecologically sound; moreover they have enabled traditional societies to adapt remarkably to their particular, sometimes extremely hostile, environments.

Recently the two authors prepared a report to that effect for the attention of the World Bank. The two case studies are extracts from that report.

Case studies can prove extremely useful for illustrating the importance of the basic components that lie behind ecologically-oriented agriculture. Indeed recourse to case studies is essential if there is to be any understanding of the means by which ecological agriculture has arisen and thrived in a great diversity of environments throughout the developing world. Regard for ecological differences automatically signifies regard for diversity and for the basic elements

of that diversity, whether in natural or human-shaped ecosystems.¹

Studies of the traditional farming systems in the Sahel indicate their ecological soundness. The acacia tree is the basis of the system, and its uprooting, in order supposedly to improve overall agricultural yields, has led to widespread deterioration of soil and of a sustainable farming base.

ROTATING ACACIA SENEGAL WITH PEARL MILLET IN THE SUDAN

The first case study is of the traditional agricultural practices of the Bideiriya sedentary cultivators and Kababish camel/sheep herders who live in the area of El Obeid in the North Kordofan Province of the Sudan, which is in the eastern part of Sahelia — that vast area that borders the Sahara desert. This is an area of low rainfall, 250-450mm a year, the soils are sandy — locally called Qoz sands — and the natural vegetation is grassland interspersed with acacia trees (*A. senegal*, *A. Tortilis*, *A. radiana* and *Leptadaenia pyrotechnica*.)

The traditional rotation of natural regenerating acacia senegal trees, from which gum arabic is harvested, and millet and other grain crops has in the past provided a livelihood and stable land use for rural peoples living in small villages just below the Libyan

desert in Western Sudan. The drought of 1968-1973, increasing human and livestock populations, the expansion of peanut production have unbalanced this system and initiated a rapid decline in land productivity, that has in places resulted in desert encroachment and the abandonment of villages, especially in the region of El Obeid, Sudan.

In this system of resource use a relatively long fallow period of up to 15 years, during which *Acacia senegal* trees regenerate, are browsed by livestock, and tapped for gum, follows a period of four to six years of cereal cultivation. Traditionally, the principal crop was millet on the sandy soils which are quaternary sand dunes and wind deposits which have been stabilized by the acacia brush savannah vegetation. The east-west belt in Sudan in which the particular land use pattern occurs is bounded on the north by the Libyan desert and on the south by a region of greater rainfall and clayey soils in which *A. senegal* does not grow well and where sorghum displaces the more drought-tolerant millet. Millet's place of origin may be in that belt in Sudan.²

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In the general area of El Obeid, where these observations pertain, small villages occur at intervals of five to eight kilometres in an almost classically hexagonal pattern, distorted by the presence of large wells that result in denser settlements. Families are large, with up to ten children. The optimum farm size in the system is approximately 60 acres, 20 of which would be under cultivation in *Pennisetum typhoides* or pearl millet, primarily, and to a lesser extent sesame. Millet yields in the past averaged 200kg./acre or slightly less than the needs of one adult (250 kg/year). Losses of grain in storage, which is in sacks buried in the sand, and in the home is around 25 per cent. Erratic rainfall causes losses also. In recent years, under shortened fallows millet yields have fallen to 100 kgs. per acre and at additional cost since over-cultivated fields are invaded by a parasitic weed *Striga hermonthea*.

Acacia maintaining the Ecological Balance

Yields from gum arabic trees begin between the third and sixth year after regeneration, and although variable from tree to tree, average between 40 to 50 kilograms/feddan (approximately one acre) until the fifteenth year or thereafter, when the tree is said to die. That is the point at which the 'gum garden' is cut down and the period of millet cultivation begins. Trees are cut with axes but not uprooted, and land is prepared and tilled with hoes. Ploughs are not used, (or needed) and if they were, would probably damage the acacia root stock. Spontaneous *Acacia* regeneration in fields is pruned. However, if cut back over too many years will be permanently deterred. The prolongation of cultivation periods in recent times has in fact discouraged regeneration.

That relatively stable land use system seems to have endured until the 1950's when subsidised veterinary and medical services were introduced to the Western provinces of Sudan. Increasing human and animal populations appear to have steadily overtaken the carrying capacity of the system, the key to which is the long fallow in gum trees. Not only did the *A. senegal* fallow restore soil fertility — above all organic matter crucial to sandy tropical soils — but the gum provided a principal source of cash income to the farmer, as well as to the national coffers. Sudan is the leading exporter of gum arabic. But increasing human numbers led to smaller farms, shortened gum tree fallows (during which increasing livestock numbers browsed more heavily on that diminishing source of forage), and declining yields of gum as well as of millet.

Browsing of *A. senegal* by livestock is a long-established tradition, deriving from times prior to the establishment of permanent villages, when the millet fields were tended by the women and children of nomadic herders, left behind in temporary camps to sow and tend the crop. Since the Acacia Savannah belt lies at the southern (dry season) extent of camel and goat migrations and the northern (wet season) extent of cattle migrations, it is browsed twice a year by migratory livestock as well as by smaller numbers of resi-

dent livestock. The steady clearing of the natural stands of acacia and conversion of increasingly larger surfaces to field crops has exacerbated the problem of foraging resource pressures caused by increasing numbers of animals.

The 1968-73 drought was the *coup de grace* for the destabilizing trend of resource use. Many acacia trees died, and large numbers of livestock died or were slaughtered. For cash income, people in some places resorted to collecting acacias for firewood and charcoal production, needed especially in villages without water, who traditionally buy it from water vendors from neighbouring villages having wells. Also peanuts were introduced as a cash crop, and cultivated widely by persons desperate for an income to re-build their herds.

Two limiting factors in the environment — rainfall and soil organic matter were previously resolved by the rotation system. First, both millet and *Acacia senegal* are well adapted to the very low and erratic rainfall regime. Secondly, the gum tree fallow replenished the organic matter in the soil which being almost pure sand depends entirely on organic matter for cation exchange capacity as well as other benefits such as nutrients and moisture retention capacity. Chemical fertilizers and labour-saving machinery seem to have no positive role in that fragile environment, since they do not overcome any of the major ecological limiting factors.

Because *Acacia senegal* gum is an international commodity*, important to Sudan's balance of payments, as well as to the region's income, official efforts to restore that traditional and stable cultivation system have been initiated, as of 1976.

The potential for improvements in the system's productivity lies clearly in the selection and genetic improvement of *A. senegal* as well as of millet, and in the management of fallow periods to re-establish more effectively and perhaps more quickly soil productivity while at the same time providing forage for some livestock.

Groundwater in that region of deep continuous sands is limited first by the small amount of rainfall, and second by the nature of the subsurface, which, being loose sand, does not concentrate water in an aquifer. Attempts to create artificial underground aquifers by building underground storage cells with local materials have not been successful.

The principal ecological feature of the system is the role and dynamics of *Acacia senegal* as a fallow crop. A number of questions can be posed in that context: To what extent — and how — does the legume contribute to soil fertility in that arid environment? Is organic matter, in fact, an important benefit of acacia fallowing? How does browsing effect acacia regeneration and gum production? Does it stimulate or depress growth? How can the dynamic of natural regeneration of acacia and other species be managed to better advantage in soil crop husbandry? In essence most of these

*This gum is tasteless and water-soluble. It is used for such diverse products as envelope labels, cosmetics, medicines and soft drinks as well as candy.

questions compel an examination of plant succession and various forces that effect it.

The invasion of the parasitic weed *Striga* in worn out millet fields poses questions of plant succession from a different angle. What triggers that weed to thrive? Does it play any useful function in the rehabilitation of soils? Other ecological aspects not reviewed in the case

ROTATING ACACIA ALBIDA WITH PEARL MILLET IN THE SENEGAL

The second case study is of the traditional agricultural practices of the Wolof and Serer people as well as those of smaller numbers of Peul, Lebou, Malinke, Toucouleur, Niominda and Bambara people in West Central Senegal — the 'Ground Nut Basin'.

The climate in that area is semi-arid. The rainfall varies from 800mm in the south to 475mm in the north. It is more variable in the northern section. The growing season is three to four months. The area is one of wooded savannah in the south and becomes thorn shrub steppe in the north. The soils are mostly sandy but become ferrallitic in the south. The population densities are 100 people to the square kilometre in the south and 30–44 people to the square kilometre in the north.

The biological features of the system are: (1) the *Acacia albida* which enriches the soil and supplies nourishing fodder; (2) cattle which enrich the soil with manure, and (3) pearl millet (*Pennisetum typhoides*) which is ideally suited for the soils and climate in addition to being one of the more nourishing of all cereals. The ecological integrity of the system has been eroded by the successful promotion of peanuts as a cash crop.

Prior to 1967 the protected French market for peanut oil led to an intensification of peanut production with fertilizers and pesticides, as well as to an extensive use of animal drawn implements that were not used in the traditional system of cereal cultivation. However, the combined effects of population growth and of drought in 1968–73 undermined both the organic as well as inorganic means of production. Furthermore, the Law 64-66 passed in 1964 discouraged fallowing, by taking away ownership of land not cultivated within a three year period.

Professor Paul Pelissier, tropical geographer, has marvelled at the wonderful expertise in rainfed farming developed by African peoples, on the light sandy soils of Western Sahel between the 400mm and 700mm isohyets.³ It is in that environment, not the more humid regions to the south or the banks of the rivers, where the highest population densities (of up to 100/sq. km.) have developed in Senegal. And throughout that rainfall belt of the Sahel from the Cape Verde Islands to Chad, Pelissier observes that a high human population is associated with a farming system in which cereal cultivation is coupled with a park-like forest cover of *Acacia albida* and cattle raising.

In the past sedentary agriculturalists in Senegal such as the Serer, lived in antagonistic symbiosis with nomadic pastoralists, notably the Peul, whose herds browsed fallowed areas in exchange for manure, milk and meat. Now economic and demographic dominance has shifted to the sedentary farmers, and crop intensification has been at the expense of pastoral land, notwithstanding the continued importance of cattle in the

study are the role of insects, birds and small animals in the system, beneficial as well as pestiferous species. Answers to those questions will be essential if efforts are to be successful in bringing the system back into balance with the environment and to develop sustainable agrarian activities.

integrated system. Nomadic herders are becoming the hired shepherds of the sedentary farmers, in a new way of life which combines farming and herding. The sedentary Wolof and Serer have steadily moved eastward and occupied lands which at the beginning of the century were traditional domains of Peul herders.

The resulting land use pattern presents the aspect of an open park-like landscape dominated by *Acacia albida*, under which are grown millet, and peanuts. Pelissier believes that the development of that completely cultivated landscape is the last phase in the evolution of land use from savannahs, initially dominated by nomadic pastoralists who tolerated small groups of sedentary cereal farmers, to the dominance of the more populous sedentary farmers. Those farmers have added peanuts to their crop repertoire, and have displaced the nomads while at the same time integrating cattle into their farming system.⁴

The present settlement pattern on that flat, arid tropical landscape is one of small villages dispersed at intervals of six to eight kilometres. Village compounds invariably have small groves of baobab trees, often showing scars where bark has been stripped to fashion rope, and bombax trees. In the more humid (800 mm) south basin, one also sees mango and *Ficus* species, while in the drier north only *A. albida* shade the village areas. In the fields — which only in the south are interrupted by patches of non-arable ironstone outcrops — *A. albida* are evenly dispersed at densities of ten trees or more per hectare. (at 45/ha a continuous canopy is formed). Their crowns show evidence of severe pruning; people lop branches in the dry season to provide for forage for livestock.

Communal land tenure is practised, and a concentric pattern of cultivation radiates from the village. The first band, extending 500 to 1000 metres is continuously cultivated in the food staple, pearl millet, *Pennisetum typhoides*, and this land receives the bulk of animal manure. Next are found the outfields, which are now continuously cultivated in peanuts but formerly were cropped ten years in millet or sesame and fallowed 50 years — sufficient time for soils to regain their natural productivity⁵. Formerly a third ring — now also planted — provided permanent grazing. Fallowed areas also served as grazing and browse areas for cattle, a source of wild fruits, and habitat for wildlife which was hunted. Today only small patches of such uncultivated areas exist in the south on soils unsuited for farming.

Ignored by agronomists and soils scientists for many years⁶, the *Acacia albida* is now becoming better known as research data accumulates on its soil-restoring and conserving characteristics and the forage value of its leaves and pods. The higher the



Acacia woodland and cattle raising go together in productive desert-farming.

price of chemical fertilizers, the more valuable that tree becomes.

Salient characteristics which make this unique tree such a valuable companion of arid zone farming include the following:

- It loses its leaves at the onset of rains, therefore does not compete with short cycle crops for sunlight, moisture or nutrients during the growing season. Thus it can be left in the fields.
- It produces an estimated 4.2 t/ha of leaves at a density of 43 trees/ha which would yield 186 kg/ha of nitrogen.⁷ Only about 10 trees/ha are found in most fields in Senegal at present.
- Leaves have a carbon:nitrogen ratio of 17, thus more quickly yield nitrogen as nitrate than organic wastes with high C:N ratios such as millet straw (55) and sorghum straw (100).
- Leaves fall when crops are planted and at a time when there is sufficient moisture for microbiological activity in the soil, thus limiting the waste of humus through oxidation or accidental burning in the dry season, as is the case for dung and residues from millet or sorghum.
- *A. albida* tap roots can go to 30 metres deep and are drought tolerant once rooted. Their extensive root system draws nutrients from the subsoil and returns them to the surface as organic litter, where the shallow rooted crops can utilise them. (That contribution has not yet been measured).
- During the dry season when the trees are in foliage, they shade the soil and slow the winds thus limiting soil moisture loss.
- The leaves provide a source of green, protein-rich forage in the dry season, essential for cattle nutrition, and without which other dry fodder cannot be well utilized. Pods are also a protein-rich animal food.

Crop yields are higher under *Acacia albida* crowns than in open fields: a 2.5 fold increase in millet⁸ and 100 per cent increase in sorghum⁹. The increase is a result of the physical, biological and chemical effects of organic matter provided by the tree as well as its influence on micro-climate. Of special although not sole importance is the cation exchange capacity provided to the soil by the organic matter in the leaf fall. In the sandy soils, cation exchange capacity hinges almost exclusively on organic matter, since the clay content is low or nil. Water holding capacity, nitrogen and support for micro-biological life — especially bacteria in the nitrogen cycle (ammonifying and nitrifying bacteria) — are additional benefits to the soil. One researcher found twice as much ammonium and nitrate nitrogen under *A. albida* as in clear areas, and the conversion of both organic matter nitrogen and urea nitrogen to mineral nitrogen was two to three times faster, owing to the large numbers of soil micro-organisms beneath *A. albida* trees.

Charreau found in pot tests that free *A. albida* organic matter (not yet decomposed) increased the mineralization of organic nitrogen to an extent more than proportional to the amount of free organic matter added. Also he found that millet took up organic nitrogen in preference to inorganic (fertilizer) nitrogen.⁵

Animal dung is the second important source of organic matter in the system, but it has declined in importance with the conversion of all lands to peanut cultivation. When fallowed plots permitted larger herds to remain in the region, the animals in effect transported nutrients, as manure, from fallowed areas to the fields closer to the villages where they were gathered at night. Without the browse and grazing formerly available in fallowed fields, cattle herds are kept in the region only during December to March immediately following the millet harvest, and are grazed to the east and northeast during the dry months. Only draft animals are kept in the region throughout the year, and for them supplementary forage from *A. albida* is crucial for good nutrition.

The decrease in quantities of manure to soil has been partially compensated by the nitrogen-fixing ability of peanuts and by the provision of chemical fertilizer at subsidized prices. However continuous cultivation of peanuts has become an increasingly untenable proposition in recent years in Senegal owing to the combined effect of higher fertilizer prices, lower world market peanut prices, drought and declining soil productivity. Consequently some farmers have stopped planting peanuts; many have been unable to pay debts to the state, and in early 1980 farmers were given a moratorium on debts incurred for fertilizer and peanut seed.

The circumstances which undermine the viability of peanut farming compel an examination of crop alternatives and especially ways to restore and maintain soil fertility without chemical fertilizer, hence through biological and ecological techniques. Hypothetically, yields of millet under *A. albida* cover could be at least 900 kg/ha or sufficient to meet the needs of roughly 3 adults, discounting losses in storage and assuming 250 kg/person/year.⁸ However, the density of *A. albida* would have to be increased from approximately 10 per hectare to about 40/ha so as to achieve complete canopy closure. Groundwater availability may determine and limit the density of trees. Millet would be favoured by the trees more dramatically than peanuts, and it is also axiomatic that an equivalent increase over-all in animal manure inputs would be needed so as to achieve the same concentration of manure now restricted to the relatively small band of millet fields adjacent to the villages. That strategy would possibly require that a portion of the village area be devoted to the browsing of cattle, either by resuming the practice of long fallow, or by permanent removal from cultivation of certain areas, which logically would be of less productive soils. An average density of 200 persons/km² would be possible under subsistence farming regimes in which most or all food is consumed locally. Thus the system could yield a hypothetical carrying capacity of almost double the present densities, which are already considered high.*

The casual mechanisms involved in *A. albida*'s contribution to soil productivity and crop production need to be better known if we are to manipulate the tree or make better use of it in managing soil fertility. Some important unanswered questions are:

- Are there differences among trees in the quality of litter? (Experimental results suggest there may be).
- To what extent do the trees return nutrients that have been lost through leaching to the subsoil?
- What is the optimum density and is this density limited by groundwater or other soil factors?
- What would be the effect (and its magnitude) of a dry season canopy of *A. albida* crowns on

soil moisture, especially on evaporation and storage during the dry season? (Ploughing at the end of the dry season has been shown to decrease dry season losses, by breaking capillarity, and to increase moisture in the subsoil (below 1m) where it is used by next season's crops during dry spells in the growing season.¹⁰)

- What other trees might complement *A. albida* in this system? (Experiments with *Balanites* and *Gueira* show they have no effect on crop yields.)
- How can cattle husbandry be improved or modified so as to increase or better utilize manure?

These are some of the questions that must be confronted in any realistic attempt to provide development assistance to the problematical area in Senegal. Indeed in both these areas we have considered enough is known about the traditional agricultural practices to show that they are ecologically sound and thereby highly sustainable. Clearly we should not set out to change them until they are fully understood.

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*This 200 persons/sq. km. subsistence level carrying capacity is however, 5 times greater than the figure of 40/sq. km. derived empirically by Lemaitre in 1954 from his observations in Niger, in villages where no land was fallowed. (Lemaitre, 1954, cited by Felker, 1978)

Commercial Fishing in New Zealand: An Industry bent on Extinction

by Gwen J. Struik

First one species and then another is over-exploited leading to a situation where the future of the fishing industry in New Zealand is put into jeopardy. The New Zealand situation exemplifies what is happening to fisheries in the rest of the world.

Ever since man began settling in New Zealand, many economically valuable ocean animals have been drastically reduced by over-hunting and some have been brought close to extinction, at least locally. That overexploitation is still occurring and today the fishing industry is facing a major resource crisis as a result of declining fish catches. In this article, histories of ocean-based animals which have suffered drastic declines are outlined and special attention is paid to what has happened to fisheries over the past 20 years as new technologies have been introduced. Observations indicate that the pattern of over-exploitation keeps occurring as new species are used, raising doubts as to whether it is possible, within the present social and economic framework, to establish a programme of sustained yield management.

COASTAL FISHERIES

Seals. New Zealand's first export industry was seal skins, with a boatload of 4,300 skins leaving the South Island in 1793. By 1809 nearly all seals on the mainland had been killed and by 1815, seals on most off-shore islands were gone. In two decades the sealing industry was finished after having harvested many millions of skins from New Zealand and the sub-Antarctic islands. The first protective legislation was introduced in 1875 and today, with complete protection, there are more than 40,000 seals. It has been estimated that if the original over-exploitation had not occurred, then 50,000 seals could have been harvested annually on a sustained yield basis¹. This estimate does not consider the destruction of seal breeding grounds which has occurred, especially on the mainland, or the decline in fisheries which are a main source of seal food. But

even a lower level of sustained yield management would still have made a substantial continuing economic contribution.

Rock Lobsters. The commercial catch of rock lobster in New Zealand is graphed in Figure 1 and shows a gradual increase to 4,900 tonnes in 1965 when lobsters were discovered in commercial quantities on the Chatham Islands. With unrestricted exploitation of this resource, the NZ catch rose sharply to 10,700 t by 1968. The Chatham Islands catch peaked at 5,900 t in 1968 and dropped to 330 t in 1975 and has remained below 450 t from 1975 to the present (1981). Since rock lobster is NZ's single most valuable marine export, and is equal in worth to nearly half the value of the fin fish catch for 1981, considerable effort has been made to study and plan the fishery. A Fisheries Research Division model suggests that a 40 per cent reduction in lobster fishing effort could result in up to a 20 per cent increase in total catch². In 1980 and 1981, licensing of a controlled fishery was introduced for all the major NZ lobster areas in order to "ensure a maximum continuing yield" by "preparing the ground for an eventual reduction of fishing effort" where necessary to maintain yield and/or economic well-being³.

It is ironic that while rock lobster yearly catches have decreased by 10 per cent, the price has increased by a yearly average of 15 per cent⁴. This growing scarcity of lobsters which are increasingly available only through expensive restaurants, can be viewed "optimistically" as meaning commercial fishing will be economically viable despite reduced catches. Pessimistically, the consumer knows that seafoods are becoming too expensive for most people. In fact this has already happened in New Zealand where retail sales of fish are dropping although restaurant sales have increased and fish consumption is up by 12 per cent⁵. People wealthy enough to afford restaurants eat more

fish whereas home consumption is declining at a time when dietary experts and health conscious people are recommending fish protein. An NZ *Consumer* article⁶ entitled, "Fish is becoming an expensive luxury" states that fish prices rose 60 per cent during 1980-81, while beef steak prices rose by 23 per cent in the same period. In January 1982, a \$5 note would buy just 710 grams of fish fillets and 760 grams of porterhouse steak. Reasons given were release from price freezes and increased prices for oil, boats, maintenance and insurance.

Scallops. A boom-bust catch history can be seen in Figure 2 for the Nelson/Marlborough scallop catch which fluctuated between 170 t and 970 t between 1962 and 1970, and then increased to 9,300 t in 1975. This was followed by a population crash so severe that the fishery has been closed for the 1981 and 1982 seasons. The number of registered boats, which was always less than 45 up to 1971, rose to 256 in 1976 and followed a boom-bust pattern similar to the catch. The "abundance" of scallops, measured by catch per boat⁷ fluctuated widely, so that a year with a high catch per boat was usually followed by a lower catch year. The Nelson scallop population crash was likely caused by excessive dredging which killed more than half the undersize shellfish thrown back,⁸ and which "ripped through the sea bottom" with so many boats going over the same area the fishermen described it as "ploughing up the bottom into great furrows"⁹. The depletion of scallops by over-fishing and the altering of their habitat may result in other organisms filling their vacant niche. Environmental factors may also play a role and a smothering algal bloom reported for 1964-65¹⁰ may have been a factor in the low catch and abundance of scallops during the three subsequent years, 1966-69.

It has been suggested that a major fishery crisis is a necessary management tool, since restrictions on an open access fishery are only accepted by fishermen and processors after a population crash. At present crisis management has resulted in a recommendation to limit scallop boats to a maximum of 30 and the takeable scallop size to over 900mm⁷, once the dredging ban is lifted. Similar crisis situations have resulted in other fisheries now being controlled by management plans including oyster, paua, mussel, eel and rock lobster¹¹.

Snapper. The total New Zealand commercial snapper catch grew by 2.8 times between 1955 (6,360 t) and 1978 (17,723 t) but then, despite increased effort and technology, declined to 11,900 t in 1981. Since snapper is the most important commercial and recreational fish this decline has been a factor in many fishermen being forced to give up independent fishing to become deckhands on larger company boats or to go into some other work. The decline in the snapper population has been well documented. A North Island study¹² showed the size and weight of snapper decreased over the five year period from 1974 to 1978. The mean weight per fish declined 40 per cent from 1.45 kg in 1974 to 0.89 kg in 1978, similar to a decline in weight of 42 per cent

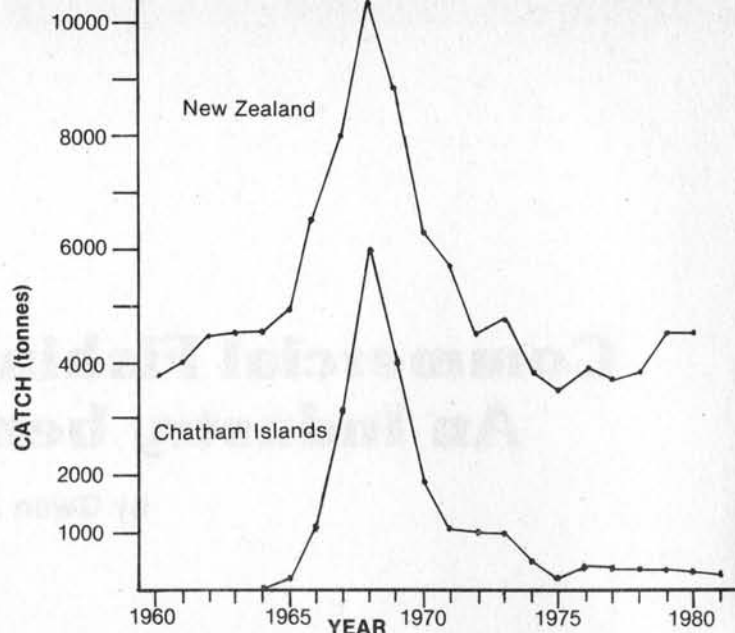


Figure 1. Rock lobster catch for New Zealand including the Chatham Islands and for the Chatham Islands alone 1960 to 1981.

which was measured for snapper caught in a South Island estuary between 1971 and 1978¹³. Snapper catch per effort decreased by 11 per cent from 1974 to 1978¹⁴ and the authors concluded that these declines in numbers, weights and catch per effort "will continue with the present level of fishing effort . . . but should then stabilise. If more boats continue to be introduced over the next few years the snapper production will not stabilise, but will fall each year. A point might be reached where the fish population was so depleted that fishing was no longer economically viable"¹². Study of another North Island snapper fishery in the Hauraki Gulf¹⁵ has also shown a general decline in catch per effort and this area will be the first controlled fishery for a fin fish stock in New Zealand.

The results of the North Island studies are similar to those in the only South Island snapper fishery. Here the use of spotter planes to locate spawning snapper schools, accompanied by purse seining, resulted in overfishing with a catch of 2,670 t in 1978 compared with variation between 400 t and 1,400 t in the pre-

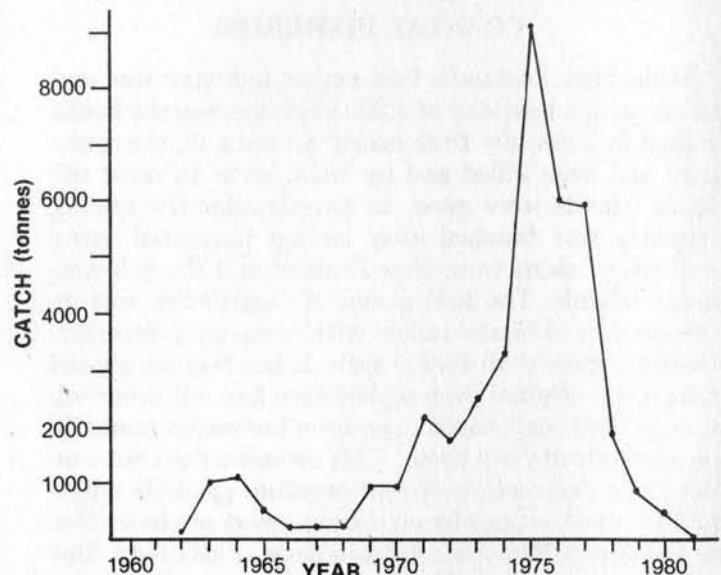


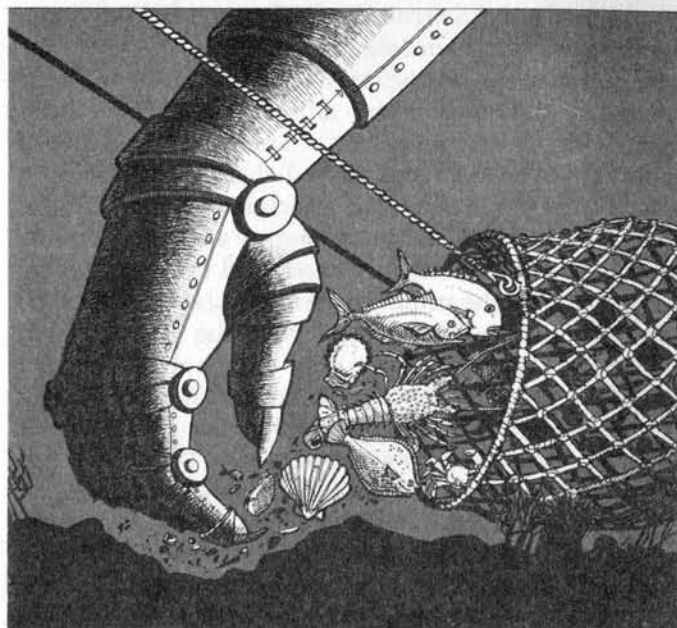
Figure 2. Scallop catch (in tonnes) for Nelson/Marlborough 1962 to 1980. In 1981 and 1982 there has been a ban on commercial scalloping.

vious 24 years. After the large 1978 catch, part of which overloaded the nets and was dumped at sea or taken to the rubbish dump, fishermen appealed to the Minister of Fisheries to place catch limits during the snapper spawning season, when the fish form schools and are vulnerable to massive catching. A quota was then set of 1,000 t, for 1979-80, an amount obtained in only eight of the previous 24 years. This quota was reached and the 720 t quota for the 1980-81 spawning season was also reached. In 1981-82 the 650 t quota was not reached in part because an extensive algal bloom "slime" affected the fishery. This 650 t quota is very close to the mean catch over the past 28 years. Research¹⁶, based on tagging, estimated the total snapper stock at 5,600 t and an annual sustainable catch of around 730 t (12.9 per cent) was recommended. More recent work indicates a stock size of 4,000 t¹⁷ illustrating the necessity of conservative interpretations to early estimates. Agreement has been reached that the spawning season quota be decreased to 400 t and minimum mesh size of cod ends increased to allow the escape of juvenile snapper. Increasing the age of capture by two years is expected to increase yield by 20 per cent. In addition, bryozoan coral beds, which are important nurseries for young fish, are now protected areas, in the hope that they will recover from recent excessive dredging and trawling.

Multi-species Coastal Fisheries Studies. A consistent and drastic decline in a New Zealand fishery from 1971 to 1978 was documented¹³ for fish visiting an estuary in Te Mako Inlet at the northern tip of the South Island. The estuary is tidal and has no permanent fish populations so that fish caught in a net survey come into the estuary to feed, and reflect the numbers of their species inhabiting or visiting the inlet. Statistically significant results showed declines in fish numbers per tide, a decrease in weight of fish per tide and declines in the mean weight per fish, which reflect a fishery depletion in the adjacent coastal area.

A pattern of decline per unit effort has also been shown for trawl catches in the Bay of Plenty, North Island¹⁸. The total catch of the five major fish species declined from 105 kg per hour of trawling in 1961 to 35 kg per hour of trawling in 1980. The three long-lived species (trevally, snapper, terakihi) declined, with trevally crashing from 13 kg to 1 kg per hour. The two short-lived species (red gurnard and John Dory) slightly increased, but their increase failed to compensate for the catch declines by the three long-lived species. A more recent Bay of Plenty purse seine fishery study¹⁹ showed the high value trevally catches increased from 1974 to 1977, then declined steadily to nearly zero in 1980, while the low value mackerel catch increased from 1,000 t in 1974 to 4,000 t in 1980.

These multi-species studies are especially important since "it is unrealistic and possibly seriously misleading to assume that individual stocks can be exploited, studied and managed as though they existed in isolation . . ." ²⁰. Environmental, social, population and economic changes make the management of any fishery more complex than simply setting an "Optimum Sustainable Yield" and expecting it to be un-



New Zealand Fishing — Grabbing all one can

varied. This was illustrated above in the many adjustments needed to be made in the sustained yield estimates of the South Island snapper fishery. Another, more dramatic example, would be the southern blue whiting population of the 200 mile NZ Exclusive Economic Zone (EEZ). Data indicates that these populations vary by as much as a factor of ten from year to year due to environmental fluctuations which affect spawning and feeding². Sustainable yield estimates would need to vary by this factor also, which makes planning based on one or several such species very difficult unless fishing effort, including capital investment, is geared to profitability in the minimum catch years.

Other Coastal Fisheries. Besides the species mentioned so far, a substantial number of other coastal species are currently at risk including terakihi^{21, 22}, trevally^{21, 22, 23, 24}, barracouta⁴, rig²⁵, ling²⁶, groper^{22, 27}, and moki². The Ministry of Agriculture and Fisheries (MAF) 1982 annual report²⁸ states that some species of coastal pelagic fish and coastal demersal fish are "over-exploited", and another official annual report⁵ sums the situation by stating "... in many fisheries there are too many fishermen chasing too few fish". There is an awareness of the need for controls among fishermen²⁹, fish processors^{30, 31} and government scientists^{4, 32, 33, 34, 35}, but there has been little agreement on when catch controls should first be implemented. The situation has become so severe that a moratorium on the issue of further fishing permits was declared by the Minister of Fisheries from 19 March 1982. This is considered to be a holding measure until Fisheries Management Plans can be made and implemented. Interim management controls are being introduced to shellfisheries and a few high valued fin fish fisheries as described in the previous section, usually as a result of a crisis or collapse. It seems that each fishery goes through this pattern, although it is often the same

people involved as is true for the Tasman Bay scallops, snapper and Chatham Islands lobsters.

So many coastal fisheries in New Zealand have been overfished that most if not all food chains have been altered and are currently out of balance. "... Once (a fishery) is overtaxed and altered there is no reason to assume that it will return to its original state⁴." This is shown by the fact that the secondary and less valuable species, which theoretically should fill the gaps left by the removal of the prime species and thereby keep the total production and diversity of the fishery from drastically declining, have only done so to a limited extent as noted in the Te Mako and Bay of Plenty examples above. In Bay of Plenty, one species, Jack mackerel, has greatly increased, and a Te Mako a few fish of new species have invaded in small numbers.

A general pattern emerges when the recent catch history of the major domestic commercial fish are graphed (Figure 3). High value (based on 1981 dockside price³⁶) species of snapper, soles and trevally have their highest catches in 1978 and have fallen below this to the present. A second group of nearly as

high value, terakihi, gurnard and flounder, have had only a moderate increase in catch from 1974 to 1981, despite new technologies and increased effort. In contrast, three lower valued species, hoki, barracouta and the mackerels, have dramatic catch increases. Two remaining low valued species were kahawai (18c/kg value) which showed a steep catch increase similar to the mackerels, but the catch levelled off between 1979 and 1981 and red cod (31 c/kg) value) which showed a catch peak in 1979 and lower catches in 1980 and 1981. The summary pattern which emerges is one of crisis signs showing for the valued inshore species with catching pressure then shifting to the less valued species and to deep water species both of which are still available enough to be fished economically. If past history is any guide, a crisis of reduced catches will then occur for the less valued species and, in turn, the crisis will force the industry to impose controls. Whether fisheries can survive such crisis management and be restored to a productivity sufficient to enable a sustained yield management plan to be enacted remains to be seen.

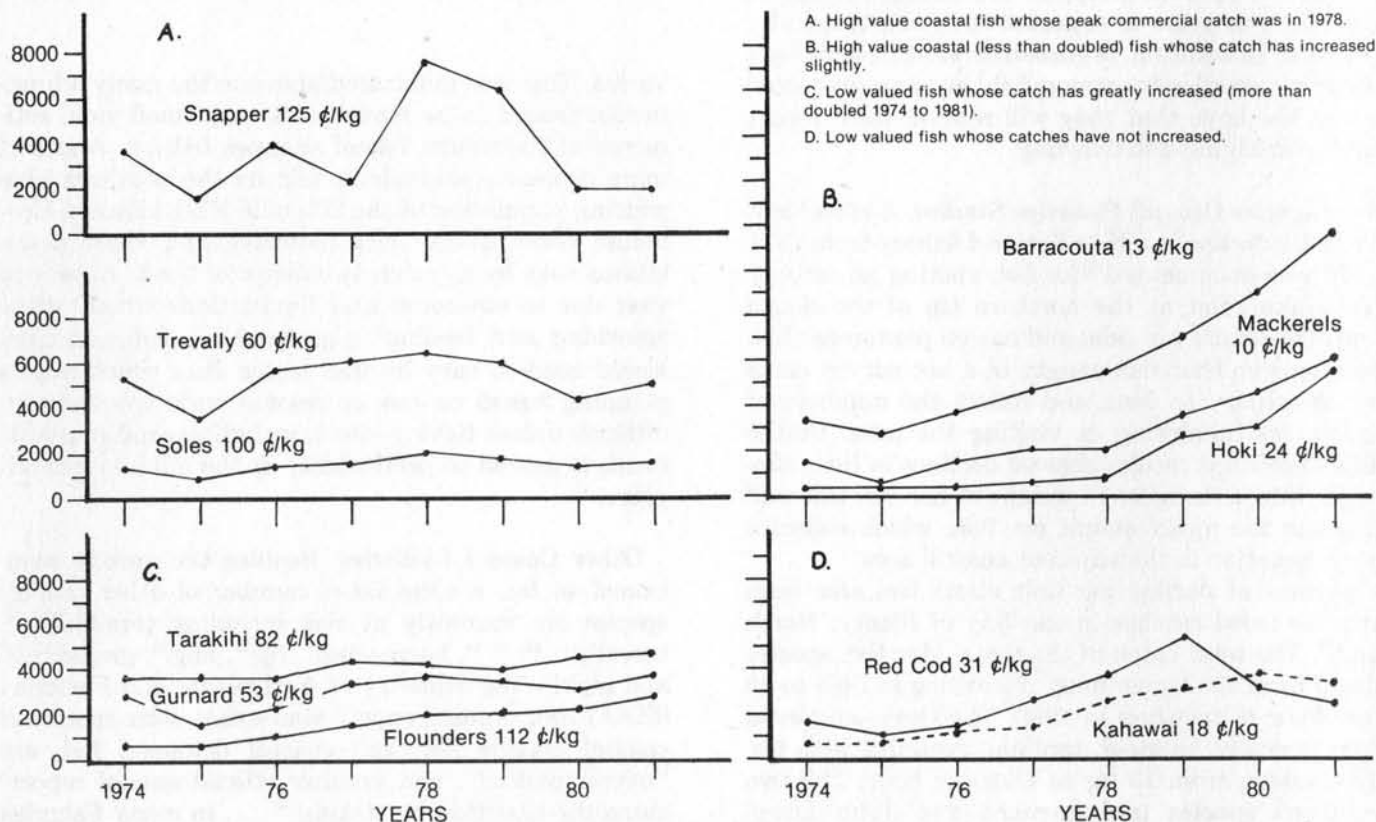


Figure 3. Catch (in tonnes) of major NZ commercial fish species 1974 to 1981. Price per kilogram value of fish based on 1981 domestic price to fisherman.³⁵

NEW ZEALAND'S EXCLUSIVE ECONOMIC ZONE

In 1978, the NZ Government declared its 200 mile (360 km) Exclusive Economic Zone (EEZ) and attempted to establish guidelines for fishing in the zone. This attempt was made difficult by a gross lack of knowledge of the area since few New Zealanders had ever fished in the 200-1,500 m deep waters of the zone and some of the fish were known only as museum specimens. Furthermore, estimates of the Maximum Sustainable Yield of the fishery, made by New Zealand, Japanese and Russian experts varied from 200,000 t to 600,000 t to 1,000,000 t. In spite of a warn-

ing of caution in 1977 that the zone may not be as rich as the higher estimates indicated, due to a lack of both big river discharges and nutrient rich upwelling³³, the government urged fishermen and companies greatly to expand, and encouragement was given to form Joint Ventures with large foreign companies, mainly from Japan and the USSR.

In order to establish catch quotas for the new EEZ, the government looked at catches previously made in the area by foreign fishing fleets. These foreign catches, graphed from 1967 to present in Figure 4,

dramatically increased during 1976 and 1977, the two years prior to the zone being declared. This overfishing of prime species during these two years was deliberately done to establish a "traditional" fishing right in order to get large allocations and to prove that a large resource existed. The foreign fleet could not be certain of a long term stay in the zone once the EEZ was declared so there was no conservation incentive based on long term commitment, and it can be said that they vacuum cleaned the area during those two years.

The deepwater trawl allocations³⁷ since the EEZ have been double the catches diagrammed in Figure 4, which means the political decision to give large allocations to foreign and joint venture fleets has resulted in almost open access to some of the deepwater fisheries. The Total Allowable Catch (TAC) of 429,000 t for 1981/82 season²⁸ also signals virtual open access to some EEZ fish stocks. "The history of open access fisheries is the history of over-capitalised fishing industries and overfished stocks".⁴ The rapid expansion in fisheries investment and a process of destructive competition has developed in the four years since the EEZ was declared. Reports come from all sections of the industry that the highly valued deepwater species are overfished. For example the MAF 1982 annual report²⁸ in referring to the deep water fishery states, "... catching capacity must be reduced if the fishery is to remain healthy, and catching operations financially viable." A 1982 report by a fisheries scientist³⁸ states that research and fishery experience have shown that many of the stocks of deepwater species are limited in size and there is a need to reduce excess catching capacity. The recognition of this need is in conflict with the requirement of the large fishing companies to receive large fish allocations in order to support their present investments. This over-capitalisation by the large companies, of which warning was made as early as 1978³⁹, is the biggest problem facing the New Zealand fishing industry.

Hake and Hoki. The 1982 MAF annual report²⁸ states that for hake and its relative hoki there is "now sufficient information available to enable reasonable assessments of stock density and to recommend appropriate management strategies". The hake catch⁴⁰ was 71 t (1975), 5,005 t (1976), 17,806 t (1977), 225 t (1978), 2,418 t (1979), 2,350 t (1980) and 2,361 t (1981). The allocation for 1982 was 4,300 t⁴¹, but the recent catch was so poor that the allocation for 1983 was reduced to 2,400 t⁴². Patchell⁴⁰ estimated the standing stock of the main hake fishery at 39,000 t and calculated an initial maximum sustainable yield of between 3,900 t to 7,800 t (10-20 per cent of total stock). He cautioned against aiming to achieve maximum yields, mainly because the concept of maximum sustainable yield is questionable, but more specifically because juvenile fish were absent from the 1979 fishery and had disappeared from inshore grounds. This is especially critical since "recruitment overfishing" is thought to cause the biggest fish population declines²⁰. Since it is the pre-spawning concentrations of hake that are fished (dramatically shown in the Patchell⁴⁰ paper with a photo of a net containing a 70 t catch of hake), the

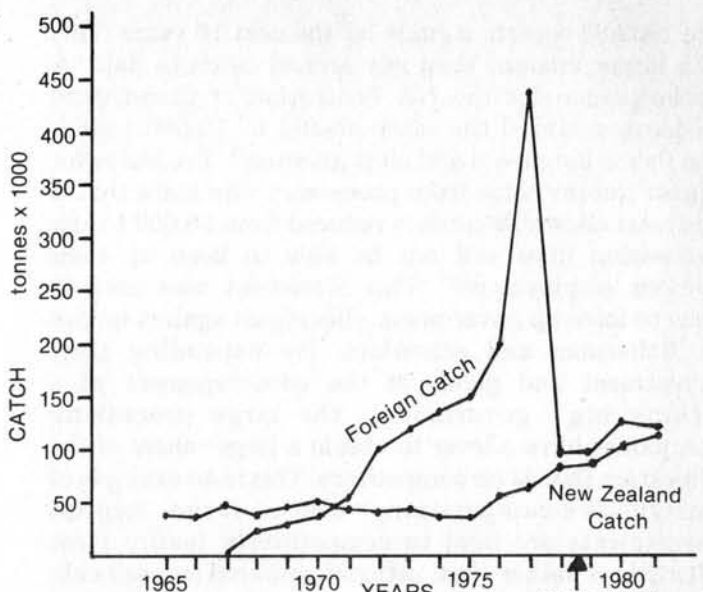


Figure 4. New Zealand fish catch 1965 to 1981.

Foreign catch, mainly by Japan, USSR and Korea, to mid-1980, thereafter by Joint Venture trawlers as well. (1978-1980 catches³⁷.)

TAC—Total Allowable Catch for 1981/82 catch year was 429,000 tonnes³⁸, well above actual catch.

NZ—Exclusive Economic Zone was declared 1 April 1978.

possible drop in population recruitment indicates a population which is not in equilibrium and is a sign to use extreme caution in quota allocations until the lack of juveniles is understood. Hake live to 25-30 years and are known to be vulnerable to dramatic population decline as illustrated by the Scottish hake fishery which declined from a total catch of 22,000 t in 1948 to 4,000 t in 1967.

The known commercial catches for hoki at the main fishery area were 6,499 t (1976), 53,854 t (1977), 678 t (1978), 2,395 t (1979), 2,657 t (1980) and 13,968 t (1981). The allocation intended as a 10 year guide is 40,400 t per year for the whole EEZ^{41,42}. The New Zealand fishermen are concerned that hoki will be "cleaned out" by present fishing pressures and they note that fish size landed is getting smaller⁴³. They also fear that overfishing hoki will jeopardise the highly valued bluefin tuna which are thought to depend on a continuous supply of hoki. (A prime bluefin can realise \$32/kg in Japan⁴⁴). They further hope for exclusion of Joint Venture boats, but NZ has its own history of overfishing, so this action alone is no solution.

Orange Roughy.

Since orange roughy lives in km deep water, it was not caught commercially by New Zealand until 1981⁷⁷, although Russian ships were likely catching it since 1972. The MAF 1982 annual report²⁸ lists orange roughy, along with oreo dories, ling and silver warehou as valued deep water species about which "there are as yet insufficient data to permit confident estimates of potential yields". The annual catch since the EEZ was declared has been 3,500 t (1977/78), very little (1978), 10,000 t (1979), 27,500 t (1980/81) with open access⁴⁵. The fishery looked like a possible "boom-bust" situation and, with little knowledge of resource size, MAF placed a catch quota of 25,000 t for the 1981/82 year. This was reached in July and the fishery closed creating a lean period for companies planning to fish orange roughy all year, although the quota was known in advance. MAF has allocated 32,700 t as quota for

the 1982/83 season, a guide for the next 10 years. This is a larger amount than any annual catch to date. A spokesperson for the NZ Federation of Commercial Fishermen stated the catch should be 10,000 t since the fish is long lived and slow growing⁷⁶. Pressures for higher quotas come from processors who state that if the total allowable catch is reduced from 25,000 t their processing lines will not be able to keep up their present employment⁴⁶. This statement was used in turn to force up government allocations against advice of fishermen and scientists. By expanding their investment and plant, at the encouragement of a "think big" government, the large processing companies have a lever to obtain a larger share of the allocation than their competitors. This is an example of destructive-competition, where large capital investments are used to competitively justify large allocations rather than rational resource assessments determining allocations.

"Overfishing of prime species was deliberately done to establish a 'traditional' fishing right in order to get large allocations and to prove that a large resource existed"

Barracouta and Mackerels.

There is no published allocation limits to barracouta or the mackerels, which are of low value at present and caught when trawling for high value fish when very abundant, or caught in seasons when the valued fish are not available. The "barracouta and mackerel price support scheme"^{55, 47} subsidised the catching of these fish for export because market prices were too low to make the larger NZ ships economic in competition with subsidised products of the EEC and the USSR. Barracouta 1981 landings were the largest of any species in the NZ domestic catch (14 per cent of catch, exceeding snapper for the first time), and together with the mackerels made up 20 per cent of the NZ landings³⁶, as shown in Figure 3C. The average landed value of barracouta plus the mackerels was 12 cents per kg, compared with a snapper landed value of 125 cents, which helps explain the extreme pressures on inshore snapper fishing. With New Zealand's history of overfishing each species and going on to the next, it seems in the case of barracouta and the mackerels that due to recent high investment in large ships and processing plants, the next species to be overfished are already being subsidised. There is evidence that the barracouta and jack mackerel resources are large, with annual yield estimates of between 98,000 t and 298,000 t (20 per cent of estimated standing stock) for barracouta and 48,000 t to 187,000 t for jack mackerel⁴⁸. However some areas are being heavily fished and management controls may be necessary soon in these areas. Both Japan and the USSR have made large catches of both barracouta and mackerel (49,000 t in 1979)⁴⁹. Marketed as "snoek" in South Africa, barracouta is considered a good eating fish, although some of the NZ catch is worm infested and does not go to human consumption. The mackerels

have a dark flesh and are considered good eating by many countries, although people raised to prefer white fleshed, bland, non-oily fish like snapper and flat fish must pay for their preferences.

World Fisheries

The tendency in New Zealand for high value marine species to be overfished is reflected in the global marine data. The global fin fish catch levelled off in 1969 at 50 m t, and has only been maintained by catch weight shifting from preferred to less desirable species and with an increased effort per catch^{49, 50, 51, 52}. These patterns are similar to the shifts noted for the Bay of Plenty and Te Mako estuary in New Zealand. These shifts have been described by Canada's Minister of Fisheries: "In a consistent pattern one stock after another has been fished down. In each case the sequence began with an explosive increase in fishing effort by overseas fleets, resulting first in a rapid increase in catch, but followed invariably by a drastic decline. At this point the fleets shifted their attention to other fish, working their way through the traditional species to less desirable and therefore previously untouched stock. And in the devastation of our Atlantic fisheries, Canada has been the loser from the outset."⁵⁰. This Canadian experience has been repeated in fisheries in both developed and less developed countries^{50, 53, 54, 55} and is illustrated in New Zealand in Figures 3 and 4.

The most dramatic example of overfishing and a lack of a sustained yield management plan is the anchovy fishery of Peru which until its crash contributed over 10 per cent of the world fin fish catch. The anchovy catch rose from 3 m t in 1969 to 13 m t in 1970 and then crashed to less than 2 m t in 1973 and since then the yield has been around 3 m t to 4 m t despite stringent government regulation. A sustained yield of 9 m t has been postulated if the extremely high catch of 1970 had been avoided⁵¹.

Social and Political Considerations — Destructive Competition

With the valued fisheries of New Zealand under stress, there is intense competition within and between overseas and NZ companies for fisheries allocations and catches. The first to suffer in NZ from this competition are the small, independent, inshore fishermen who, even when protected, compete with the large Joint Venture vessels, and more recently with large NZ company boats. The large boats are heavily capitalised and even when restricted to fishing outside the 12 mile zone, none the less fish the valued inshore fisheries as well, often causing the owner-operated-boat fishermen to quit or go to work for the big companies. In 1981 there were 3,500 fishermen and less than 1 per cent of them landed 39 per cent of the total NZ fish catch⁵⁶ indicating that catching is mainly done by bigger boats with small manpower.

Following the decline in inshore fishermen, competition next starts to eliminate the smaller coastal fisheries companies and the same process, but faster, then happens in the deep water sector. In July 1982, 56 per cent of the provisional deep water allocations was

given to three large companies⁴¹, and within a month, two of these companies announced plans to buy two smaller companies, thereby concentrating 67 per cent of the allocations in the three companies. Two of these three companies are owned by firms which were not in fishing until after the EEZ was declared in 1978. Their capital came to a great extent from forestry, an industry heavily subsidised by government and the companies are well acquainted with working politically for subsidies and incentives, but are not necessarily knowledgeable in being responsive to fluctuating fish populations. This competition for profit, rather than responsiveness to the vagaries of the biologic base, means the valued fisheries are being placed in jeopardy of not being maintained on a sustainable yield basis.

A Fisheries Industry Board spokesman states that "In this intensely competitive environment, those who survive are likely to be those who are prepared to fish illegally"⁵⁷. One method used to gain entry has been labelled "blackmail"⁵⁸ where one large fish processing company indicated that unless their allocation was large, 160 people would be out of work. Their "privileged position" was criticised by a rival processing company for obtaining government import licences for two large trawlers. A NZ fisherman working on a foreign Joint Venture boat documented, with photographs, methods used in the deep water fisheries such as a net liner which prevents small fish escaping, and the regular dumping of 35 per cent of hoki catches because the ship's processing facilities could not cope with the quantities netted. He felt that the hake, hoki, squid and orange roughy stocks were threatened by these practices⁵⁹. Further complaints by NZ observers on board Japanese Joint Venture ships licensed to trawl for hake were that the crew were illegally catching bluefin tuna, not reporting catches, using double cod-ends to catch smaller fish, and habitually netting a larger weight than could be processed so that up to 25 per cent or more of the catch was wasted⁶⁰. This wasting was made not only of the less valued species, but often of highly valued species, including those that were actively breeding. The Tokyo correspondent for Radio New Zealand quotes a Japanese official who had completed a study of fishing activity in the South Pacific. "New Zealand must understand that Japanese fishing has become a multinational enterprise. When the foreign resources are efficiently depleted and business drops off, Japan pulls out leaving behind devastated waters and unemployment"⁶¹.

Technological Fixes.

Next to the adverse effects of over-capitalisation, technological fixes have had a major impact on NZ fisheries. The first fix was the introduction, in just a few years, of more efficient methods and materials for locating fish and catching them (spotter planes, sonar, radar, pair trawling, purse seining, stronger materials, bigger ships, etc). This has suddenly enabled the predator (people) to catch more prey (fish) with overfishing the inevitable result.

The second technological fix has been the introduction, in the early 1970s, of a computer to process fisheries data. Since the computer could handle more data

than previously, the forms for fishermen requested much more detail and many fishermen boycotted the forms. In addition, the computer facilities had growing pains. The result was that no consistent, complete statistical data on NZ fisheries has been published since 1974. The compound effect of these two technological fixes is that there has been too much power introduced too fast and with too little informational constraints to aid those with the wisdom for future fisheries planning and management.

Fuel and Operating Costs.

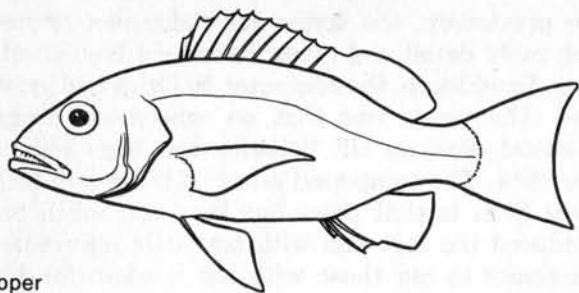
All of the above discussion is based on the assumption that once a sustainable yield estimate is established, harvesting to the limit can occur. For this to occur, variables such as boat size, method and fuel must be considered. Slack⁶² found that purse seiners and pair trawlers used half to one-third as much fuel per weight of fish caught as do single trawls which have much less impact on schooling fish. In contrast, other workers⁶³,⁶⁴ noted that estimates of efficiency must also consider capital investment, use of expensive overseas capital, catch method such as set lines, quality of fish caught and flexibility in adjusting to changing fish populations. Support for the use of small boats also comes from Allaby⁶⁵ who pointed out that the smaller capital outlays on small boats means they are less compelled to maximise catch returns in poor years and are, therefore, more sensitive to fish behaviour. The need for the NZ government to subsidise barracouta and mackerel catches, to keep large boats economically viable, illustrates this point.

"As long as our culture is based on competitive, macho, greed rewarded, short-term gain, our marine and coastal resources will continue to decline"

As a result of recent fuel price increases there will be a lowered fishing effort and many fishermen and fishing boats will have to leave the industry. These price increases together with the lack of fish have already caused trawlers to make fewer fishing trips since they are "unhappy about going unless they know the fish will be there"⁶⁶. The same patterns are occurring overseas. An NZ fishing delegation visiting Choshi, Japan, a port handling 400,000 t of fish annually, reported that "the cost of fuel was making fish operations uneconomic . . . (and) operational costs now absorb 50 per cent of the gross value of the catch of most trawlers and unless alternative fishing grounds can be found many will be forced out of business"⁶⁶. If a highly industrialised country, close to markets has this prospect, a large expansion in the fisheries of NZ, which also imports fuel, is unrealistic except by using non-fuel, or low fuel fishing methods. Such methods are now occurring and fishermen are adding sails and experimenting with a wind propulsion system⁶⁷.

Hopeful Future Trends.

There are some strong indications that some of the destructive fishing practices which have plagued New Zealand fisheries are coming to an end.

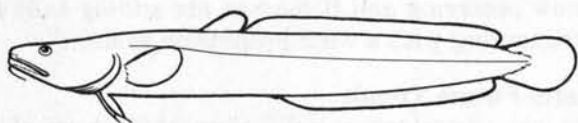


Snapper

1. Concepts of limits-to-growth are becoming firmly established in most sectors of the fishing industry, where four years ago this was not true. When the EEZ was established in 1978, there were headlines such as "Fishing could outstrip farming"⁶⁸, and "Fish resource potential may be 1 m tonnes"⁶⁹. The facts are that from 1978 to 1982 fishing exports have remained about 2 per cent to 3 per cent of farming export earnings and although the EEZ may have 1 m t of fish they are not "economic" species. Today the industry knows that quotas, allocations and limited entry are necessary, even desirable, whereas even coastal quotas were bitterly contested in 1978. The next step is to set sustainable limits soon enough to be effective. Here, destructive competition and political manoeuvring seem to be decisive and concern for export earnings can over-ride concern for sustainable yield. The NZ Fishing Industry Board 1982 annual report⁵ considers that a system "of management by individual allocation should be carefully considered". They have suggested an allocation of individual quotas or private property rights to fish resources, similar to those in forestry, farming and mining and have noted "there is already a precedent in the fishing industry with the dredge oyster fishery". In coastal areas, controlled fisheries modelled on the Foveaux Straits oyster fishery, with strict regulations of access and boat quotas, are being considered and implemented for shellfish and finfish. Perhaps the lesson will also be expanded to deepwater fisheries, although enforcement is much more difficult with foreign vessels and inadequate observers. Recognition of limits in the deepwater fisheries is clearly stated in the 1982 MAF annual report²⁸.

2. Far more is now known of the deepwater fisheries around NZ since the NZ-EEZ was declared, and this knowledge will become readily available. Prior to 1978, the Japanese and Russian data were not publicly available and application for sustained yield management impossible.

3. Marine shellfish farming has recently become well established. With the exception of the controlled oyster fishery, all valued coastal NZ fish and shellfish stocks have become depleted, so farming is becoming a reasonable option. The farmer leases a particular



Hake

public coastal area to manage for sustained yield for the farmer's profit. Farmed stock include oysters and mussels at present, and potentially scallops, paua (abalone) and clams⁷⁰. Snapper farming is also being studied⁷¹.

4. Marine habitat conservation and management is being supported by fishermen and MAF scientists. For the first time a marine nursery area of bryozoan coral has been closed to dredging and trawling in recognition of its importance for young snapper, terakihi and other fish^{72, 73}. The Fisheries Management Plan of another area, recommends a fish nursery area be closed to trawling and Danish seining for part of the year⁷⁴. In addition, MAF has supported the establishment of a marine reserve⁷⁵.

5. The Fisheries Act 1908 is being re-written to establish regional committees to formulate Fisheries Management Plans. The coordinator of these plans believes⁷⁸ that the inshore fishing industry is "paying the price for five years drastic overfishing" and suggests that to reverse this trend will require "the cooperation of everyone". Representatives of all coastal water user groups—commercial, recreational, and in some cases environmental—are to meet and formulate a plan by consensus. At the same time coastal planning is being undertaken by some local territorial bodies. In the past, fisheries personnel have had little input in coastal conservation and development decisions when industry, farming, mining and urban areas expanded to the detriment of estuaries and coastal habitats on which many fish depend.

6. Fisheries data is expected to be published in full starting in 1983 and the 1975-82 data will also become generally available thereafter.

Conclusions

The preceding examples of repeated fishery mismanagement in New Zealand and elsewhere, especially of new fishery resources, raises the question of why such boom-bust situations keep reoccurring. Why is there still over-exploitation and population crashes, now that catch histories are so well known and prevention so obviously needed? I believe our inability to maintain high levels of ocean productivity is both a legal (governmental) and a cultural question. Legal, because of the lack of agreement on fisheries ownership and the responsibility such ownership entails. As long as fisheries are regarded as common property, and public property is considered fair game to be ripped-off, it will be difficult to manage fisheries for sustained yield. For some fisheries a system of leased proprietorship can be evolved so that fishermen regard their patch of water, ocean bottom or fisheries allocation in the same way that farmers regard their patch of dirt. But even if such concern can be achieved, there is still the cultural question of public attitude towards human worth and towards the worth of all living things. As long as our culture is based on competitive, macho, greed rewarded, short term gain, our marine and coastal resources will continue to decline. When human worth is based on co-operative, life sustaining, loving and rational values, then our coastal resources have a chance of being maintained.

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India: The New Seeds

A disaster in the making as pests have a field-day with the high yield varieties

by Bharat Dogra

Throughout India high yielding varieties particularly of rice and of wheat, as well as new agricultural practices are taking over from traditional cropping methods. Yet the promise of markedly higher yields has not been fulfilled, mainly because of problems of genetic uniformity and susceptibility to disease.

In recent years the agricultural scene over a large part of India has changed substantially. This change is manifest in the new crops, crop-varieties and farming practices. The most crucial change has been in the growth of new crop-varieties—the numerous traditional varieties being replaced by a smaller and smaller number of new high-yielding varieties (HYV). The change is crucial, since upon it depend other changes in cropping patterns. Indeed the new seeds have meant the introduction of a 'package deal' consisting of chemical fertilisers, pesticides and farm machinery in place of the largely manual labour and organic manure based traditional agriculture.

Although 'India's Green Revolution' has been widely celebrated in the literature of development, the extent of the change has not always been realised. The area planted to HYV cereals was less than 100 hectares in 1964-65, by 1971-72 it had increased to 18 million hectares, by 1975-76 to 32 million hectares and by 1980-81 to 45 million hectares. Thus the kind of crops, the crop-varieties used as well as the way of growing them, have been entirely changed over 45 million hectares within a time-span of less than two decades. As economist Ranjit Sau states "This is an unprecedented diffusion compared to any innovation anywhere in the world. Millions of peasants have gone for it. Many of them, of course, use only a fraction of the recommended package of inputs."

According to the projections made in India's Sixth Five-Year Plan, by 1984-85, 56 million hectares will be brought under the HYVs. Already three-quarters of the area under wheat, two-fifths of the area under paddy and an equal proportion of the area under maize are planted with the high-yielding varieties.

In fact, such varieties give higher yields than the traditional varieties they replace only when fed with a 'package' of chemical fertilisers, pesticides and a higher and more regular supply of irrigation water than was required by the traditional varieties. In that regard, those varieties are *highly responsive* to the inputs rather than intrinsically 'high yielding'. On the other hand, several traditional varieties are capable of giving yields comparable to or even higher than those achieved with the new fertiliser-responsive HYVs. The performance of the traditional varieties appears particularly impressive when examined relative to energy input. This fact is brought out very clearly in the survey of paddy varieties in the Chattisgarh region of Madhya Pradesh by Dr R.H. Richaria, an internationally reputed agricultural scientist and former Director of India's Central Rice Research Institute.

It should also be added that India is among those developing countries facing a severe foreign exchange crisis to which the green revolution has contributed by increased dependence on imports of chemical fertilisers and pesticides or alternatively on the raw materials and machinery imported for the manufacture of those fertilisers and pesticides.

During the fourteen years from 1952-53 to 1965-66, some 5228

thousand tonnes of chemical fertilisers were used in India, while during the next fourteen year period of the green revolution (1966-67 to 1979-80) the quantity of fertilisers used was seven times greater, 35,487 tonnes. The use of chemical pesticides (technical grade) increased from negligible amounts to nearly 60,000 tonnes per annum in recent years. Similarly there has been a big increase in the various types of farm machinery necessary for tilling and harvesting the new varieties.

Several comparisons have been made of the increasing yield of various crops before and after the advent of the HYVs in India. Such studies arrive at different conclusions depending on the period covered and on differences in methodology. However the general conclusion is that despite a massive increase in expenditure on chemical fertilisers, pesticides, irrigation and on farm machinery, there was no significant increase in the rate at which yield was increasing in the later period as compared to the earlier period.

Rice is by far the most important crop of India, and 40 per cent of the rice area in India has already been brought under the HYVs. According to information given in a recent official publication (1980) a total of 140 HYVs of rice suitable for different agro-climatic conditions have been released in India, although farmers have so far restricted themselves to only a few popular HYVs.

Most of the HYVs are derivatives of T(N)1 or IR 8 and are therefore endowed with the dwarfing gene—*dee-geo-woo-gen*. That narrow genetic base has created an alarming uniformity with vulnerability to



Futile attempt to keep the pest down.

diseases and pests. Also most of the varieties are derivatives from straight single crosses.

A similar uniformity is found in wheat, the second major food-crop of India. As Dr. M.V. Rao, a prominent wheat expert, states "Previously wheat varieties were grown in each of the (five wheat) zones based on their maturation periods. But with the recent availability of photo-sensitive varieties, the same varieties could be grown, from the high Himalayas to Cape Comorin. Prior to the 'wheat revolution', all the wheats grown in India were of the tall conventional type. As the farmer wanted straw for his cattle, he preferred the tall types and the breeders in the past had to keep that requirement in mind while producing new varieties. Some of the older varieties were outstanding for their good grain quality and regional adaptability and for their performance under low-input conditions. With the exception of a few, most of the old wheats have now been replaced by newer varieties, particularly under irrigated conditions. The older varieties have either gone out of cultivation or occupy a limited area."

As with paddy, on paper a fairly large number of wheat HYVs may be available for cultivation by the farmers, but in practice only a very limited number of varieties are grown by the farmers on a large scale. Out of the 100,000 tonnes of certified wheat seed that was earmarked for production for the year 1977-78 winter (rabi) crop season, just one wheat variety, Sonalika, accounted for 65,000 tonnes and another, Kalyan Sona, for 20,000 tonnes.

In its 1976 report the National Commission of Agriculture foresaw some of the dangers: "India is in a vulnerable position with regard to devastating and debilitating epi-

demics because of the few varieties with a narrow genetic base which are presently under cultivation. Two varieties namely Kalyan Sona (or its red grained sister line PV 18) and Sonalika are most widely grown in India. In Punjab in 1972-73 90 per cent of the HYV area was under Kalyan Sona or PV 18. The same position prevails in other wheat growing States. The hills of North India which form the foci of infection for yellow and brown rusts also have large areas under Kalyan Sona and Sonalika. The unplanned cultivation of Kalyan Sona in the hills has led to the multiplication of rusts to which Kalyan Sona is susceptible. Continued cultivation of Kalyan Sona and Sonalika in the hills is fraught with danger. Experience in other countries with wheat, maize and other crops has clearly shown the need for diversification of genotypes for resistance to major diseases."

Narrowing Genetic Base

Thus not only has the genetic base of our major food crops become very narrow in recent years, careless policies of breeding and spreading new varieties have further enhanced the threat from pests and diseases.

'Karnal Bunt' (*Nevossa indica*), a fungi disease of wheat, was first found many years ago in the Karnal area of India but did not affect crops significantly until recently when the WL 711 wheat variety was introduced in a large way in India's wheat bowl of Punjab and Haryana. That variety was cleared for release only through the overruling of objections raised by several scientists. Vindication of those doubts came when Karnal Bunt disease caused extensive damage over a vast acreage. Yet in subsequent years, the WL 711 variety was not withdrawn, so that Karnal Bunt continued to damage the wheat crop.

Once farm scientists knew of the vulnerability of that variety to Karnal Bunt, why did they go on recommending its use? Were the varieties available to the scientists so limited, or obtained from such a narrow genetic base, that there was no alternative but to use highly susceptible varieties?

Some clues can be obtained from experience with high yielding varieties of rice. On March 15, 1966, the Director of the Central Rice Research Institute (CRRI) wrote a confidential letter to the Director General of the Indian Council of Agricultural

Research in Delhi, in which he stated: "The International Rice Research Institute (IRRI) Manila, has from time to time been sending experimental material into this country which are being grown in several states. It has come to my notice that most of the material is susceptible to a very peculiar disease, not known to this country so far, suspected to be a virus." The author of the letter further warned, "I must point out that in the last Rice Research Workers Conference, during November, 1965, IR 9-60 was recommended as one of the donor parents for hybridization programme in the various rice growing states. But this material has already been observed by me at CRRI and two other centres to be infected with the yellowing disease at an early vegetative phase. I must also inform you that IR 9-60 is not only susceptible to Tungro virus, but also to bacterial blight. As such it is not a desirable material for use as a donor parent, since if used, the diseases may spread to wherever the material is grown. Under those circumstances such diseases would soon be beyond our control."

"That some sort of inoculum of such dreadful diseases is building up in the country is evident from the fact that Taichung Native I which did not show any yellowing of leaves in the early vegetative phase of the summer crop of last year, has now exhibited it. Since the Ministry of Food and Agriculture has initiated a huge programme for rapidly spreading this variety in the near future timely action must be taken against any future catastrophe."

Having sounded those warnings, the Director of CRRI, made the following recommendations:—

- (i) wherever rice cultures from IRRI are being grown, they should be carefully watched: hence the following instructions should be issued:
- (ii) action must be taken to withdraw from the hybridization programme recommended under item A (2) of the Rice Research Workers Conference involving IR 9-60 as the donor parent.
- (iii) restrictions should be imposed against the free import of IRRI rice material unless handled by CRRI.

Unfortunately, those warnings and recommendations were ignored by the authorities and instead the director of CRRI was prematurely retired from his post. Meanwhile the Taichung Native Variety continued

to be used, and the breeding programme based on disease and pest-susceptible parents went on as before.

The policy proved disastrous for the rice farmers of India. It has now been officially acknowledged that over the past 15 years of the green revolution, India's rice farmers have been asked to grow high yielding varieties endowed with a narrow pest and disease-susceptible genetic base. Thus a government task force on rice-breeding recently stated: "The introduction of high yielding varieties has brought about a marked change in the status of insect pests like gall midge, brown planthopper, leaf folder, whorl maggot, etc. Most of the high yielding varieties released so far are susceptible to major pests with a crop loss of 30 to 100 per cent. Most of the HYVs are the derivatives of TN(1) or IR 8 and therefore have the dwarfing gene of *dee-geo-woo-gen*. The narrow genetic base has created alarming uniformity, causing vulnerability to disease and pests. Most of the released varieties are not suitable for typical uplands and lowlands which together constitute about 75 per cent of the total rice area of the country."

The task force was also critical of research into disease-resistant varieties. "The results of the insect resistance breeding programme so far are not very encouraging" it said, "even though a few varieties have been released as resistant to pests, except Ratna, no other variety is having a good spread." Ratna is popular "not for its tolerant nature to borers but for its good grain type, early maturing period and wider adaptability characters. Like its parent, Ratna also records stem borer damage up to 30 per cent. Therefore a stem borer variety is yet to be developed for which a good donor is to be first identified.

"For gall midge, even though the donors are highly resistant, unfortunately most of the resistant varieties released so far in the country are either poor yielding or do not show consistency in resistance when grown in different locations. Here also high yield and high degree of resistance are yet to be combined."

The new high yielding varieties have also brought about substantial changes in crop-rotation and in the inter-cropping pattern. In the past it was common to inter-crop wheat with various legume crops but now, where the new seeds are used, such



The Philippines — where India's rice came from.

inter-cropping practices have been discouraged. And in Punjab, the centre of India's green revolution, a widely practised rotation was for maize to follow wheat. Now however, maize is being replaced by the more remunerative paddy crop. However, that rotation is likely to prove highly destructive in the long run for the soil.

A 20-year (1980-2000) perspective plan for agriculture prepared by a working group constituted by the Punjab State Planning Board has pointed out that heavy reliance on the wheat-rice rotation has "upset the ecological balance of the State and the agro-ecosystem has become fragile". In its report, the Board states that the situation is such that it is becoming increasingly difficult to stabilize agricultural production.

Recent research on fertiliser application efficiency in Punjab has revealed that when wheat cultivation follows after rice, production amounts to 13.5kg of wheat per 1kg of fertiliser used. In contrast, when wheat follows on maize, 20kg of wheat is obtained for 1kg of nitrogen fertiliser.

Thus not only have the new seeds, despite the application of large quantities of fertilisers and pesticides, failed to improve yields significantly in India, but in addition they have made the food-system

extremely vulnerable. Furthermore, even when high growth rates have been achieved in selected areas, as in Punjab, the prospects for sustainable development are poor, because of the accompanying 'cancer of land'.

Dr R.H. Richaria, the eminent farm scientist, puts his finger on the reasons for the follies in the breeding policies pursued in India's Agricultural Research Institute. "There may be many causes for the failure to raise rice yields significantly" he says, "but if we were to discover a single major factor for creating such a deadlock in rice production, it cannot be other than the lack of attention paid when finalising our strategy for the high yielding varieties programme after 1964-65 to the local adaptability of new germ plasm."

Dr Richaria recommends the concept of an intermediate technology for improving rice cultivation. He defines such an intermediate technology as that which fits in well with local conditions and is within the reach of an average farmer in terms of input costs and resources, and he would prohibit the introduction of any variety which had specific requirements that demand the creation of ideal growing conditions for maximum production.

Risk Assessment and Control of Toxic Substances in the Workplace: *

Who Counts the Cost?

by Clive Jenkins

Industry has always been loathe to recognise the hazards associated with its products as well as with the process of their manufacture. Accidents are messy and hence get immediate attention with regard to their prevention. Occupational health and the risk to workers and to the public from carcinogens and other hazardous chemicals with long term effects are rarely satisfactorily resolved. Most of the deliberations on such hazards are carried out by 'experts', with the potential victims—the workers—in general excluded from the discussion. Moreover the basis of risk assessment—epidemiology—is too often an inadequate method, since it depends on precise record-collecting over long periods and an appreciation of which substances out of many thousands are hazardous, and which likely to accentuate risk through synergistic interactions. Proper laboratory assessment is nigh possible. The onus should be on the industry to protect, not to wait for substantive proof that is never forthcoming.

Both in America and in Britain, the media has come to support the view that the cost of legislation in the field of public and occupational health is greater than the benefits it bestows on society as a whole. This argument at its crudest level simply regards health as an individual matter and at a more sophisticated level involves the use of such techniques as cost/benefit analysis. Those who propagate such views are not noted for their intellectual rigour or their sense of history. However, the generalized allegation that industry is carrying some kind of unacceptable burden remains and must be countered. Unfortunately industrialists and politicians in this country are rarely as direct as their American counterparts. The Chairman of Koppers Co. USA at a conference in 1978 said "you and I know that the market system would not give us environmental

things; they add value not wealth. The only way to improve the quality of life is through intervention".¹ There is no evidence that business voluntarily takes into account the general health issues of society; in fact evidence to the contrary is growing. To take a British example, we have no policy or strategy in this country for the disposal of toxic waste. This is not surprising. The Gregson Report noted "we do not know how much hazardous waste is produced in the UK, who produces it, what it is and what happens to it."² Those regulations which do exist are ignored and short term financial gain takes precedence over the long term costs of dealing with land fill waste sites which will normally fall on society as a whole. The Chairman of Rechem said recently "in the last year we have lost 15 per cent of our chemical treatment business. Some of this is due to the recession but a lot more is due to industry switching back to land fill and cutting corners."³

The case for an interventionist policy has been made. The kind of strategy that is needed is a more complex matter. Britain led the protection, worker safety and health. They are not economic

world in its public health policies in the late nineteenth century, and it led in most of the important developments in occupational health. It did so on the basis that health was an issue of social, economic and political policy. I argue that those are still the central issues and that the arguments are not essentially different today from 50 years ago.

Self Regulation

There is a great deal of misleading argumentation in the field of health and safety about the need for self regulation. This was a particularly fashionable phrase around the time of the Robens Report in 1972.⁴ The Act which actually reached the statute book was a framework of law. 'Self Regulation' in this context does not mean that employers should be responsible for their own standards although industry spokespersons have clearly regarded this as the case. "Greater efficiency does not mean more legislation; self regulation is equally valid in a recession."⁵ John Locke, Director General of the Health and Safety Executive, has a rather clearer view.

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'Self Regulation' in the health and safety context means that "those who are going to be affected by health and safety Regulations and Codes of Practice should be closely involved in their preparation. . . . Individual industries should feel a responsibility for identifying their own special problems and finding solutions. . . . Thirdly, in the individual workplace 'self regulation' means to me that management and workers accept a responsibility for carrying out the general duties set out in the 1974 Act."⁶

I have no quarrel with this formula except that the role of trade unions in the field of occupational health issues is a great deal more complex than the majority of safety issues. The right to know is a fundamental pre-requisite to responsible action and, in the current climate, to face a worker with a choice between work and health is again to individualize social choices which are inherently collective. A citizen of London can no more opt for a lead-free environment than a worker in Associated Octel can opt for another job in the industrial devastation of Liverpool.

The employer strategy of treating all regulations as if they were unjustified on the grounds of costs is easy to demolish. Such arguments historically would have been used to defend slavery or child labour and indeed they were. A more sophisticated approach has, therefore been required and that has come in the form of cost/benefit analysis. In our experience of dealing with health and safety issues there are a number of very real practical problems in applying a technique which was developed essentially as a tool of economic, not social, decision making.

The difficulty of defining costs

Industry does not cost health and safety in a way which can produce agreed data. A recent NEDO Report from the chemicals sector highlights the problem:-

"Companies, however, are rarely able to quantify accurately the costs in this very diverse area. It is not possible, therefore to comment on the extent to which procedures and legislation act or may act as a constraint on the

growth of the chemical industry. No evidence was found of economic benefits at company level comparable with financial costs; as with costs, benefits are difficult to identify and quantify, thus it should not be concluded that none exist.

Accident statistics for the industry, including those produced by the Health and Safety Executive and the Chemical Industries Association, are dubious in their significance and give no indication at all of any improvement. Statistics on employee health are effectively non-existent."⁷

Trade unions have a further problem. To accept business assertions about actual costs at face value is about as credible as asking the taxman's advice on how to avoid income tax. The kind of claims that were made about the cost of controlling exposure to vinyl chloride monomer in the PVC industry adds some factual basis to suspicion.⁸

"We have no policy or strategy in Britain for the disposal of toxic waste."

I also have another reservation about costing which comes from my experience as a member of the Advisory Committee on Toxic substances.⁹ At no time during my three years of membership have the employers actually been prepared to lay costs on the table and justify them. This was specifically requested in relation to the benzene



standard because of the persistent generalizations about costs. No such breakdown was ever forthcoming. I draw from this the conclusion that industry is prepared to make a great deal out of exaggerated costs in generalities but rarely are they prepared to justify them.

Difficulty of Quantifying Benefits

How do you quantify the absence of fear from the development of a long term disease? How do you quantify an unhealthy retirement?

Nor is it the case that these risks are spread evenly over the community. To paraphrase Vic Feather who once said "it's not that 100 per cent of the population are 10 per cent unemployed, it's that 10 per cent of the population are 100 per cent unemployed." It is important to remember that when discussing chronic and often fatal diseases.

Our experience is that these issues do not get quantified as they are essentially unquantifiable and therefore are simply left out. They are, however, the essence of social policy and undermine the applicability of cost benefit techniques to health and safety issues.

A Common Scale

Any proponent of cost benefit analysis knows that costs and benefits have to be expressed on a common scale for the analysis to stand up. The problem of applying that to occupational health and safety is that those who carry the costs are rarely those who get the benefits. An enterprise is only willing to make an assessment within its own criteria, it does not take into account the cost, for example, to the National Health Service of chronic ill health caused by working in dusty industries.

The cost to industry and the cost to society are in different spheres and I have yet to see a system that resolves this dilemma. It is not even clear at the macro level what social costs are to be included.¹⁰

My reservations, however, go deeper. For normal economic exchanges compensation is often as good as prevention. If you damage my car the cost to fix it is a fair exchange. Health cannot be purchased. The asbestos victims illus-

trate this point. It took a television programme to remind us that each asbestos related illness involves a real person.¹¹ To criticise this on the grounds of sensationalising the issue is nonsense. The opposite is the case. Hard facts and figures immerse us to the human tragedies that lie beyond them. As Bill Simpson said in respect of the cancer debate "If you cannot get emotional about your own death, I am not sure what you can get emotional about."¹² Trade unions have accepted for some time that compensation is but a poor alternative to prevention.

While rejecting the cruder forms of the cost benefit analysis, society has to have some mechanism for deciding which policies have priority over others and how socially desirable objectives can most effectively be achieved. It brings us to the central issues of how this process should take place and the difficulties which can be involved. I think the issue of controlling chemicals in the workplace, particularly carcinogens, illustrates the difficulties.

In February, 1980, ASTMS issued a Policy Document on the Prevention of Occupational Cancer.¹³ The purpose of the document was primarily to inform and alert our members to what we considered a real and growing problem, but it was also to engage in the arena of public policy making.

The main principles of the policy were as follows:-

- cancer can best be defeated through a policy of prevention based on the fact that the disease is caused overwhelmingly by environmental cancer agents, including occupational carcinogens;

- cancer agents pose a hazard which is qualitatively different from that of most other toxic substances, in that:

- (1) there is no known safe level of exposure;
- (2) there is a long latent period between exposure and contracting the disease;
- (3) the disease is irreversible and often fatal, except in some cases such as skin cancer;
- (4) detection of susceptible individuals is not feasible.

- A policy of waiting to 'count the bodies' by epidemiological

methods is unacceptable as the sole basis for detecting cancer agents. In addition there must be an agreed method of preventing exposure of workers to agents that can cause cancer in animals which are very active in short term tests.

- This detection programme needs to be backed by stringent regulation by government authorities, through:-

- (1) a chemicals pre-testing scheme which subjects all new chemicals to cancer tests *before* being put on the market;
- (2) a general cancer policy which places automatic controls on substances once they are recognised as cancer agents - to reduce exposure to such substances in the workplace to the lowest feasible level.

- Trades Union and employers can reach agreement locally to undertake thorough searches to check that carcinogens are not being used, or if they are found, to be substituted wherever feasible. Where substitution is impractical, then exposure must be reduced as close to zero as possible through total containment of operations.¹³

I do not propose to repeat the arguments on the above points. Instead for the purposes of this seminar I propose to look at three specific areas:-

- (1) Should workers' representatives be involved in the assessment of risk?
- (2) How much cancer is caused by occupational factors?
- (3) What level of proof is required for the development of a prevention policy?

In order to have a reasoned debate, we must have some agreement about the use of terms and on the difference between fact and opinion. In the field of cancer policy, this has been particularly difficult and in one in which we ourselves have been accused of lacking objectivity. John R. Goldsmith, Professor of Epidemiology, Ben Gurion, University of the Negev, Israel, in a recent letter to the Journal of Occupational Medicine argues that:

Sir Richard Doll, one of the world's renowned epidemiologists fails to convince that epidemiology has contributed much to

the prevention of cancer. According to Doll "What epidemiology (and epidemiology alone) can do is to demonstrate the size of the risk that is associated with a particular level of exposure and therefore help to determine the level that is socially acceptable."

But as Goldsmith points out "Limitations of exposure are the most relevant steps toward making the risks acceptable, and the epidemiologists have had little to contribute to this process."

"The determination of risk acceptability is not a scientific process, as Lowrance¹ has made clear, although all scientific work can contribute to estimation of risk. When work in toxicology finds that an agent is an animal carcinogen, but epidemiology fails to identify human risk, the issue until now has been passed on to legislators, lawyers and other policymakers. This class of "suspect agents" is relatively large, and with present levels of support, epidemiology is hardly contributing to the resolution of the policy issues for reasons inherent in the field. With respect to the prevention of occupational cancer, there are two types of problems for which epidemiology has not fulfilled its potential, and the deficiency is our own and not due to lack of support. These topics are the occurrence of other illness or impairment at an earlier period or with lower doses of agents known to be human carcinogens. We have been ignoring the potentiality of the sentinel reactions for the prevention of occupational cancer. Secondly, for at least 20 years we have had evidence that there were a number of occupations with excess risk of cancer, but for which the identification of agents was missing or ignored.

The implications of the first situation are that prevention of other associated diseases or impairments can have a central position in the effort to prevent cancer. The implication of the second is that both more careful evaluations are needed for the exposure of persons in occupations at high risk, and that exposures to potentially carcinogenic agents need to be reduced. Thus these somewhat neglected aspects of occupational cancer epidemiology lead to suggested improvements in epidemiological monitoring and in industrial hygienic conditions.

"The determination of the magnitude of health risks from occupational exposures is the essential work of occupational epidemiology. The determination of how much or what kinds of risk are acceptable is a political and not a scientific task."

On this basis, therefore, I will examine the three aspects of the cancer debate that have been particularly illuminating in respect of the assessment of risk. Should workers representatives be involved in the assessment of risk?

In 1983 this would seem a ridiculous question embodying an outmoded paternalism irrelevant to a democratic society. The trade unions' defence of the participation of workers in the process of risk assessment is based partly on the moral rectitude of such a position and partly that workers do have practical experience that is relevant to the evaluation process. In Britain the rights of trade unions to participate in the assessment of risk are embodied in the 1974 Health and Safety at Work Act, although it must be emphasized that there are major aspects of occupational risk which do not come into this system. For example the Advisory Committee on Pesticides has no trade union representation and despite criticism by the Director General of the Health and Safety Executive¹⁶ and vague promises from the Minister of Agriculture this remains the position at the time of writing.

Resistance to the role of trade unions is more commonly associated with single entrepreneurs than large companies which are members of modern employers' associations. What has been interesting however, in respect of the occupational cancer debate is just how attractive the strategy of exclusion from decision making has been to employers who wish to limit controls on occupational carcinogens. Following the publication of the ASTMS Policy Document, a number of employers' associations were sufficiently concerned to orchestrate a response,¹⁷ in which they proposed that cancer policy was a clinical question and must be left to the experts. This answer was an attempt to avoid the ASTMS argument that occupational cancer is not a medical problem but one which employers and unions must resolve in the workplace itself by removing and controlling carcinogens. Meanwhile the Chemical Industries Association refused to have anything other than a "medical" meeting where the CIA's medical advisors would meet

the trade union medical advisors. Both ASTMS and the GMBATU consistently refused to accept that position and the CIA eventually was forced to abandon it.

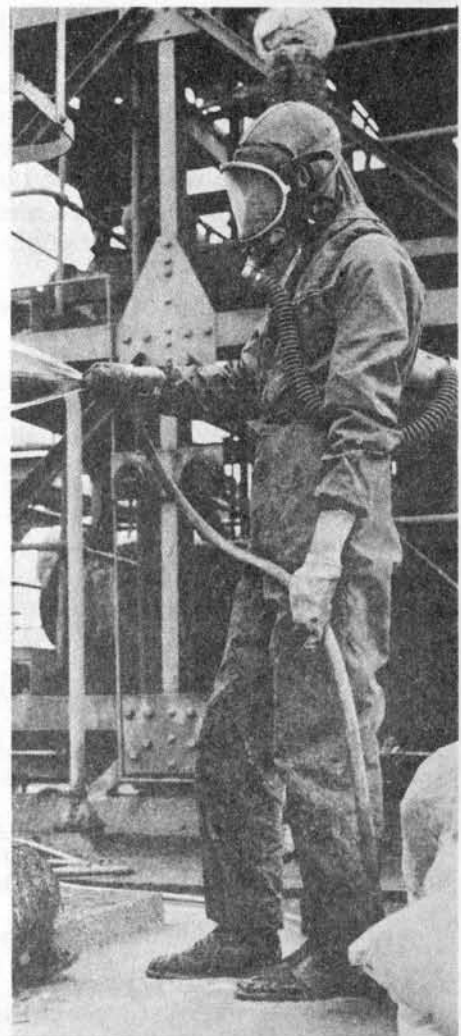
Excluding the potential victim

The justification for the CIA position is contained in an unpublished paper which has widely been circulated.¹⁸ It is essentially the same as the European Chemical Industry, Ecology and Toxicology Centre Monograph "Risk Assessment of Occupational Chemical Carcinogens".¹⁹ The basic premise of both papers is that trade unions are to be excluded as far as possible from the risk assessment and those who are exposed to hazards should have little or no say in what is an acceptable level of risk. After distinguishing "hazard" and "risk", the CIA suggests that each should be treated separately by special assessment groups. The groups, the CIA proposes, are to be made up of specialists "with a high degree of expertise from a wide variety of disciplines." Given the small number of non-industry toxicologists, it would be difficult—indeed impossible—to gather the sort of specialists who would fulfil the CIA's other criterion—that of immediate partiality. Even the line those experts are expected to take is made obvious by the CIA's suggestion that the risk assessment group should be further advised on matters of economic impact and costs of alternative actions. It would seem that the risk of being assessed is really that of industry having to spend some money. The health of workers appears to be very low on the group's intended agenda. This should come as no surprise since on page 3 of this document, the CIA state that "economic considerations should largely determine whether the required control technology can be applied or whether the material or process will be retained in use."

There is no mention anywhere in the document of the need to inform workers and their representatives of the hazards and risks from their work. Indeed, the CIA obviously wish to maintain maximum secrecy on this matter. They disapprove of

topics being publicly discussed "before the available data has been properly examined." Instead the CIA proposes that the HSE should decide which chemicals should have priority for assessment. This proposal precludes not only union, but CBI involvement in this vital process. Close involvement with assessment groups composed of industrial experts would further ensure that the most important decisions were taken before the matter even reached ACTS.²⁰

There are in my experience two very effective ways of resisting legislative action. Firstly, to ensure that no data is effectively collected so that the debate can go on forever as to whether or not a problem really exists. Thus at the present time there is no requirement for companies to keep records for epidemiological purposes; there is no requirement for them to disclose such records to union representatives; there is no requirement actually to do epidemiological studies and no requirement to reveal the information if such studies are in fact done. I hope this situation will be



Trying to keep the danger at arms length.

"The right to know is a fundamental pre-requisite to responsible action and, in the current climate, to face a worker with a choice between work and health is again to individualize social choices which are inherently collective."

remedied in the near future by the introduction of detailed regulations for the Control of Substances Hazardous to Health.²¹ However, what I wish to point out here is that industry lobbies have delayed and delayed effective regulation by straightforward opposition to collecting data that could be publicly available.²²

The second strategy is to collect the data in a way that downgrades the problem or in more extreme cases makes it disappear. An example of that is to use the Industrial Injuries Prescribed Diseases lists as an indication of the amount of occupational cancer. Thus you set up a system which defines which cases of occupational cancer are compensatable and you then use that as a figure for the estimate of *actual* occupationally related cancers.

Estimates of cancer from occupational causes vary considerably. Wynder and Gori in 1977 gave estimates of between 1-10 per cent but detailed documentation of methodology was not available.²⁵ Higginson and Muir 1979 used a modified "site specific attributable risk technique" but again gave little detailed documentation.²⁶ Cole in 1977 estimated 15 per cent in men and 5 per cent in women.²⁷ This was essentially an industry by industry response but again based very much on estimates. Fox and Adelstein 1979 said 12 per cent using a technique called social class standardization.²⁸

All of those estimates were criticised by the Birdbord et al Report on the following grounds:-²⁴

1. Incomplete data
2. The fallacy of "one effect - one cause" explanations (e.g. attributing lung cancer to smoking even when clear occupational exposure agents such as asbestos were a contributory factor).
3. Latent period, age and duration of exposure (previous epidemiological studies have often uncovered only a fraction of total deaths attributable to a cancer agent).
4. Changes in exposure patterns.

The Report also points out that

previous approaches tried to estimate the proportion of present cases of cancer attributable to exposure in the past—but a far more relevant question is the contribution of present exposure to future cancer incidence.²⁹

The Bridbord paper tried to get round these problems in a number of ways which have been criticised in some detail. "The method used for projection of the future annual risks among current employees in each of the six industries was to multiply the number of millions of workers currently employed there, irrespective of their actual duration or degree of exposure (which will be negligible in many cases) by the percentage excess risks of cancer that have been observed by special epidemiological study in the United States or elsewhere among a few hundred or a few thousand workers who have been heavily exposed for many years to the agent of interest."³⁰ As a result of such an approach Doll and Peto produced their estimate of an excess cancer risk of 2-8 per cent. Yet, epidemiology has identified less than 60 substances as carcinogenic to humans.³¹ In addition they have been criticised for their interpretation of cancer trends. Devra Lee Davis, for instance, states that:-

"My colleagues and I have reached three pertinent conclusions on cancer mortality for sites associated with occupation for males in the past decade. First, while the proportion of older men dying from all causes has declined, the proportion dying from certain cancers has increased. Multiple myeloma and cancers of the lung and brain have increased sharply in those aged 55 to 84—at least 50 per cent for those between 75 and 84. Second, other cancers known to be associated with occupation (kidney, esophagus, and liver) have also increased in older men. Finally, some cancers associated with cigarette smoking have declined (bladder, pancreas, buccal cavity and pharynx), while others have

increased (lung, esophagus and kidney).

Environmental Exposure — How much Cancer?

These findings do not present a simple picture. Some of the declines in mortality reflect improved treatment, especially for bladder cancer, which is among the curable cancers. Some of the increases may be artefacts, resulting from increased use of high technology for diagnoses. In addition, the cancers associated with cigarette smoking also are associated with occupation and (in some cases) alcohol and nutrition. Undeniably, as Doll and Peto indicate, cigarette smoking remains the chief preventable cause of most cancers. It is also responsible for a host of other public health problems, ranging from heart disease to fires and low birth weight. But our data suggest that the real contribution of occupational and environmental exposures remains an important research question that cannot be readily resolved by examining national cancer rates."³²

No doubt the protagonists will continue to debate the issue and perhaps the most diplomatic contribution to the debate came surprisingly from the Office of Carcinogen Identification and Classification of OSHA; a somewhat beleaguered outpost in the current US regulatory climate.

"In our opinion, further quantitative estimates using data currently available will serve only to divert much needed resources that could be used in more meaningful activities. If society chooses seriously to embark on an effort to quantify environmental causes of cancer, there is a need to commence activity for establishing criteria and data that would be necessary to answer the question in the future."³³

I interpret this and similar statements as a truce among the academics. They are essentially saying that the kind of information which the policy makers require is unavailable. Is the answer then simply to delay action until such proof is available? This leads on to what I consider to be the most important aspect of the whole debate.

The development of health and safety legislation in Britain has been heavily weighted in favour of initiatives on safety rather than on health. Some of the reasons for this are clear enough. Safety is more visible, more immediate but the development and the nature of legislation itself has also been a factor. Under the Factories Act, there is a clear and unequivocal duty on employers to guard machinery. In legal cases it has been held that if an injury has occurred, then almost by definition, the machine has not been properly guarded. Section 63 of the same Act lays down a duty to be kept as far as practicable in relation to the removal of dust and fume from the workplace. The duty to guard has been an endless basis for effective prosecution by the Inspectorate and our high standard of machinery guarding derives from it. On the other hand, there have been few successful prosecutions under Section 63. This has been almost entirely due to the level of proof required. A successful prosecution under Section 63 requires that the prosecution prove *beyond all reasonable doubt* that the substance involved is injurious to health. I doubt if, by this criteria, smoking would stand convicted. The estimate of future potential risk does not fit easily into this level of legal proof.

Exactly the same problem faces those who are trying to develop a preventative strategy in the field of toxic substances at work. This problem is particularly acute where reliable human data is absent. This is almost universally the case with respect to carcinogens. The debate on acceptable proof has become whether or not we can act on animal data or whether we have to have evidence of *actual* human disease. A policy of waiting to collect human evidence has a certain Alice in Wonderland quality. As the Queen said to Alice: *Sentence now verdict later.*

There are a number of reasons why the epidemiological method is inappropriate in a strategy for the prevention of occupational cancer.

Epidemiology cannot identify relatively low levels of risk. Few epidemiological studies have been adequate to detect anything smaller than a 50 per cent increase in the



A foundry grinder wearing a personal respirator to prevent inhalation of silica dust.

cancer incidence compared with the general population. The main arguments are:-

1. The period between exposure and the onset of the disease can be anything up to 50 years. As strategy for prevention this has obvious drawbacks.
2. Very rarely are workers exposed to single substances and the pursuit of a single carcinogen is often a hopeless task. A needle in a haystack is a useful metaphor for a carcinogen in a dyestuff plant or a carcinogen in the rubber industry.
3. In order to establish exposure levels a large amount of data has to be available. There have, of course, to be personal records. Many or all of the basic information sources are missing.

For these reasons, the defence of epidemiological studies as the determining tool of a cancer prevention policy fits well into the strategy described previously. If you make sure the evidence is never going to be available you can delay regulations for ever.³⁴

To date, the scientific principles of the OSHA policy remain the basis for any preventative policy. These can be summarized as follows:^{35,36}

■ Properly designed and conducted tests using appropriate animal species (e.g. rats and mice) are accepted as valid ways to identify chemical substances that may cause cancer in humans. In nearly all cases, chemicals that cause cancer in humans have been found to cause cancer in small rodents.

■ Established test protocols, which include administration of

To protect the home,
first clean up the plant

high doses, sometimes by a route different from the expected human exposure route, are appropriate and scientifically valid methods for identifying potential carcinogens in humans. The intrinsic carcinogenic character of a chemical substance is independent of dose level. High doses simply make this characteristic easier to discern in a test situation. Chemical carcinogens tested by one route usually produce cancers when tested by other routes as well.

■ Induction of benign tumours is accepted as an indication of the carcinogenic potential of a substance unless definitive evidence shows the substance incapable of inducing malignant tumours. Some tumours pass through benign stages as they progress to malignancy, and some chemicals may produce benign and malignant tumours.

■ Methods do not now exist for determining a safe threshold level of exposure to carcinogens. Uncertainties in the dose-response relationship between specific exposures and cancer risk, unknown factors that influence individual susceptibility to cancer, and unpredictable interactions among cancer-causing agents prevent determination of safe levels for human exposure to a carcinogen. Any exposure, however small, is regarded as an addition to the total carcinogenic risk.

■ Methods now available for quantifying the estimated human risks from a given exposure to a potential carcinogen can provide only approximations of the actual risk.

Towards a Social Strategy of Risk Assessment

One of the most insidious aspects of the cost/benefit fashion in the assessment of risk is the attempt to equate one type of risk with another across a whole range of different hazards. Tables are produced comparing the risk of crashing in an aircraft with crossing the road and with working in a chemical factory. One of the minor problems with this kind of assessment is that it concentrates on mortality rather than morbidity. Quality of life still remains more important than quality of death. However, the fallacy is much more profound. Barry Commoner goes on to make the substantive point:³⁷

Suppose we compare the costs of a regulatory action that might be taken against cigarettes or red lollipops—banning them. Banning cigarettes would wipe out a \$6 billion industry (in annual sales), whereas banning even all uses of Red Dye No. 40 would eliminate sales of only a few million dollars per year. Clearly, the social costs of banning red lollipops are much smaller than the costs of banning cigarettes. But this fact would, of course, be a palpably illogical basis for action, since cigarettes are more dangerous. The logical fault is obvious: In a risk/benefit assessment what should be compared is risk and benefit associated with the same substance, not risk (or benefit) of Substance A with the risk (or benefit) of Substance B.

The whole history of control of toxic substances and indeed drugs and pesticides has been to avoid the issue of social use of particular products. Yet I cannot see ultimately how any reasonable strategy can avoid the issue indefinitely. Nor is this an issue which leaves union interests unscathed. We can ban lead in petrol, but who in the name of wider social good will confront easily the workers made redundant as a consequence? In order to make any policy socially acceptable there has to be some allocation of costs.

I must argue finally that economic criteria have little initial place in a policy of controlling toxic substances at work. We seem to have forgotten that the idea of right and wrong is also a relevant criteria of social judgement. There is a

straightforward proposition which states that workers should not become ill as a result of their work. Furthermore, hazards in the workplace are often different from other hazards in that they are essentially preventable. Nobody knows where a preventative strategy for breast cancer would start; on the other hand we do know an effective strategy for the prevention of mesothelioma, that is by banning the use of asbestos.

Risks taken at work are not voluntary and it is a great mistake to base any social policy on the assumption that they are. Nor do I actually think, that a great many 'voluntary' matters such as bad diets and smoking are quite as voluntary as is occasionally pretended. I would, therefore, like to conclude with a plea that we abandon trying to rest upon inadequate sciences as a basis for social policy; that we act on the evidence that is available in the context of clear moral values; that society does have a duty to protect us from the untrammelled effects of the free market approach.

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"A classic episode in the history of disease prevention took place in London in 1854. An epidemic of cholera occurred in the neighbourhood around Broad Street. John Snow, the hero of the story, studied the habits of the victims and found that almost all obtained their water from the well on Broad Street. Swift action was taken; the pump was closed down and the epidemic rapidly subsided. This disease was caused by exposure to the bacterium *Vibrio cholerae*. One can imagine the reaction that might occur today if it were proposed to close down the pump on the basis of evidence of the kind obtained by John Snow. Many scientists would point out that it had not been conclusively demonstrated that the water was the cause of the disease. They would be troubled because of the lack of satisfactory theoretical knowledge to explain how the water could have caused the disease. Furthermore, other habits of those who had become ill had not been adequately investigated, so it would not be possible to rule out other causes of the disease. The scientists would have been correct. Others would have pointed out that some members of the community who drank from the Broad Street well had not succumbed to cholera. Thus, even if there were something wrong with the water, there must be other factors involved, and if we could control these we would not have to be concerned about the water. These conclusions are also correct. Some who consumed water from the Broad Street well would have objected to closing it because the taste of the water from other wells was not as agreeable. Finally, if the pump had been owned by an individual who sold the water, he would certainly have protested against closing down his business on the basis of inconclusive evidence of hazard."

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Abbreviations:

NEDO - National Economic Development Office
 ASTMS - Association of Scientific, Technical and Managerial Staff
 CIA - Chemical Industries Association
 GMBATU - General Municipal Boilermakers and Allied Trades Union
 CBI - Confederation of British Industries
 OSHA - Occupational and Safety Health Act



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Rutland

— a true English region surviving bureaucratic attempts to destroy it

by Bryan Waites

The greatest revolution in local government this century occurred in 1974. As the administrative axe fell, so many ancient counties vanished, new ones created and boundaries redrawn. Famous names like Westmorland, Cumberland, Huntingdon and the Yorkshire Ridings went and new names with a pseudo-geographical familiarity appeared such as Cumbria, Humberside, Avon and Cleveland. The administrative map of Wales also changed radically leaving only the well-known name of Glamorgan, which, however, found itself divided into three new counties.

A two-tier system of county and district replaced county borough, urban and rural district, once the backbone of English local government. In England and Wales 47 counties and 333 districts were created covering the whole country except the great conurbations which were designated Metropolitan Counties—now due to be disbanded after a short life of ten years.

Although the new county map looked familiar and new counties had comforting old river or topographical names, in fact it concealed a complete revolution not only spatially but politically. There were, too, 'unseen' changes such as the separation and re-organisation of Water Authorities into ten large, autonomous areas.

If there were new concepts and principles in the re-organisation they were not easy to discover. As usual, the end product seemed to reflect political expediency and compromise rather than a considered regional philosophy. Consequently, many people were dissatisfied. On the one hand there were those looking to a division into organic city regions, on the other those wishing to retain the historic counties intact.

Rutland, once England's smallest county, was in the latter category. It vanished into Leicestershire, although it was made a district, thus retaining some of its former unity. However, the demise of Rutland

seemed to signal the end of a conflict with Leicestershire dating back at least to the 1960s when, through mighty efforts to 'keep local government local' Rutland had won a great victory to remain independent. Now, on the national tide of local government reform and with a population of only 26,000 it was unable to sustain its resistance.

Yet, officially, no one had been asked for their opinions about the proposed change. Of course, in an obscure corner of the newspaper the Boundary Commission had inserted their required piece so that representations could be made to them but this formal, almost secret statement did not reach most of the population. The administrative juggernaut was programmed to run blindly over all.

A private survey, however, reaching seven towns and villages and 800 people (almost three per cent of the population of Rutland) found over-whelmingly that 'The people of Rutland say keep independent status'. If everyone questioned had been born in the county this might have been explicable but the survey found that on average 64 per cent of the respondents were recent arrivals as residents, many being com-

muters. Even so, more than 80 per cent, in two villages 95 per cent, of replies indicated retention of fully independent status. Why was there such a strong feeling, one might say a patriotic loyalty?

The personality of Rutland was clearly distinguishable. It could be seen to have a special identity and from this a well-appreciated integrity. Its landscape was a microcosm of rural England at its best. Rolling countryside with small fields and splendid hedges. Villages that reflected the great stone tradition of England growing, it seemed, out of the very earth itself as the sun glinted on the rich brown marlstones and ironstones of the cottages and farms. Narrow country lanes set deeply into the landscape around. It was the heart of the fox-hunting shires with all the pageantry and tradition that implies.

Its aristocratic stately homes and famous public schools added another characteristic. So too did the two typically English market towns of Uppingham and Oakham, the latter the county town with its twelfth century castle hall, full of lordly horseshoes given for a thousand years as a tribute by pass-

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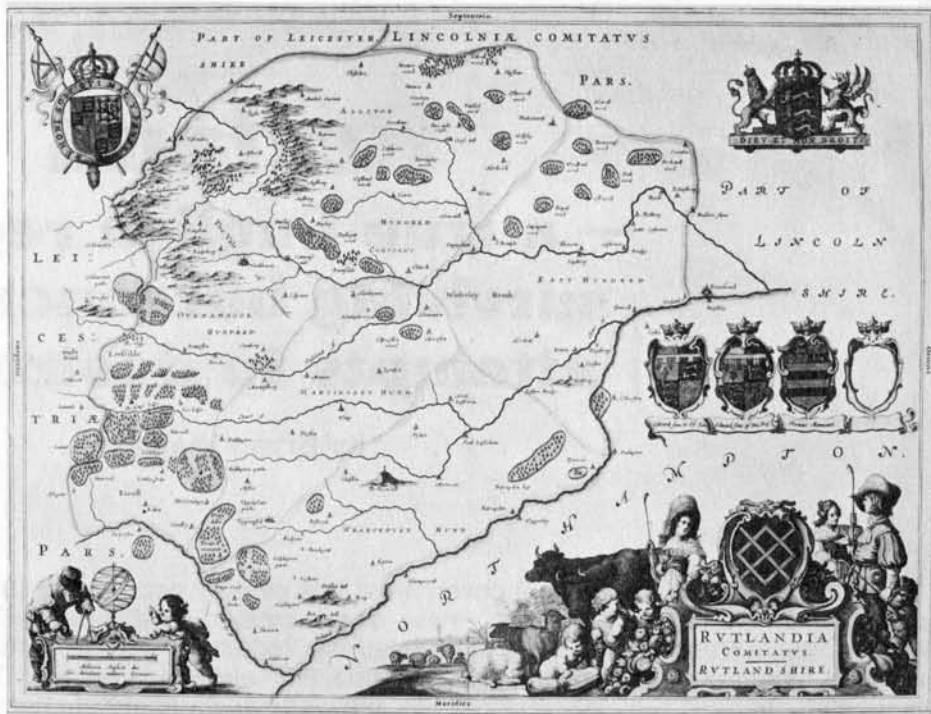
ing Peers of the Realm, and its Assize Court and Butter Cross.

Truly, the county seemed an island of Stilton cheese, Hunt cakes, County ale, Ketton stone and Collyweston slates 'still largely untouched, still a picture of a human, peaceful, slow-moving pre-industrial England with seemly villages, handsome churches . . . one hundred and fifty square miles of unknown England'. Indeed, such was its charm and identity that Professor W.G. Hoskins said that it should be set aside at once as the first 'Human Conservancy' with notices at each entry to the county 'Rat Race Ends Here'.

Rutland's small size was conducive to its special identity. Like an island only seventeen miles across it is comprehensible to its inhabitants. It has a personal quality due to its small scale. It seems like a private domain demanding its own loyalty. Commuters, working in Peterborough, Leicester, Nottingham and Northampton more than twenty miles away can retire to their Rutland haven each day.

On the edge of the Fens, with the Welland valley marking its southern boundary and minor scarplands its western, Rutland has a kind of geographical distinctiveness. But this is not the real reason for its identity. That issues more from its 1000 year old historic continuity as a separate unit. It arrived as a county rather late, in the thirteenth century, but research is now showing how it may have been a unit as a pre-Roman estate. Later it became part of the dower of the Queens of Mercia then of the Queens of England. Its special position on the frontier between Danes and English emphasised its importance as a pledge of goodwill for agreements made. As the last bastion of pre-Conquest England it passed into the county system later but its evolution epitomises the unfolding of a greater theme—the gradual unification of England itself. It is the strength of this historical continuity which, almost subconsciously, binds Rutland and its people in their region.

There can be other threats to an area which help to create a unity within it and a regional consciousness. One kind is the planning



Rutland by Blaeu 1645

threat. Following on from the re-organisation in 1974, the new county authority initiated a Rutland Structure Plan which was to chart out the growth in the area for the future. This was to be consolidated by District Plans which are now being formulated.

On the face of it these are necessary and useful exercises. They may safeguard areas rather than threaten them. However, several policy choices are invariably available. Which will be chosen? This is the problem facing the public for it might be the wrong choice. It might be *growth* when it should be *conservation*. Luckily, planners fully consulted Rutlanders and they were always aware of the area's special, sensitive role in the county as a whole. Broadly, therefore, a policy of conservation was chosen.

There are, though, insurmountable environmental threats which, each day, we can read about, as they are to be found in all parts of the country. The new airport, the much-needed motorway, the quarry, industrial extensions and the like frequently next door to an important heritage site, or to a fine town or village. These threats can encourage and strengthen regionalism by the united opposition they provoke.

Even before the re-organisation of 1974 Rutland was threatened by the construction of England's largest

man-made reservoir, the size of Windermere. Royal Assent was given in 1970 for its creation. So England's smallest county was to have England's largest reservoir covering three per cent of its surface. Already having one reservoir and the proposal of others Rutland seemed destined to become the Lake District of the East Midlands.

The completion of Rutland Water in 1976 has, in fact, been a twenty-first century miracle for it has brought the future to Rutland ahead of its time and yet has not destroyed the past. It has changed the quality of life. It has been so landscaped as to fit into the scene without marring it. Though it attracts tourists the facilities are so well spaced that they do not normally intrude. Most Rutlanders who once opposed the scheme with stickers and placards proclaiming 'Don't Flood Rutland' now agree that it has become part of Rutland helping to enhance its name and reputation. But a watch is constantly kept to ensure that Rutland Water does not explode into a commercial bandwagon.

This is what people fear from the next threat on the environmental horizon, namely Wonderworld, Britain's Disneyland, now to be established a few miles from Rutland's border in the south near Corby. Increased traffic from urban centres to the north of Rutland is

bound to cross Rutland's narrow roads and cause congestion.

Meanwhile, insidiously, for a number of years quiet environmental assaults have been made on those very roads. Widening, corner cutting, verge interference, hedge grubbing, too much house building, etc. have reflected the greater use of this convenient area by commuters and the authority's response to help them travel more easily and live better. However, people and planners are now more aware of these secret dangers.

Beyond the blue horizon, too, in the direction of Belvoir Castle, the home of the Duke of Rutland, lies the greatest threat of all, the development of western Europe's largest coalfield. Permission has just been given for a limited exploitation near Melton Mowbray. There is no doubt that the Nation will need such enterprises but they raise the eternal conflict of beauty and the beast, of conservation and exploitation, found from the Welsh Mountains to the Peak District and to the Yorkshire Coast and particularly felt in our National Parks. Rutland's special fear is the passage of spoil over the area and, maybe dumping in our quarries, the increase of traffic again and the attractiveness of the area encouraging more residents who work on the coalfield.

Such threats, some of which have turned out to be benefits, together with local government re-organisation, have occurred within a decade. Indeed, this has been an environmental revolution in a short time in a small area. However, we should be thankful for it since it has increased the *territorial strength* of the area as a *region* or *pays*. People cling to their region even more if it is threatened and in defending it they acquire an *esprit-de-corps*, morale, loyalty and, dare one say it, patriotism?

So Rutland through its special personality, its size, its geographical distinctiveness, its historical continuity and by its vigorous response to the attack of an environmental revolution has consolidated its regional role, even in the face of being swallowed up by Leicestershire. It has claimed loyalty and allegiance not only from its natives but also from its commuters. In

doing so it has shown the indestructibility of the English region and its capacity to adapt to massive changing circumstances. But what is the lesson Rutland dares to give to Britain?

That people *make* regions by perceiving them as their units for living, giving to them allegiance, loyalty and love. Feeling pride in them and being willing to defend them against threats. Encouraging their odd customs and eccentricities, indeed, making certain that they will not vanish. In short, people appreciate uniqueness in a world which is becoming more and more standardised. The region by its special distinctiveness is the bulwark against dreary sameness and mechanical conformity.

Rutland—a Manageable Size

This makes such regions *organic*. They live and they work. Though one may find physical, natural and historical support for a region's distinctiveness, in the end, these are not essential ingredients. Nor do we need to think that city regions are the only organic regions. Throughout the countryside of Britain there are innumerable well-defined and cherished regions large and small with their own well-developed organic existence, waiting, perhaps, to be recognised.

When an historical, administrative area coincides with a perceived area regarded with affection and loyalty we have the greatest cement for establishing a permanent region. Coincidence of physical, historical, cultural, administrative, perceptual and behavioural elements should be sought for in the soundest regions.

Scale: Rutland can be known because of its small size. It reminds us that, like the family, it is within reach of our understanding. As Lewis Mumford said, "people are attached to places as they are to family and friends. When these loyalties come together, one has the most tenacious cement possible for human society . . ." In modern jargon the message is 'small is beautiful'. Politically the message is equally clear: keep your units small, allow your people to know their region, respect its territorial integrity, give them some freedom within it to exercise their own con-

trol and let the tentacles of central government touch it gently and sometimes not at all.

There is a greater need than ever before in history for the individual to re-establish the bonds between himself and his region—really to try to return to the earth

'so near and dear to me,
The church, the brook, the
cottage, and the tree . . .
Dear Native spot! which length
of time endears'

as John Clare expressed his deep feeling. Our region will give us the psychological refreshment and cultural re-invigoration we lack.

As analysis of Census Returns and proliferating market research findings show more and more significant regional variation within and throughout the country we can no longer believe that regionalism is a thing of the past. Indeed, it is an ever-present and growing force, not only in Britain but also abroad. Is it the twentieth century rebellion against conformity, centralisation and internationalism? There is no doubt that there is a need for more investigation into regional consciousness and regional differences using newer methods of computer analysis to discover the *real* regions of the people in Britain. Only then can we respond to their needs and understand their philosophy.

Rutland reminds us, through a thousand years of change and challenge, unprecedented in the last fifteen years, that a region, a true region, can survive, should be recognised in any administrative or planning deployment and must be given its chance to live and operate as one of the most important and vital components in our national fabric.

Numinous Nature and Material Progress

by Ken Penney

It has been said that at one time all nature was numinous to human kind. By this, I understand it to mean that human beings even in our own society until recently treated natural objects like trees, rivers, and even the soil as if they were more than just objects put there for the enjoyment and exploitation of human beings, but contained spirits and god-like attributes that had to be revered and often propitiated. It is very difficult for those of us brought up in Western urban culture to really appreciate how this form of world view could have once prevailed and then almost entirely disappeared. Yet I recollect when I was young we lived in a Cambridgeshire farming cottage that had no water mains, which meant that we had to walk almost a mile to collect fresh drinking water. As a result we treated clear water with a great deal of respect, and I know that I myself gazed with great wonderment at water springing out of the ground after heavy showers of rain. At that time I had no esoteric explanatory system that would tell me that spring lines would often occur in clay areas such as those where I lived. It is nowadays no small wonder to me then that communities in the past that were so dependent upon water for their very existence, should treat springs as something magical and the home of spirits and gods.

Much the same was thought of trees. Nowadays when we see them moving and hear the noises they make when they do so, attribute this to the force of the wind. Yet to earlier human beings, this cause and effect was not part of the customary explanation system and instead they saw the movement of trees as something magic and powerful and believed that the noises the trees made in the process to be the words of spirits and gods attempting to communicate with mankind. These beliefs were not confined to so-called primitive people, even in the so-called civilised Western Society the incredible power of the soil to produce the growth of things that we and our animals could eat was looked upon with a great awe. After all, it was this process of growing food that human beings depended upon, once they had passed from being migratory tribes depending upon hunting and gathering.

Yet, as time passed, we in the West experienced a cultural revolution which we now call 'the growth of science'. Science has provided us with new forms of explanation. Gone now is the mysticism attached to springs, the trees, to soil, to stones, to rivers and to

the power of the waves and tides. Nowadays we can explain springs in terms of geological strata, the noises of trees in terms of interaction between the wind and the cellular structure of living things, and the magical power of the soil disappears under a great welter of chemical equations that supposedly explain the mystery of growth. All too often we cast aside some of the earlier explanatory systems as being utterly valueless, but perhaps we might be making a mistake in doing so. Let us remember that one of the early selling points of tobacco was that it was capable of bringing up the phlegm that lay latent in the human body and although most of us who once alas may have been heavy smokers, realise that tobacco is the cause rather than the munificent liberator of phlegm, there are still quite a number of people who think of tobacco as having this medicinal property. At any one time there can be a multitude of explanations for a whole variety of phenomenon, and that which happens to be acceptable at any point in time depends upon a host of factors, many of which are sociological and cultural.

We in the West have seen as a result of our revolution in science, a consequent growth in the output of material commodities and services. This transition has made itself manifest in such things as the water mains which provide us with the infinitely valuable water resources that enable us to live almost anywhere, unlike our forefathers whose location depended upon supplies of the life-giving substance. The progress of materialism, communications, transportation, and scientific knowledge, has allowed humans to live in an urban society on a scale never really before known, and people born and bred within this form of society tend to lose contact and awareness of their dependence upon the soil and the nature that lies around them. Only those who have seen plants in their prime and ready for harvest trampled by animals or eaten by pests, or have seen perfectly healthy animals keel over and die, can really understand the fickle powers of nature and the deep sense of reverence that a successful harvest safely home can induce.

True there are vestigial remnants of the old-time nature worship in our own urban culture. Folk singers still recite the mystic rites associated with John Barleycorn and even scientific people have been seen to touch wood on occasion. Relics of tree worship can still be seen with the Christmas-trees and mistletoe that decorate our houses at what was once called Yule-tide. These anachronisms apart, our highly vulnerable and dependent urban society

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has in the space of almost one generation seemed to have not only lost contact with its roots but to have developed an outright contempt for nature, and the passage of materialist progress has caused most of us to treat natural objects not as things worthy of respect but as mere inanimate inputs in a production process that is judged and evaluated in terms of profit. Furthermore, within our artificial and over-extended materialist society, we seem to have developed entirely new forms of commodities that are themselves dependent upon nature. Communities that once depended upon fishing for their livelihood are now put out of business by international trade in canned produce. Surprisingly though, fishing has become a sport and urbanised man is willing to pay huge sums to engage in the sort of hardships that at one time were necessary for survival. People who had to rely upon skis to get from one place to another, no longer have to do so because there are modern communications, so skiing has become an expensive sport. People who once had to walk to get to the market, now go by car. As a result, people are willing to pay for expensive walking holidays and all the ritual clothing that goes along with it. Over-weight business executives who pride themselves on having escaped the trap of manual labour are willing to pay vast sums to go along to a body-building gymnasium and there acquire the muscles that would have come quite naturally to a blacksmith or a navvy.

The material and technical progress that has caused us to lose respect for the environment around us and cause us to think of nature as being one of a series of technical inputs, has been accompanied by the translation of what was once vital and necessary work into required leisure activities which go to raise our gross national product and at the same time require the input of environmental resources. Perhaps much of this bizarre transition can be summed up in the story of a guest of ours who once stayed on our Devon small-holding. He was a bright young American doctor who continually preached to us the virtues of jogging and he would rise at what he thought to be an early hour in the morning, nod to those of us who were up cutting the wood for the wood-burning stove, and in his rather expensive jogging gear would set off to trot around the Westcountry lanes. Meanwhile we lit the stove to provide hot water and heat for cooking the breakfast, and then most of us repaired to the vegetable plot to collect vegetables and fruit for the day's meals. Many who have engaged in this sort of occupation will know just how easy it is to drift off while doing some such task into a delightful daydreaming line of thought that is both comforting and exciting. Imagine the hilarity that arose when our American guest came trotting back some hours later demanding hot water for a shower, and then while tucking into breakfast the rest of us had prepared, told his wife that she must make haste and get ready because he had booked a session of transcendental meditation in a neighbouring town. After all, he had paid for it, hadn't he?



Wiley

CONSERVATION IN PERSPECTIVE

edited by **A. Warren** and **F.B. Goldsmith**,
Ecology and Conservation Unit, University College, London

This book reviews the nature conservation scene from straight scientific ecology and its application, to the theory of choice and management in nature conservation, through more practical problems of the direct application of ecological knowledge, to questions of organizing and administering nature conservation in all the voluntary and governmental bodies that are involved.

Since the earlier book, *Conservation in Practice*, there have been a great many changes in conservation and ecological science. There is a new Wildlife and Countryside Act (1981) and the evaluation of nature has become important for planning enquiries, County Trusts for Nature Conservation and the Nature Conservancy Council. New issues have emerged such as the drainage of agricultural land and the afforestation of the uplands, paralleled by an enormous growth in the establishment of voluntary groups and in the literature and courses on ecology.

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Trees and Networks in Biological Models

by **N. MacDonald**, *Department of Natural Philosophy,
Glasgow University*

Trees and networks abound in biology — ranging from real networks such as the branching pattern of the lung to abstract networks such as food webs. The first half of this book deals with the description of abstract networks, using the terminology of graph theory. Part I is concerned with the characterisation of overall properties of networks in terms of appropriate numerical indices, and Part II with stability of steady states and oscillations in networks. The second half (Part III) gives the first available general review of the description, biophysics and simulation of real branching structures, with illustrations from botany, zoology and the physiology of arteries, lung airways and nerve cells.

The balance struck between the mathematical content and the choice of examples is such that the book will appeal both to mathematicians working on biologically-oriented problems, and to postgraduate biologists and research workers in a wide range of disciplines who need to model networks in their particular speciality.

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Plutonium Export and the sacking of Ross Hesketh

Dr. Ross Hesketh has been dismissed from his post at the CEEB's nuclear research laboratory at Berkeley, Gloucester. The case raises vital issues concerning what the CEEB is doing with its plutonium, and also concerning what the public have a right to know. Hesketh claims that he began to experience harassment at his job following a letter he wrote to *The Times* on October 30th, 1981; which observed that for the CEEB to sell plutonium to the Reagan administration would blur the civil-military distinction.

In 1981 the House of Commons agreed to the export of plutonium of unspecified isotope composition, to the United States, under a Defence contract. In response to that agreement Hesketh wrote his *Times* letter. Since then he has published two papers on the matter as well as writing further letters to the press in association with Sir Martin Ryle. He argued that the International Atomic Energy Association statutes require in general that the export of fissile materials "shall not further a military purpose"; and that both Britain and the US have voluntarily placed their nuclear facilities under the IAEA safeguards system.

Nothing more was heard of the proposed plutonium export until this year's Sizewell Inquiry. On day 42, CND's spokesman Rob Edwards questioned the Department of Energy. "If", he inquired, "it had been agreed in 1981 to export plutonium to the US, then why have we heard nothing more about it?" Answer, "There simply is no longer discussion about the matter." He

persisted, "if something has been agreed in principle and then it is not discussed, I am at a loss to understand what status it has."

In essence it appears that the deal is off; or at least, it is inoperative for the time being. That being so, the credit for dissuading the CEEB from a rather serious error of judgement should go in part at least to Dr. Ross Hesketh.

As a result of his action, Hesketh has lost his job. For 23 years Hesketh had worked at the CEEB's nuclear research laboratories at Berkeley, Gloucester, and for the past 8 years has been a senior manager in the fuel and core branch in which he held the post of section head. At the beginning of 1983, Hesketh was informed that he was to be moved to another post, incurring the loss of his research team, of all authority to initiate new work and of associated financial authority, of control over the work he does and of secretarial assistance. This he regarded as a demotion and refused to move. He was first warned, then sacked, and an internal appeal tribunal on June 20th, 1983 upheld his dismissal.

The merit of Hesketh's work goes further than mere cancellation of a proposed export of plutonium contract. His article, "The Export of Civil Plutonium" published in *Science and Public Policy* in April of 1982, gives details and figures for civil and military stockpiles, stored and reprocessed, with a lucidity difficult to find elsewhere; it may be contrasted with more woolly estimates many appearing to over-estimate by 10 tons or more his own calculations. Hesketh's papers give

invaluable aid to anyone seeking information on such difficult issues as how the extent of fuel burn-up relates to final plutonium isotope composition; and as to how to evaluate the labyrinth of parliamentary answers concerning plutonium stocks.

As Hesketh points out, "the UK civil Magnox programme is one of the larger producers of plutonium in the Western World." Yet CEEB publications give no indication that its Magnox reactors are of similar design to the piles made to breed the first atom bomb material. Meanwhile from evidence given during the Sizewell Inquiry, it transpires that the isotope composition, not only of plutonium exported to America, but even of that stored at Windscale, cannot now be divulged "for national security reasons."

According to such evidence, no more than half a ton of plutonium has been exported to the US. That export was prior to 1971, the plutonium being used apparently for making californium, for medical purposes. Such a statement contrasts with a report in *Nature* (27.5.82) of "as much as four tons of fuel-grade plutonium that the United Kingdom supplied to the United States over several years." Hesketh is sceptical of the californium story, in as much as three or four tons may indeed be the quantity so far exported to the US.

Nevertheless CEEB, as well as Department of Energy officials, continue to repeat that "no CEEB plutonium has ever been used for a military purpose."

If they wish such statements to be believed, they should spell out in more detail what they are doing with their plutonium, in particular that fraction of weapons-grade quality which is formed from short runs at the beginning and end of a civil reactor's lifetime. Hesketh estimates that the UK's civil programme will exceed the military programme (Calder Hall and Chapel Cross) by a factor of about six in the rate of production of plutonium, thus generating about 2 tonnes a year.

STOP PRESS. Dr. Ross Hesketh has been 're-instated' in his job at the CEEB, although in reality he will not return to the Berkeley Research Laboratories, but will remain on 'Sabbatical' leave until his official retirement in July 1984. Thus his pension rights have been safeguarded. Both Hesketh and the CEEB are keeping quiet over the reasons for the original dismissal. The Engineer's Association, however, is looking into safeguards over plutonium proliferations.

Nick Kollerstrom

Forest Exploitation in Sierra Leone: A Tale of Devastation



Sierra Leone, a former British colony, is one of the smaller countries in Africa. Situated on the west coast of the continent between Guinea and Liberia, the republic consists of a roughly circular piece of territory of 72,600 square kilometres, making Sierra Leone comparable in size to Scotland. A population of approximately 3.5 million live in this small corner of Africa, the majority of them subsistence farmers.

Natural Vegetation: A great band of tropical rain forest extends from Sierra Leone, across the west and central regions of Africa to Zaire. Here depending from which end one starts, one might say that the tropical rain forests of Africa begin or end in Sierra Leone. Certainly any one who chanced to pay a visit to the country two centuries ago, would have found from casual observation that Sierra Leone belonged to the forest belt indeed at that time nearly three-quarters of the country's surface was covered by high forest. A visitor coming here today would need some convincing: for where once stood magnificent primary forest, now stands degraded farm bush, most of the country's high forest having been destroyed.

Historical Aspects: Full scale timber exploitation began in the early 19th century but the country had been well known for its forest resources long before that. There is little historical information on Sierra Leone before the fifteenth

century when the contact with Europe began. At least until 1462, Sierra Leone was as far south as any European explorer had sailed along the African coast. In that year the Portuguese sailor, Pedro da Cintra, sent by his king, arrived in the natural harbour at the foot of the mountainous peninsula which another Portuguese explorer had seen from a distance out at sea two years earlier. Inspired by the wild, rugged appearance of the forested mountains, and very likely also by the roaring thunder of the then rainy season, da Cintra named the area 'Serra Lyoa' meaning Lion Mountains.

The mountains, their forests and the numerous mountain streams that tumbled down towards the sea assured that there would be wood and water, and Pedro da Cintra was delighted to find abundant supplies of fresh water. From that point on Sierra Leone became famous as a 'watering place' and was a routine port of call for many an explorer in the sixteenth century. Amongst these were Francis Drake who stopped by in 1579 *en route* to England on the return journey of his voyage around the world. Other visitors came specifically for trade: ivory, wax, gold, camwood, fresh fruits, woven cloth were some of the commodities to be obtained by barter from the natives. Talabi Lucan in *Our Sierra Leone* (1964) writes, "They (the traders) found out that there was plenty of timber and iron in the country." The first traders were Portuguese, but news of the good

things Sierra Leone had to offer soon spread and the Spanish, French, English and Dutch started coming much to the displeasure of the Portuguese, who jealously tried to guard their trade by building forts.

Rivalries between the European traders of different nationalities came to a head during the course of the slave trade which began flourishing after 1500. African chiefs found it profitable to pay for goods from Europe with slaves (usually prisoners of war from tribal battles) as well with ivory, gold and other commodities.

The slave trade was to continue into the 19th century, when it was replaced by the timber trade, to which we shall now pay attention. By now the idea that prosperity and progress could be obtained only by a ruthless exploitation of the nation's resources was deeply ingrained in the minds of Sierra Leone's rulers. That unwholesome idea persists to the present day, even though there has been no accompanying prosperity, or progress over the centuries, and the country still remains under-developed despite more than 500 years of contact with Europe and so-called trade. Undoubtedly such an attitude towards natural resources was largely brought about and encouraged by Europeans who viewed the country (as they viewed the rest of Africa) mainly as a source from which cheap supplies of slaves, ivory, minerals, timber and other goods could be obtained. In return the Africans received

consumable goods which they soon used up. In that way the Africans sold their birthright for a mess of pottage.

Christopher Fyfe in his *Short History of Sierra Leone* writes that the timber trade in Sierra Leone was begun by an Irishman, John McCormack who started exporting logs in 1816. Writes Fyfe: "... trees of up to 30 metres high grew all over the surrounding country ... McCormack realized that they could be turned into money. Ships were built of wood then. He ... decided to cut them down for export to England.

"He and other traders settled on the islands in the Port Loko Creek. They employed Kru labourers to cut down the trees on the banks and float them over to be prepared for sale. Eventually the logs were taken to England to be used for ship building.

"The neighbouring chiefs were delighted. Since the Anti-Slave Trade Act no slaves had been exported from the Creek or (River) Rokel, for the Colony Government prevented it. The slave traders had moved away and the chiefs lost their rents and their supply of goods. The timber traders brought business back, built timber depots and paid the chiefs rent for them in the old way. Goods were available for timber now instead of slaves. Temne labourers also began working in the timber trade. They received regular wages. ... paid in goods. So the timber trade spread prosperity through the country. But the prosperity was not permanent. The timber traders cut down the trees but planted no new ones. In any case it takes centuries for a really big tree to grow. Once all the big trees in an area were felled they moved to another until the whole country was gradually deforested."

By 1827 something like 10,742 tons of timber had been exported to Britain. The figure rose to 24,048 tons by 1832. From 1827 to 1835 a total of 82,911 tons were exported from Sierra Leone. By 1840 the supply of timber near the coast was exhausted and the exploiters progressed inland. By the end of the 19th century the timber trade declined most of the forests having been removed by the loggers and by shifting cultivators who came in their wake.

The timber trade as well as depriving Sierra Leone of an important resource, also Fyfe points out, spread disease. Horses and cattle

in the country suddenly began dying of a disease in the 1850s: it was trypanosomiasis caused by the bite of the tsetse fly. Tsetse flies do not breed in high forests, only where there is shade close to the ground. When the tall forest trees were cut down all over the coastal area and exported to Europe, the tsetse fly, which had been absent in the area before, moved in. Today not a single horse or donkey is to be seen in Sierra Leone and the only cattle that can survive in this now tsetse-ridden country are the disease resistant Ndama cattle—a dwarf variety which is a very poor producer of meat and milk.

Delayed Concern

It took almost a century (from the time timber exploitation began in Sierra Leone) before the colonial authorities became sufficiently concerned about the decline in the country's forests, to do something about it. In 1911 a forestry department was set up with a chief conservator of forests, and the first ordinance came into being for creating a forest reserve in the peninsula mountains behind the capital. By 1920, estimates indicated only one per cent of the original primary forest remained, mainly in the Gola area, which by virtue of its remote location and inaccessibility, had escaped exploitation (at least for the time being). In 1923 the Gola Forest, the only virgin forest left in the country, was demarcated a forest reserve. In the years that followed other surviving pockets of high forest were made into reserves. Despite all that today only three to four per cent of the total land area supports forest.

The Present Position: One would think that a nation that had seen one of its most valuable resources drastically reduced to such alarmingly low levels would do its utmost to protect what is left. On the contrary, Sierra Leone is now in the process of exploiting the last pockets of remaining forest. Dr. Geza Teleki, who undertook a six-month wildlife survey in 1980 during which he travelled extensively throughout Sierra Leone writes (*Zoonooz* magazine, Oct 1981): "By the 1920s less than 4,000 sq kms remained intact, mostly within a few managed forest reserves. Today the total area of primary forest is well below that last figure, and

the shrinkage continues year by year as more blocks are concessioned to timber companies. The Gola Forest complex ... totalling about 580 sq. kms. is the only standing representative of the original coastal rain forest biome. Of that small area some forty per cent has already been logged, another twenty per cent will be felled by the 1990s and the rest can be salvaged only if existing concessions are cancelled."

The Gola Forest, said to be the oldest primary forest in West Africa, had been concessioned to two companies, one of them the indigenous, Forest Industries Corporation and the other SILETI, a partnership between the Sierra Leone government and an Italian firm, based in Milan. Therefore, as is the case with most enterprises in which the government is involved, there was a political interest in the exploitation of the Gola. That involvement tended to deter people who should have spoken out against the destruction of the forest: they felt that any utterance on their part might be interpreted as being anti-government. I recall suggesting to one of our leading scientists, an authority on the Gola and one who felt strongly about saving it, that he and I should join forces to launch a 'save the Gola' campaign. He backed out on the grounds that it was too 'delicate' an issue, with political implications. He was undoubtedly recalling that it was a person no less than the vice-president of the nation who had 'steered' through Parliament the bill ratifying the agreement which empowered SILETI to exploit the Gola.

The Slenca Campaign: Nevertheless, feeling that the issue of saving the forests was far greater than what politicians thought or did not think, I went ahead, alone, to launch the campaign, in my capacity as founder of the Sierra Leone Environment and Nature Conservation Association (SLENCA). I wrote letters to the relevant government officials, sending a copy to the Head of State. These were followed by articles published in our main national newspaper. Both letters and articles drew attention to the vital role played by forests in preventing soil erosion, regulating water supply, moderating the climate, purifying the atmosphere and so on. Emphasis was placed on the need to con-

serve surviving remnants of forest in view of the massive deforestation that had taken place in the last two centuries. A special appeal was made for the Gola Forest in particular.

All that was done in 1977. There was a favourable public response to the newspaper articles: it all came as an eye-opener to most people here. However, the response of the government officials to the letters was an embarrassed angry silence: how could an outsider know so much about a subject about which only they, the officials, were supposed to know? In contrast to the arrogant attitude of the officials, SLENCA won the support of a very important figure, the President of Sierra Leone, Siaka Stevens, who in an audience he gave to SLENCA's chairman and me, revealed that the newspaper articles gave him facts on Gola previously unknown to him. President Stevens became patron of our Association and his patronage and support were most invaluable to SLENCA—particularly at times when the antagonism of officials in his government threatened to be an obstacle to projects SLENCA was trying to implement.

Presidential support notwithstanding, once agreements have been made, particularly where those have financial implications for the national economy, it is very difficult (though not impossible) to get them changed, even though the Head of State may be sympathetic to conservation considerations. Therefore the SILETI company were allowed to continue selective felling of trees in the eastern Gola Forests. Although I, on behalf of my organisation had called on the authorities to cancel the agreement granting the concession to SILETI (and was supported in this by at least two foreign scientists, one British, one American, who had undertaken studies of the forest) the government found it difficult to take such a step for it was believed that production of timber by SILETI would save much needed foreign exchange by making it unnecessary for the country to import timber.

Not long after we had made our appeal, the government started to discover that the concession to the Italian company was one of the worst mistakes it had ever made; far from earning revenue on timber, it was losing it, thanks to mismanagement on the part of SILETI.

Some of the activities of the company that came to light were as follows; the company cut down more trees than they needed and the result was that many heaps of logs were left rotting by forest paths; SILETI engaged in the unauthorised felling of trees by using forged official stamps to mark trees; they smuggled logs out of the country via neighbouring Liberia and the company paid no royalties to the government even on logs legally felled, to name only a few irregularities. To crown it all the company did nothing in the way of reforestation even though this was called for in the concession.

SILETI is now inoperational because of labour problems and other difficulties and its future seems very uncertain. However it has left its own chapter in the story of the devastation of Sierra Leone's forest resources.

A Greater Threat: Forest Industries Corporation

Poised to take over SILETI's area of operation in Gola Forest East in the event of the Italian company backing out, is the F.I.C. a state enterprise whose record in forest exploitation makes SILETI's look like childplay. Indeed the latter's operations are less harmful when compared with the F.I.C. which engages in whole-scale clear-cutting. Entire forests have been removed by this corporation in what is termed 'forestry development programmes'. Areas like the Kambui Hills, which once supported luxuriant forests, now stand bare as deserts in the wake of operations by the F.I.C. To compound the problem cleared areas are not allowed to regain forest cover by regeneration, as farmers come in and farm (illegally) as the F.I.C. moves out.

All that is bad enough but worst of all, this destructive enterprise is receiving huge amounts of western aid to further its exploitation programmes. The West German government recently provided the F.I.C. with 30 million DM for the construction of a 'timber complex'. To supply the complex, which includes a sawmill, the F.I.C. intends to exploit the largest portion of the Gola Forests—Gola North—as well as the Gola East which the Corporation hopes to take over from SILETI.

The Gola Forests, apart from being the only remaining primary

forests in the country, are the home of several endangered species, including the pigmy hippo, black and white colobus monkey, red colobus, diana, mona monkeys, the West African forest elephant, chimpanzee, and Jentink's duiker*. An elephant survey conducted in 1982 emphasized the importance of saving the Gola if the survival of that species is to be ensured. Previous surveys carried out by foreign scientists have all shown the absolute necessity of making the forests into national parks or strict nature reserves, such conclusions being recommended time and again to the government. However the timber lobby is strong and the government undecided. Notwithstanding, I am continuing the campaign to save our last portions of primary forests and remain optimistic. International help in the fight would count for much. A flood of letters from readers of this article to the President of Sierra Leone, appealing for the Gola Forests to be saved from destruction by F.I.C. and other companies would have a positive result, indeed the President was once very impressed by the hundreds of letters he received from all over the world appealing over another issue: the bringing to an end of the mass export of baby chimps from Sierra Leone.

Daphne Juboku-Metzger

* New species are being discovered in the forests—a new kind of weaver bird has recently been found living there. As little research has taken place on the flora and fauna of the Golas probably much remains to be discovered.

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Books

Spraying — a lethal cloud

A BITTER FOG: HERBICIDES AND HUMAN RIGHTS, by Carol Van Strum. Sierra Club Books, \$14.95.

Carol Van Strum's interest in herbicides was first aroused when her four children were doused by a truck spraying the verges of the road near her farm. By nightfall, all four were sick, and in the days and weeks that followed plants in the garden abruptly died, and chicks and goslings with grotesque deformities were born on the farm.

In rural Oregon, on the western seaboard of the United States, such exposure to herbicide is far from infrequent, not only from trucks but also from the helicopters that spray the forests. Especially with a wind blowing, helicopter applications of herbicide cannot be confined to a localized area, and many wells and watercourses are tainted with the chemicals.

When Van Strum and her husband began to understand the breadth of the problem, they organised a meeting at which local people could compare their experiences, and compiled a horrifying list of symptoms: the river was full of dead plants and animals; farm animals sickened and gave birth to defective offspring; people complained of headaches, nausea, nosebleeds, and tumors; women experienced vaginal bleeding and pregnant women miscarried.

A letter detailing these observations prompted nothing more than bland reassurances from the Forest Service: herbicides were perfectly safe. A little research revealed, however, that there were several studies leading to quite opposite conclusions, and contact with their authors confirmed this view.

Constituting themselves as Citizens Against Toxic Sprays (CATS), the group decided to take their case to court. They quickly discovered that lawyers with a knowledge of environmental law are few and far between,

and those who would be willing to take on a case with little prospect of financial reward are scarcer still; but finally they found a willing attorney.

The strategy that they developed was to seek an injunction preventing the herbicide spraying, on the grounds that the Environmental Impact Statement (EIS) regarding the spraying was inadequate. As one of the CATS group commented, "What really surprised us was to learn that there is no law you can invoke to stop your government—or anyone else—from spraying poison all over you. All you can do is say they didn't prepare an adequate statement telling what the poison would do!"

Thanks to many hours of unpaid labour, including a search of scientific literature which enabled their attorney to rebut most of the statements made in court about herbicide safety, the judge determined that the EIS was inadequate, and granted the injunction. The next year, however, the Forest Service prepared a more complete EIS and, reluctantly, the judge lifted the injunction. It was then a matter for the Forest Service's "expert judgement" whether to spray or not; they decided to spray. CATS had gained a single year's respite from exposure, at a cost of \$24,000.

The difficulties in obtaining legal protection against exposure to biologically active chemicals are not unique to this case. The entire regulatory apparatus for herbicides in the US enshrines the principle that these materials are safe until proven otherwise.

The relevant legislation—the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)—provides that registration of a pesticide may be regarded as evidence that the chemical is safe when used as directed. Registration itself is based on documents provided by the manufacturer: not even complete test reports but only summaries and conclusions. The discovery that a product has been registered on the basis of fraudulent or non-existent testing does not alter its status as a registered substance, and the FIFRA provision still holds: the burden of proof rests with the public. As a matter of fact, many herbicides—and many other chemicals in common and everyday use—have been registered on the basis of fraudulent tests, conducted at the now-notorious (and defunct) Industrial Bio-Test Laboratories.

A company whose tests show that a herbicide may be hazardous is under no compulsion to make that information public and, by declaring the information a trade secret, may protect itself from disclosure altogether. There is not even a public right to sue for enforcement of FIFRA; all that exists is the right to sue Federal agencies to enforce

correct procedures. If a catastrophic decision is procedurally correct, there is no legal recourse.

As Carol Van Strum points out, it should surprise no one that the phenoxy herbicides—which include 2,4-D, 2,4,5-T, and 2,4,5-TP (silvex), and are often contaminated with dioxin—may be toxic to humans: they operate by scrambling the genetic material which is as basic to animal as to plant tissue. Proof of injury by herbicides is a different matter, however, since the manufacturers, and the regulators, insist on a strict demonstration of cause and effect, a stricture more appropriate to physics than medical science, where effect may lag cause by as much as twenty years in the case of cancer, and the variables involved are enormous in number and scarcely controllable.

It's clear from all this that herbicide use is an issue not only of health but of human rights: that the victims of toxic chemicals have such limited power to protect themselves from further exposure, or even to discover the hazards they face, says little for democracy. The Environmental Protection Agency (EPA) has been characterized as "a bureaucracy of concealment." If a woman from an area of heavy spraying gives birth to an anencephalic infant—a baby with no brain—the EPA may take the body away for testing, but no more is heard from them. The treatment of people who live in the target areas verges on contempt: talking to a group of women who were concerned at the number of miscarriages they were experiencing, a timber-industry representative told them that "babies are replaceable," and advised that, in future, they time their pregnancies so as not to coincide with the spraying.

What is the remedy for this dismaying situation? Carol Van Strum has a suggestion: the legal right to informed consent. She argues that, if the right to informed consent were established in law, as it has been for medical drugs, the EPA could function not so much as a regulatory body but as a channel for information from the manufacturer to the public. An informed public could then itself make the evaluation of risks against benefits in each particular case. The manufacturers and the EPA would be held accountable for their failures.

Whatever their merits, these proposals would face a major obstacle in practice: the spirited opposition of the herbicide industry, which has reasons for liking the status quo. Van Strum believes this obstacle is not insuperable. She advocates that the right to informed consent be drafted as an amendment to the US Constitution; the campaign for such a Constitutional Amendment would then provide an excellent vehicle for education and consciousness raising, as the

proponents of the Equal Rights Amendment have shown. (Feminists have also discovered, it should be added, that the ratification of a Constitutional Amendment can be a long and exhausting process, not always ending in success.)

A Bitter Fog is full of information on the effects of herbicides, on the regulatory system, and on the experience with Agent Orange in Vietnam—but, because it concentrates throughout on the human dimensions of the subject, it is neither dry nor polemical. The book may be read as testimony to the strength of ordinary people, and to the need for us to exert that strength. As one woman tells the author, "They're destroying the world, and they make the laws that protect them while they do it. And we're responsible too, for sitting by while they do it. We teach our kids to be law-abiding, but we have to teach them that the law isn't necessarily right. . . . When push comes to shove, we've got some power, too."

Bernard Gilbert

Aux Armes Citoyens

DEFENCE WITHOUT THE BOMB.
The Report of the Alternative Defence Commission, Taylor and Francis.
£4.45.

It is regrettable that *Defence Without the Bomb* was not published before the general election, because it demonstrates just how Britain and Europe could erect a credible defence without recourse to nuclear weapons. At the heart of the Commission's analysis of alternative non-nuclear defence is a strategy called 'Defensive Deterrence'. As the examples of Sweden, Switzerland and Yugoslavia testify, it's a well tried strategy.

The Commission argues that ultimately European security depends upon achieving substantial disarmament, reducing tension between East and West, and minimising the chance of accidental nuclear war. Contrary to conventional wisdom is the recognition that these aims cannot be won without the dissolution of the two great military blocks. Furthermore, there is little hope of reducing tensions if the West insists on bargaining from a Thatcherite 'position of strength'.

Rather, we should signal our purely defensive intent which requires a combination of non-nuclear weapons, deployment and strategy so as to indicate that no offensive action is intended or possible. Thus, a strategy of defensive deterrence, whether

adopted within NATO or unilaterally by Britain, means scrapping even conventional offensive weapons such as long-range bombers and tanks. The political advantage of this would be to loosen rather than cement Warsaw Pact unity, possibly to the extent that the Soviets could not be confident of her satellites' support for a major offensive into Western Europe.

While this strategy commands us to leash our defensive guard dog, it also demands that his teeth be sharpened to deter trespassers. So the second tier of the strategy is organising our defence in such a way as to make invasion very costly by enacting a high entry price, which involves an element of defence in depth so that our defence does not begin and end at Dover or Berlin (should Britain remain in NATO). Such a strategy would entail the dispersal and broadening of the base of our defence, following, perhaps the Swiss example of a citizen army. The report is ambivalent about recommending conscription which the strategy seems to imply, but does recognise that it demands less reliance on a small professional army and more involvement at the citizen level.

Such involvement is particularly important when facing the possibility of nuclear blackmail. The Report's response to blackmailing lies broadly within the scope of defensive deterrence. Should an aggressor threaten occupation of, and then occupy Britain, the Commission argues that there is a substantial role for civil resistance and non-cooperation providing it is planned and rehearsed before. The defeat of the state need not imply the surrender of the people. The Report describes how Yugoslavia has made preparations for guerilla war in the event of occupation but suggests that the examples of Swedish and Swiss measures for civil resistance may be more applicable in the British context. Such resistance is, in a sense, an extension of defence in depth. For, although civil non-cooperation is not strictly a military tactic, its effects can be as demoralising for an occupying power as guerilla warfare.

Other non-military approaches are also examined by which the likelihood of nuclear blackmail can be minimised. The Report argues for further economic inter-dependence, since an enemy would be keen to avoid devastating important centres of production supplying her with essential resources, and markets for the sale of her own products.

The Report's authority is founded

on empirical evidence supporting its strategy drawn from the experiences of countries closer to the USSR than the United Kingdom. The case of Sweden is perhaps the most pertinent because of her political and economic similarities to Britain.

She pursues a policy of armed neutrality, which has kept her out of war for one hundred and sixty years. As with Britain, the main threat is considered to be the seizure of strategic areas rather than military occupation. Sweden has universal conscription with refresher courses which means she can mobilise eight hundred thousand men within seventy-two hours from a population of eight million. Since her military strategy is broadly one of defensive deterrence, she maintains four hundred and twenty combat aircraft, fighter squadrons and anti-aircraft missiles but no long-range bombers. She keeps twelve submarines for coastal defence, and the army is organised to put up a substantial frontier defence. But since 1967, the emphasis has been put more on defence-in-depth, whereby less highly trained territorial units are equipped with simpler weapons rather than high technology weapon systems. In the event of nuclear blackmail, Sweden's concept of total defence includes a civil defence programme, which involves deep shelters for the whole population and economic defence measures to meet disruption of supply.

Switzerland too has a tradition of armed neutrality and a citizen army organised at the canton rather than federal level. It has a civil defence programme similar to Sweden's and a defence strategy which involves the dispersal of infantry units so as to reduce the advantage of tactical nuclear weapons. Those static units are supplemented by mechanised mobile units for counter attack.

For those who are paranoid about the possibility of Soviet invasion of this green and pleasant land, Yugoslavia's defence is instructive. Since the invasion of Czechoslovakia in 1968, her strategy aims to deter not simply military intervention in the context of a wider war but Soviet occupation per se. Therefore, she has an in-depth defence, drawing on local territorial defence forces to supplement the army. There is an explicit plan for partisan resistance should the country be occupied and parts of the army are organised to transform themselves into guerillas.

The Report suggests that we should draw on the experience of all three countries in forming our own defence.

There are, though, problems attached to this strategy. At the military level it is questionable whether or not precision guided munitions could counter air and tank offences. Scientific and strategic experts disagree about how decisively and permanently the evolution of P.G.M.'s (or 'smart' weapons) gives the advantage to defence rather than attack. It is clear, however, that the dispersal of defence units towards an in-depth as opposed to concentrated frontier defence weakens the effectiveness of battlefield nuclear weapons and tank offences.

At the political level, defensive deterrence is radical in that the thrust of its logic requires democratisation and decentralisation of defence. For, since 1945, there has been a persistence to look towards increased concentrations of power to find solutions to world problems. The Commission is doubtful if it is politically possible to involve more people in defence, particularly at the local level, as in Switzerland. Indeed, it is easy to see how both right and left would construe such measures as a threat to the State, which of all institutions is sacrosanct. Yet as our examples show a degree of decentralization in defence need not be incompatible with either a capitalist or socialist society. This seems to support Leopold Kohr's argument that it is size rather than ideological conflict which threatens world peace.

So it is inevitable — although the Report is loathe to admit it — that defensive deterrence demands the dissolution of NATO as it stands, and a decoupling from the American battlewagon.

David Lomax

Pointing the Finger at Man

THE RELIGION OF THE MACHINE AGE Dora Russell, Routledge & Kegan Paul £12.95.

THE DORA RUSSELL READER 57 Years of Writing and Journalism, 1925-1982 Pandora Press £3.95.

According to the publisher's blurb *The Religion of the Machine Age* "reflects the two aims which have determined Dora Russell's life: to liberate women and to try and end the Cold War". Mrs. Russell is a distinguished writer, and was a fearless pioneer of the women's movement. She is now well into her eighties, and in her new book she reveals wisdom, breadth of vision and a splendid

knowledge of history all of which make her very readable, but I do not believe she has written anything new to contribute to the ending of the Cold War or the liberation of women. The book is full of interest and much that will make her readers nod emphatically in agreement, or equally emphatically disagree—but her real purpose, as she says herself, is "to trace, from some examples, the consciousness of the male as he creates, worships, discards and re-creates his gods", and through this to show how disastrous has been the development of intellect, to the point where it has made us slaves of the machine.

The Religion of the Machine Age starts with a preface entitled "The soul of Russia and the body of America" exactly as Dora Russell wrote it at the age of 26. For a variety of reasons the book was not completed at that time, and naturally the 1983 version has been revised and updated to include the later history of the technological age. Although references are made to the Falklands War, the events of the last fifty years have not materially altered the author's thesis, which I do not think she successfully establishes, that the world would have been a better place today, if women, not men, had been in charge. It's a terribly difficult proposition to put over and all too easy to refute, but Mrs Russell hardly adds to the modern feminist's armoury by asking questions such as this: "Was the machine age another human mistake, another aspect of the absence of the female hand on the tiller?" For surely this is to suggest that, had women been our leaders, progress from the stone age to the machine age would simply not have happened, and that, if it could be substantiated, denies women imagination, inventiveness, scientific ability, the thirst for knowledge—indeed every quality that we claim to have in equal parts with men. Does Dora Russell really believe that the technological age, in which we are all now trapped, could have been avoided if the aspirations of the men had been subordinated to the rule of women? Where in this view of our past does she allow for the awe and wonder that impel men (and women) to seek answers to the mysteries of life? However right she may be in believing that modern technology spells disaster for mankind, it is difficult to accept that this situation could have been avoided by any fundamental difference in the historical attitudes of men towards women.

In *The Dora Russell Reader* Pandora Press have put together a collection of the author's works spanning the period from 1925 to 1982. Sexual politics, racism, militarism, industrialism are the themes that have been her concern throughout her life, summed up, perhaps in this cri-de-

coeur from *The Religion of the Machine Age* "I am convinced that it is the voice of women, proclaiming what their hearts say, crying aloud in defence of life on earth, that is the one last hope of deliverance." It is her conviction that men, priding themselves on their intellect, have wrongly avoided emotion and feeling, because they regard them as weaknesses and fear that the expression of them will undermine their own estimate of themselves as superior to women. Dora Russell believes that emotions are as important to human experience and understanding as the intellect, and that the vision of a peaceful world, which we all share, can never be fulfilled until men have accepted this. Mrs. Russell is a humanist, a moralist and an optimist. One cannot but admire the passion that has kept her fighting and writing for some 57 years.

Ruth Lumley-Smith

Other Books Received

AN ILLUSTRATED HISTORY OF GARDENING Anthony Huxley-Papermac in Association with The Royal Horticultural Society £7.95

The theme of this captivating book is the art of gardening over thousands of years; the development of tools and implements; of beds and containers; of pest control and weeding and of the propagation, feeding, watering, training and protection of plants of every sort. This is a history most painstakingly researched and entertainingly presented, with quotations from Homer to Jane Austen and an astonishing collection of pictures from ancient and less ancient manuscripts and other sources, garnered from the world over. This is a celebration of gardens and gardening and cannot fail to delight anyone who has experienced the profound spiritual rewards of gardening. Buy it and wrap it up in brown paper while you browse, and then, if you can bear to part with it, give it to your favourite gardening friend for Christmas.


SEALS OF THE WORLD, Judith King, OUP, British Museum (Natural History) £12.50

Here is a book for the specialist. It describes all thirty-four species of seals, the subtle differences and life histories that separate one from another. It is very thorough, very clearly written and well illustrated. An excellent reference book that the enthusiastic amateur will treasure and marine biologists, zoologists and other scientists must surely find indispensable.

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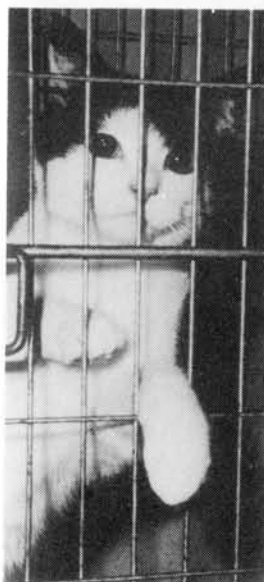
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