Pollution Control Investment Decisions and Policy Preferences of Senior Managers of the Southern African Fish Processing Industry

by

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Plume of polluted effluent from a fish factory
in Sandy Point Harbour, St. Helena Bay, Republic of South Africa

To my wife Estelle and father Professor Robert Lipschitz
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Abstract

Pollution Control Investment Decisions and Policy Preferences of Senior Managers of the Southern African Fish Processing Industry

Pollution control regulations directed at the land-based factories of the Southern African fish processing industry do not appear to promote the required level of investment in pollution control systems. Two self-administered mail-questionnaires comprising undisguised fixed-alternative and open-ended questions were constructed to survey the opinions and viewpoints of a census consisting of twenty-seven senior managers responsible for making pollution control investments in the demersal and pelagic sectors of the fish processing industry.

The first questionnaire was directed at establishing the relative importance of factors that influence waste and pollution control investment decisions as well as the perceptions and preferences of managers with regard to various pollution control policy options.

Descriptive statistics such as the modal class were used to summarize the distribution of opinions and viewpoints within the research population. Rank ordered preference data was analyzed using a multidimensional unfolding computer algorithm. This structural multivariate statistical method is a special case of non-metric multidimensional scaling that generates perceptual maps which can aid in the discovery of the hidden structure underlying multidimensional decisions.

Investments in waste and pollution control do not appear to have a high priority when compared to other strategic investments that the fish processing industry managers may make. The relative importance of factors that could influence the managers of the industry to invest in waste control equipment appear to be determined by the perceived financial returns that can be expected from such investments.

Findings suggest that pollution control legislation is rendered ineffective due to inadequate enforcement. However, it appears that existing legislation needs to be rationalized in order to facilitate compliance. The most favoured pollution control instruments were those that lowered the cost of legally mandated expenses such as subsidies and income tax allowances. These were followed by permit systems which specified the allowable characteristics of discharges while allowing individual companies freedom of choice as to the method of achieving compliance.

The second questionnaire was used to verify the researcher's interpretation of the findings and preliminary conclusions drawn from the replies to the first questionnaire.

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Glossary

Attitude	Some preference, liking or conviction with regard to a specific object or idea.
Bloodwater	All liquid (including transporting water) separated from the fish prior to cooking.
Coding	A technical procedure by which data are categorized. It involves specifying the alternative categories or classes into which the responses are to be placed.
Demersal	The region of the water column on or near the sea bottom; demersal fish are netted by bottom trawling.
Descriptive research	A research design in which the major emphasis is on determining the frequency with which a phenomenon occurs.
Dry off-loading	Pneumatic (vacuum) off-loading of fish catch from the boat hold without the addition of water.
Ex post facto research	A research design in which one starts with the observation of the dependant variable and then searches retrospectively for explanations.
Fish-meal	A milled, dried product made from fish or parts thereof, generally produced by cooking the raw fish with steam and pressing the material to obtain the solids which are then dried.
Fixed-alternative questions	Are characterized by the condition that respondents are limited to choosing a response from among a set of alternatives.
Ideal point	The ideal point represents an individual's position in joint space; it is assumed that an individual's ideal point corresponds to that individual's ideal stimulus.
Joint space	The representation of individuals and their preferences for a set of stimuli as points in a common geometric space; psychological distance is represented by geometric distance in the joint space.
Monotonic	The preservation of the original rank ordered preferences of individuals for a set of stimuli.
Multi-dimensional scaling	An approach to measurement in which people's perceptions of the similarity of objects and their preferences among objects are measured, and these relationships are plotted in a multi-dimensional space.

Multi-dimensional unfolding	A term first applied to the analysis of preference data; when used to analyze ranked preference data of a number of individuals for a set of stimuli, it represents a special case on nonmetric multidimensional scaling.
Open-ended questions	Are characterized by the condition that respondents are free to reply in their own words.
Pelagic	The open water environment consisting of water both over and beyond the continental shelf; pelagic fish are free swimming shoal fish which are trapped by means of a purse seine (net).
Stickwater	Water and entrained organic materials that originate from the draining or pressing of steam cooked fish products.
Stimulus	An object or idea presented to an individual in order to evoke a response.
Wet off-loading	The removal of fish from a boat by the addition of water to the hold followed by pumping the catch in a stream of water.

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CHAPTER 1

Introduction

The pollution control policy of the South African government does not appear to be effective in preventing and controlling pollution generated by the land-based operations of the southern African fish processing industry (Water Research Commission, 1986; Appendix I). This study is a multidisciplinary investigation of the influence that legal and other factors have on the investment decisions of senior management of the southern African fish processing industry. The investigation is mainly concerned with factors that influence decisions to invest in waste and pollution control systems. This study also examines pollution control policies that senior management of the fish processing industry would prefer the South African government to adopt.

1.1 BACKGROUND TO THE PRESENT STUDY

1.1.1 A Brief History Of The Southern African Fishing Industry

According to Grindley *et al.*(1986) and Payne and Crawford (1989), fishing has been an economically important industry in South and South West Africa only since the turn of the century. The growth of the South African pelagic (shoal fish industry) coincided with the collapse of the Californian pilchard fishery between 1936 and 1952 (McHugh, 1980). The southern African pelagic industry became a major economic concern in 1943. Catches of the pilchard (*Sardinops ocellata*), the basis of the pelagic industry continued to rise until 1962. In that year the combined annual catch for South Africa and South West Africa was approximately one million tons and fish was South Africa's most important commercial food export. In 1962 South Africa was ranked as the eighth most important fishing country in the world (Grindley and Rabie, 1983).

After 1962 pilchard catches declined rapidly and by 1964, anchovy (*Engraulis capensis*) comprised the basis of the pelagic fishing industry. Fears for a collapse of the South African pelagic fishing industry, due to over exploitation, led to catch restrictions being imposed (Grindley and Rabie, 1983; Prosch, 1985). By 1985, South Africa held the position of the eighteenth most important fishing nation in the world (Anon, 1985b).

The demersal (bottom trawl) fishery of southern Africa is based on hake (*Merluccius capensis* and *Merluccius paradoxus*) (Grindley *et al.*, 1986). The demersal resources also show signs of over fishing, according to Stuttaford (1987). This is manifested by the fact that ships now have to trawl farther afield and in deeper waters than before to obtain good catches. Furthermore, many of the fish now being caught are below spawning age (Grindley *et al.*, 1986). Nevertheless, there appears to be scientific evidence that both the pelagic and demersal fish resources are beginning to recover (Anon, 1985b).

The pelagic and demersal fish catches are processed in twenty-one factories situated along the south and west coasts of southern Africa (Figure 1.1.1(*a*)).

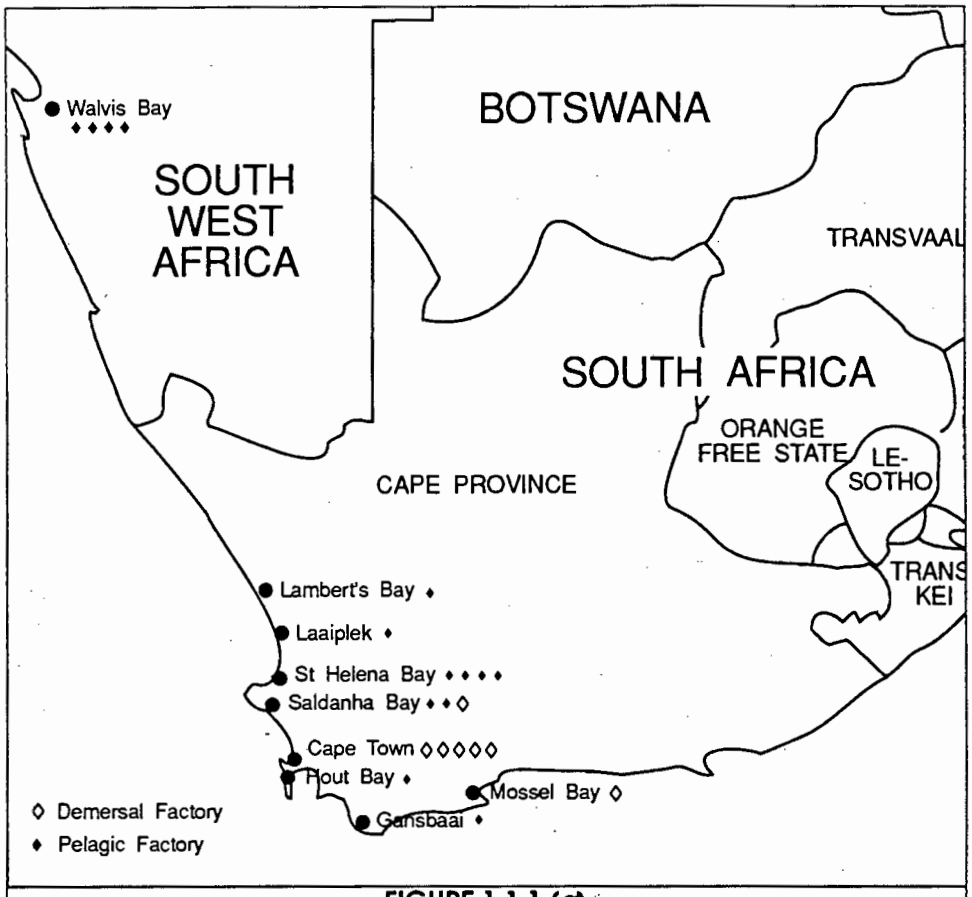


FIGURE 1.1.1 (*a*)

A map showing the location of the demersal and pelagic fish processing factories in Southern Africa, 1988

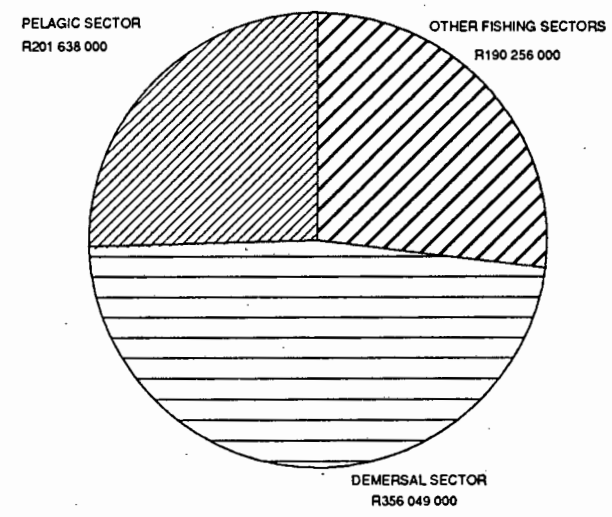


FIGURE 1.1.1 (*b*)

Pelagic and demersal sector contribution to the F.O.B. wholesale value of the South African Fishing Industry for 1987 excluding Walvis Bay

Source: Sea Fisheries Research Institute

Sea Fisheries Research Institute unpublished statistics reveal that the 1987 Free On Board (F.O.B.) wholesale value of fisheries products, including shell fish, rock lobster and other products, but excluding the contribution of Walvis Bay, was estimated to be R747 943 000 (Figure 1.1.1(*b*)). The demersal sector catch for 1987 was 209 972 tons. Demersal fishing contributed R356 049 000 (or 47.6%) of the industry's 1987 income. The pelagic sector contribution was estimated to be R201 638 000 (27%), which represented a catch of 674 121 tons of fish. In contrast to demersal fish, the bulk of the pelagic catch comprising mainly anchovy is processed into fish meal and fish oil. Only 22 000 tons of pilchard from the 1987 pelagic catch were canned for human consumption (Du Plessis, 1988).

A survey of the manpower resources of the Southern African fishing industry was conducted between 1985 and 1986 by the Sea Fisheries Research Institute. Unpublished statistics show that 19 604 persons were permanently employed by the industry during 1985. A further 4 854 persons were employed on a seasonal basis (Figure 1.1.1(*c*)).

Of the combined total of 24 458 persons employed by the industry, 8 311 (34%) were in the demersal sector of which 4 911 (20,1%) were employed in the factories. A total of 6 153 (25,2%) persons were employed in pelagic sector of the industry of which 4 753 (19.4%) worked in the factories (Figure 1.1.1(*d*)).

1.1.2 Fish Processing Industry Pollution

Pollution generated during the processing of fish consists of effluents, emissions, noise and negative aesthetic impacts in the vicinity of fish processing factories. Stauth (1983, p85) defines pollution as 'the residuals of human activity that adversely affect the next user of some environmental resource'. Waste is generally a by-product of all industrial activity. Some by-products can, as is the case with the residuals of fish processing, find useful application in other industrial processes (Tomczak, 1984). Although the residuals of fish processing are neither hazardous nor toxic in the same sense as chemical pollutants, they can and do cause problems when they are released in quantities that exceed the assimilative capacity of the receiving environment. Therefore the definition of Stauth (1983) will be extended in this study to cover all residuals from fish factories which have adverse effects on the next user of some environmental resource.

Surveys have shown that the South African coast line is relatively unpolluted, when compared with coastlines of the northern hemisphere, except for a few areas where coastal utilization is high (Basson, 1984; Jackson and Lipschitz, 1984; Kullenberg, 1984). However, over the past three decades, contamination of the sea by fish processing factories during summer and autumn still represent the major, albeit localized, source of pollution along the west coast of southern Africa (Cloete, 1979).

Oxygen depletion of the water column by bacteria during the decomposition of organically rich fish factory effluents has resulted in the degradation of the natural environment. Impacts have ranged from changes in the dynamics and structure of benthic (bottom dwelling) communities and the disappearance of whelks (*Bullia* sp.) from beaches adjacent to fish factories, to mortality of rock lobster (*Jasus lalandii*) and fish (Anon, 1973b; Brown, 1964; Christie and Moldan, 1977; Newman and Pollock, 1973; Water Research Commission, 1988).

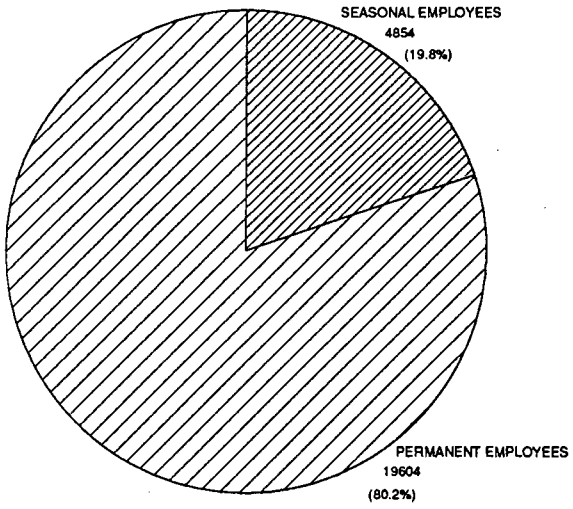


FIGURE 1.1.1 (c)
Manpower resources of the Southern African fishing industry, 1985/1986
Source: Sea Fisheries Research Institute

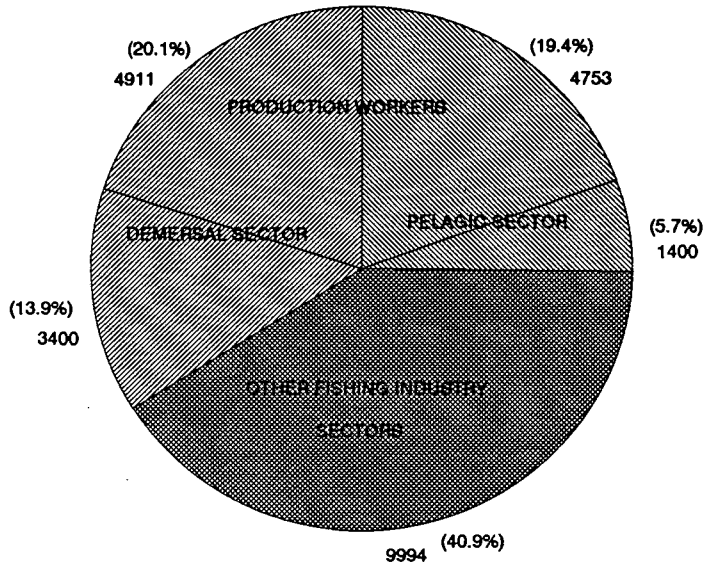


FIGURE 1.1.1 (d)
Diagram showing the number of employees in the demersal and pelagic sectors of the fishing industry as well as the proportion involved in production in those sectors.
Source: Sea Fisheries Research Institute

The pelagic sector of the industry uses sea water during the off-loading of fishing vessels, for evaporator cooling water and in some cases for fish oil polishing (refining). Fresh water is used for boiler feed make-up and for fish oil polishing during refining. Typical effluents comprise bloodwater, stickwater, oil polisher water, emission deodourizer effluent and wash water.

Bloodwater, the major effluent of the fish processing industry, consists of organic fluids which are rich in protein and fish oil. Bloodwaters are generated when anchovy, which are destined for fish meal production, after being trapped in a closed net, are pumped in a stream of water into the boat holds. Pumping tends to damage the fish, which results in the release of bloodwaters. On arrival of the boats at South West African factories situated at Walvis Bay, sea water is added to the fish in the hold. The water is used as a transporting medium when the fish are off-loaded either by means of pumping or suction. This is known as wet off-loading. The fish are separated from the transporting water in the processing plant. At some plants, after a minimum of treatment in scum or settling tanks, the transporting water, together with the bloodwater, is returned to the sea.

Wet off-loading is thus responsible for gross pollution of harbours. Bloodwater pollution is especially high when boats have to travel long distances from the fishing grounds to the factories (Water Research Commission, 1983). The further boats have to travel the greater the decomposition of the fish arriving at the factory is likely to be, and hence the greater the amount of bloodwater. This problem is exacerbated by the addition of water to the holds of vessels which increases the volume of effluent that needs to be treated.

In contrast to the wet off-loading practices employed in South West African fish processing factories, fish destined for meal production at South African factories are sucked out of the holds

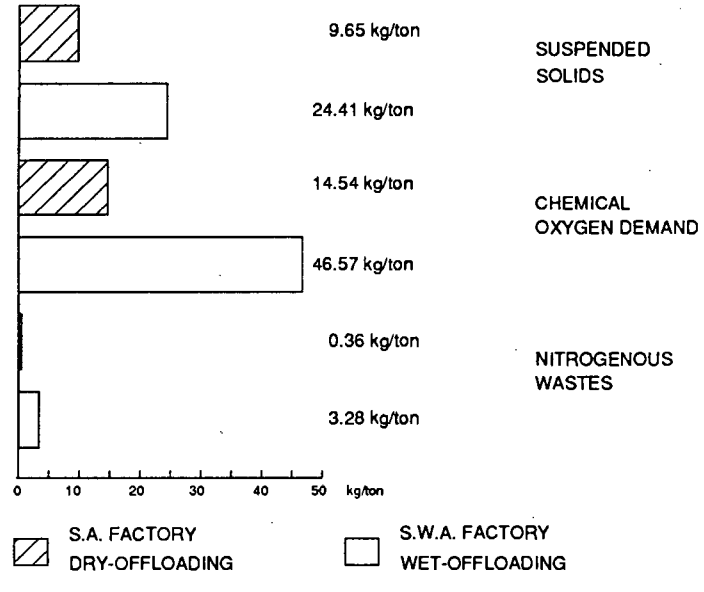


FIGURE 1.1.2 (*a*)
Averaged industry effluent characteristics per ton of fish meal produced for dry off-loading South African and wet off-loading South West African pelagic factories
Source: Water Research Commission, 1983

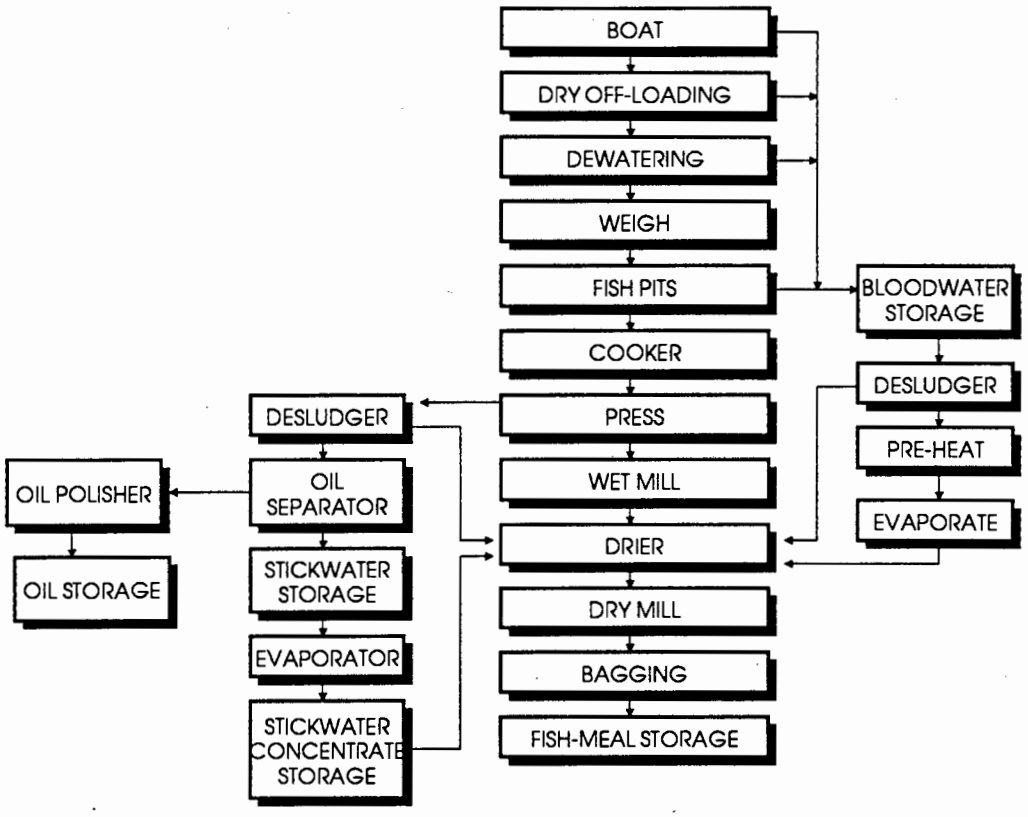


FIGURE 1.1.2 (*b*)
Schematic diagram showing the fish meal production process
Source: Water Research Commission, 1986 p.16.

by means of a vacuum generated by large air blowers. Such processes that make use of vacuum pneumatics to off-load fish are known as dry off-loading practices. Dry off-loading, when operated correctly, significantly reduces the volume of bloodwater discharged to the environment. However, at some factories water is added to facilitate the dry off-loading process (Anon, 1982a). This practice runs counter to the main objective to dry off-loading systems, namely the reduction of bloodwaters (Figure 1.1.2(*a*))

During the production of fish meal and fish oil the fish are cooked and then pressed (Figure 1.1.2(*b*). The solids remaining after pressing (fish cake) are dried by means of hot air, prior to milling and bagging. The expressed oily fraction is desluged in a centrifuge. The liquid phase remaining after centrifuging is known as stickwater and contains high concentrations of protein rich fish oil. The oil is separated from the stickwater after polishing (refining) and then stored. The remaining oil-free stickwater is then concentrated by evaporation and returned to the fish cake.

Effluents are generated during the processing of fish meal comprise stickwater (which is not fully utilized), stickwater evaporator condensates, cooling water and oil polisher water. Scrubbing towers, which are used to remove odours from the hot air drying the fish meal, also

produce an effluent. In addition to the above effluents plant and floor wash waters need to be treated (Moore, 1974; Water Research Commission, 1983).

In contrast to the pelagic factories, the demersal factory effluents are significantly lower in volume and less concentrated. This is because the demersal fish arriving at the factories have been cleaned at sea. As much as 50% of the total mass of these fish, together with the non-quota by-catch or so called 'trash fish' may be dumped at sea (Payne pers. comm., 1986). Shore based effluent problems in this sector are thus generally the result of poor housekeeping practices.

Food processing factories can also cause changes in both the ambient sound levels as well as olfactory impacts (Zubbe, 1977). Odours emanating from fish meal dryers, fish storage pits and rotting fish remains are associated with poor housekeeping practices. These odours were among the first problems that brought the industry into conflict with local communities (Moore, 1974).

Emission and odour problems are dependent on weather in that they are most acute on calm slightly humid days when there is insufficient atmospheric turbulence to dissipate them. Fish meal dryer exhaust gas emissions fall into two categories, those arising from normal operations and those arising from incorrect operating procedures. Normal emissions comprise a highly complex mixture of volatile alkaline materials, volatile acids, sulphur dioxide, carbon dioxide, carbon monoxide and particulate matter (Moore, 1974).

Under normal operating conditions when dryers are operated at temperatures below 350 degrees Celsius, air pollution controls are generally effective. These controls involve passing the hot air used to dry the fish meal through a cyclone to remove any entrained particulates, and then through a scrubbing tower to remove odours. At temperatures above 350 degrees Celsius, scorched fines become entrained in the exhaust gases and scrubbing towers become ineffective in removing odours (Tucker pers. comm., 1987).

1.2 CONCEPTUALIZATION OF THE RESEARCH PROBLEM

According to Moore (1974), harbours that are suitable for use by the fish processing industry must provide the following facilities:

(i) Shelter for boats;
(ii) A fresh water supply;
(iii) A source of power, preferably electricity;
(iv) A transport infrastructure for the distribution of products;
(v) Accommodation and amenities for factory workers.

In addition to the above facilities, harbours should be located as close as possible to the fishing grounds. This is because the cost of fuel for boats can be as high as 50% of the operating costs of a fishing company (Stuttaford, 1985a).

Harbours which have the above facilities are valued by other sectors of society, primarily for recreational boating. The growing awareness in society of the effects of pollution has led to a conflict between the fish processing industry and other users of these harbour environments. Complaints have been received by government, or are aired in the news media, concerning the negative impacts of the fish processing industry on the environment (Anon, 1987b; Kies pers. comm., 1986; Molloy and Robinson, 1980; Tucker pers. comm., 1987).

Environmental problems usually arise out of economic activity when businesses consider mainly the direct costs such as labour and materials which are involved in production (Stauth, 1983). The social costs of production, which are occasioned by the use of common goods, such as air and water, seldom enter the calculations of businessmen (Kapp, 1977; Randall, 1981). Such resources remain unpriced, the reason being that they are either too large, too diffuse or intangible to enter into market transactions (Bekerman, 1975; Ruff, 1970; Stauth, 1983). Consequently polluters are able to pass on the social costs of degrading such common goods to other users of these resources with impunity.

Society expects government to correct divergences between direct and social costs of production (Harris, 1974; Kahn, 1984; Kenney, 1986). The public response to perceived pollution of its environment has been to call on government to regulate the activities of the offending industry (Pentreath, 1978; Senecca and Taussig, 1979). Pollution control can be achieved either by government limiting courses of action through a system of rewards and penalties, or by influencing the values and criteria employed by decision-makers.

Pollution control legislation usually requires companies to make investments in waste and pollution control systems (Hagevik, 1970; Royston, 1979). Such investments could involve the diversion of large amounts of capital from productive activities within the enterprise. Investment decisions of this nature are the responsibility of the top management of a company. A knowledge of factors that top management considers when making such decisions will provide a basis for understanding their actions with respect to pollution control. Furthermore, such knowledge may help administrators influence polluters to behave in a socially responsible way. This could be achieved by influencing the criteria that managers consider in strategic decision-making and goal setting.

The need to reformulate current South African pollution control policy, with respect to fish processing, is indicated by the unsatisfactory pollution abatement performance of the industry today (Water Research Commission, 1983; 1986; 1988; Appendix I). Pollution control policy formulation presents administrators with two basic problems. First, the need exists to determine an appropriate level of environmental quality. Second, a suitable policy instrument must be chosen capable of ensuring that the required level of environmental quality is achieved. The identification of suitable policy instruments to prevent and control fish processing industry pollution forms the basis of the second part of this study.

According to Moore (1974) resident and ratepayer associations in the vicinity of fish processing factories have had some success in influencing government pollution control policy. Miltz (1984) states that such special interest groups will probably play a greater role in public policy in the future. Pressure groups, according to Johnson (1972), are often more enthusiastic about action than they are informed about solutions that will work. When uninformed social actions compel government intervention, a chain of events is set in motion which can culminate in clumsily drafted and inappropriate regulations. Such regulations often prescribe standards of technical performance which, according to Harris (1974), generate high costs which industry feels cannot be economically justified. In such situations trade-offs evolve haphazardly as the often unforseen and unintended effects of poorly drafted regulations work their way through the economy (Fox, 1981).

Ill conceived legislation serves no one's interests as it may impede legitimate business without improving the wellbeing of society. At best such legislation leads to the inefficient use of resources. At worst, ill designed and unduly restrictive controls may drain the dynamism from the business system (Harris, 1974). Fox (1981) and Rosencranz (1981) state that inappropriate regulations are seldom likely to achieve their objectives due to businessmen at all levels negotiating delays, developing means of partial compliance, defending themselves through lawsuits and generally seeking ways in which to minimise the intervention of government in their operations. Orbach (1980) is of the opinion that many of the problems associated with poorly drafted regulations can be avoided if all the parties concerned in the formulation of such regulations are informed as to the perceptions, motives, goals and constraints of the party whose actions they wish to influence. Furthermore, Rabie and Erasmus (1983) state that incorporation of the viewpoints and opinions of industry at the policy formulation stage could decrease the need for later judicial review of policy, and possibly lead to a greater acceptance of administrative decision-making.

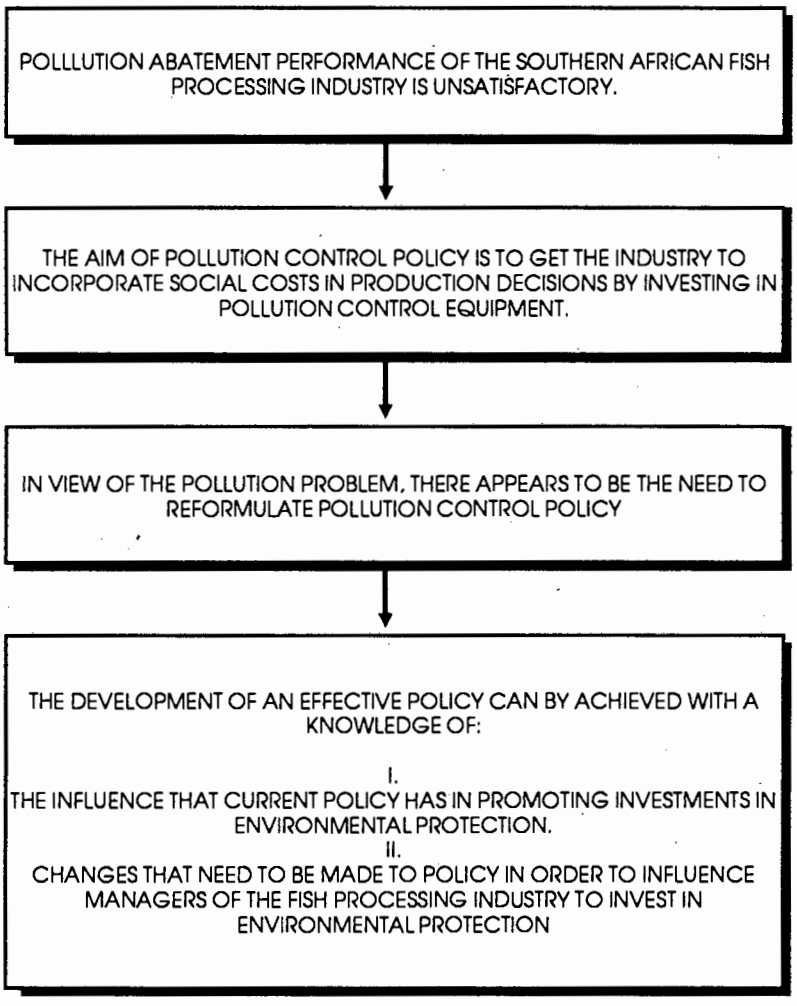


FIGURE 1.2
Conceptualization of the research problem

In view of the need to reformulate existing pollution control policy so as to influence management of the Southern African fish processing industry to make the necessary investments in waste and pollution control, certain information needs to be collected. Firstly a knowledge of the factors that influence such investment decisions is needed. Secondly, before new policy can be developed, the impact of current policy on the operations of the fish processing industry needs to be evaluated. Thirdly, pollution control policy options that the fish processing industry would prefer the South African government to adopt need to be identified as such options have a greater probability of being successfully implemented. These elements are summarised schematically in figure 1.2.

1.3 OBJECTIVES OF THE PRESENT STUDY

The major objectives of the present study are:

1. To establish the relative importance of investments in waste and pollution control systems, compared with other strategic investment priorities, to senior managers of the Southern African fish processing industry.
2. To identify the factors which influence senior managers of the Southern African fish processing industry when investments in waste and pollution control systems are required.
3. To establish the viewpoints of senior managers of the fish processing industry regarding current government pollution control policy.
4. To discover which policy options senior managers of the Southern African fish processing industry would prefer to see the South African Government adopt for the control of pollution from land-based fish factories.

1.4 RESEARCH APPROACH AND DESIGN

Investments in waste and pollution control, compelled by law or by public pressure, make demands on the financial resources of manufacturing concerns. Such investment decisions are usually the domain of top management. A comprehensive literature survey revealed that although many studies have been conducted on the fates and effects of fish factory pollutants, few publications exist on the way in which production decisions contribute to pollution problems. The paucity of published information led the researcher to conduct unstructured interviews with people who were knowledgeable with regard to pollution control and the fish processing industry. Experts in the fields of attitudinal research and questionnaire construction were also consulted as to methods that could be used to investigate the possible relationship between government pollution control policy and its impact on the fish processing industry.

In the past, according to Royston (1979), pollution studies were undertaken mainly out of a concern for human health. Such studies focused on the point of discharge into the environment. In recent times the emphasis of such studies has shifted to the modification of production processes with the aim of eliminating waste by improving efficiency. Royston (1979) points out that environmental problems can thus be traced back to management investment decisions which are subject to the criteria of financial return and technological feasibility.

Managerial decision-making is a dynamic process that is generic to all forms of organized activity. The process of decision-making is also eclectic in that it is composed of elements drawn from many sources. There is a growing awareness that managerial decision-making is both a product of and an influence on the culture in which it exists (Harrison, 1981). Only by knowing how and why managers behave as they do can we fully understand the pollution problem and take appropriate remedial action.

Behavioural studies on attitudes and perceptions can provide useful insights into the relationships between pollution control policy and other factors that could influence managers to invest in pollution and waste control systems. Although descriptive research designs can yield useful information about the distribution of an opinion or attitude within a population, such designs generally provide little insight as to the relationship between attitudes and observed behaviour. Attitude is often used as an important explanatory variable in creating models of behaviour (Taylor, 1984). People in a given society hold many beliefs and values, not all of which are equally important. A belief is a descriptive thought that a person holds about something. It may be based on real knowledge, opinion or faith.

Attitude describes a person's enduring favourable or unfavourable cognitive valuations and emotional feelings toward some object or idea (Kotler, 1980). Opinions can be regarded as verbal expressions of attitudes (Uhl and Schoner, 1969).

Taylor (1984) points out that the study of attitudes is important as there is a general belief that attitudes are related to behaviour. He states that behaviour prediction rests on the thesis that if the attitudinal response to an object or idea is positive, it is to be expected that the behaviour towards that object or idea will also be positive, and *vice versa.* Attitudes function in people's lives so as to enable them to demonstrate consistent behaviour towards similar classes of objects or ideas. This results in people not having to react to everything in a fresh way. Kotler (1980) states that attitudes economise in energy and thought, and it is for this reason that attitudes are very hard to change once they have become established.

The determinants of human behaviour are, however, far too complex to be accounted for by a single predictor variable. It seems much more likely that most behaviour is determined by a variety of variables and that the relationships between these variables is complex, involving various types of interaction and mediation. The failure of attitudes alone to effectively predict behaviour towards objects and ideas, is an indication that other factors can influence observed behaviour. Social pressures, for example, could preclude a person from acting in accordance with his feelings. Nonetheless, if it accepted that human behaviour is substantially under the control of factors that have predictable effects, it follows that a knowledge of these factors, and their relationship to one another, will make the prediction of behaviour possible (Taylor, 1984).

Scientific efforts to predict behaviour became established only in the twentieth century. In the field of social behaviour two major theoretical orientations evolved, namely, those of the learning theorists (probabilistic orientation) and those of the latent process theorists (Lemon, 1973; McGuire, 1969; Taylor, 1984).

The probabilistic orientation views man essentially in stimulus–response terms. The "black box" which intervenes between stimulus and response is not taken to have an internal life or conscious cognitive processes. Hence attitude is not regarded as a mental process, but is defined in behavioural terms of stimulus–response links. Attitude strength is simply the probability of occurrence of defined behaviour in a defined situation (Fuson, 1942). The learning theorists saw behaviour as the result of positive and negative schedules of reinforcement. They believed that human behaviour could be accounted for in contingency tables, with rows of stimuli, columns of responses and probabilities in the individual cells.

The latent process theorists rejected this mechanistic approach, claiming that human behaviour is far too subtle and varied to be described without recourse to unobservable constructs or processes which mediate behaviour. Man is seen by these theorists as a creature with an inner life i.e. a thinking, reasoning, conscious organism.

According to Taylor (1984), were it not for refinements introduced by Doob (1947) and Osgood *et al.* (1957), which employ mediational concepts, learning theory's ability to deal with the attitude construct would be virtually nil. This is due to the rigid way in which this approach models human mental processes. Such processes can never be adequately accounted for in the stimulus–response paradigm. Nonetheless, in spite of its limitations, the behaviouristic orientation can help in the understanding of certain attitudinal phenomena.

Either because of its intuitive appeal or its greater flexibility, the latent process approach has become the more popular model in psychology (Taylor, 1984). Two major types of latent process constructs have been identified by theorists of this persuasion, namely, personality traits and attitudes. Both are regarded by most theorists as the product of experience and are therefore subject to change. Attitudes are seen to play an adaptive role in the personality. Their functions include the optimization of goal attainment, ego defence, value expression and the systemization and categorization of information. Latent process theorists claim that the stimulus–response model is an inadequate way of looking at human functioning. They emphasize man's consciousness, his power of reasoning and thinking and his need to integrate and understand the information he receives from the external world via his senses. The latent theory approach postulates underlying unobservable mental constructs which mediate behaviour. Most theorists of this orientation see attitudes as "stored-up experience" in the form of evaluations of objects, actions and events (Taylor, 1984).

The main interest of attitude studies has focused on attitudes as predictors of behaviour. All theorists see attitudes as a response to a specified object. The term "object" must be taken in the broad sense to include a wide variety of phenomena, including events, ideas, people and actions. Most theorists claim also that "objects" should be placed in a social context. Attitudes may therefore be regarded as mental models of external "social objects". Such models always incorporate an evaluative or affective component. Hence attitudes are characterized by the fact that they place "social objects" to which they refer on a like–dislike dimension (Taylor, 1984).

The three major theoretical approaches of the latent process orientation are, those theories that view attitude as a tripartite phenomenon, the consistency and balance theories and the instrumentality theories. According to Ostrom (1968), it was only in the late 1940s that psychologists began to see cognition (thinking), affect (feeling) and conation (action tendencies) as three different but related facets of attitude. This thinking–feeling–acting orientation probably has its greatest exponents in Krech an Crutchfield (1984) and Krech *et al.* (1962). Krech and his associates describe the cognitive component as comprising all evaluative beliefs about an attitude object. The affective component is seen to include all emotions or feelings connected with the object and the action tendency involves all the behavioural readiness associated with an attitude. This suggests that although action tendency is a component of attitude, overt action need not result in all cases, but that a predisposition to behave in a certain way towards an object exists. Taylor (1984) suggests that it is possible that the three components of attitude are brought together with a reasonable level of compatibility with one another through processing and evaluative activities undertaken by the individual at a "higher level".

Consistency and balance theories are based on the assumption that beliefs, attitudes and values are all part of an internal system which strives towards consistency or congruence. When incongruence or dissonance arises the individual experiences "psychological discomfort" which induces him to make efforts to regain a sense of congruence or consonance (Festinger, 1957). Dissonance can arise in a number of ways, for example, between different beliefs and attitudes or between attitudes and behaviour. The approach taken by most consistency and balance theorists has been to investigate the attitude–value system in order to account for dissonance phenomena (Taylor, 1984).

The instrumentality theory paradigm is largely as a result of the work of Peak (1955; 1960), Rosenberg (1956; 1960) and Fishbein an Ajzen (1975). Peak (1955; 1960) states that an attitude towards any object or situation is related to the ends which the object serves. Hence attitudes towards any aspect of experience depend on the utility of such events in helping us achieve our goals, or rather the ability of such events to help us to achieve satisfying emotional states.

Fishbein and Ajzen (1975) make reference to the tripartite (cognition–affect–conation) aspects of attitude and add behaviour as a forth category of functioning. However they reserve only one category, namely affect for attitude. According to Fishbein and Ajzen (1975) beliefs about "social objects" lead-on to the attitude construct but are not seen to be a part of it. This is because they are of the opinion that it is the evaluation of beliefs rather than the beliefs themselves which constitutes attitude. Nonetheless, the Fishbein–Ajzen conceptualization of affect tends to be rather cognitive because it is seen to be based on cognitive material. They regard conation (behavioural intention) and behaviour to be only partly motivated by attitude because attitude is seen to be only one of the causative factors underlying conation and behaviour.

Ajzen and Fishbein (1980) claim attitude to be the summative outcome of the evaluation of beliefs. According to Fishbein and Ajzen (1975) only certain "salient" beliefs are involved in the determination of attitude. However they do not provide an adequate definition of what

constitutes a salient belief. This in turn creates certain methodological difficulties in applying their theory. Furthermore, it is also possible that the additive weighted model which they postulate might not be adequate to account for psychological processes that occur in attitude formation and expression.

Taylor (1984) is of the opinion that it is not possible to make a clear distinction between the probabilistic and latent process theories of attitude. He points out that not all the learning theories in the probabilistic camp pose a simple "black box" model, some (Doob, 1947; Osgood *et al.*, 1957) do employ mediational concepts. The instrumentality theorists on the other hand, who on the basis of most criteria qualify for inclusion in the latent process camp, make use of learning theory concepts such as habit strength and reinforcement. Although learning theory may provide some useful insights into some of the processes involved in attitude formation, it is inadequate as a general framework in which to study attitude or attitude related concepts. A critical comparison and evaluation of learning theory and latent process approaches is made difficult by definitional problems. The approach taken in the present study was therefore to assess attitude at the point where the internal processes have already brought together the disparate elements into a generalized attitude towards the whole "object".

1.4.1 Research Design

Surveys are the most appropriate means of collecting information on perceptions, attitudes, motives and intentions (Bailey, 1982; Churchill, 1983; Wentz, 1979). Survey data can either be gathered by means of observation or by inquiry. Inquiry involves the direct questioning of respondents, and is the most common way of sampling viewpoints and opinions of people on a wide range of issues (Bailey, 1982; Churchill, 1983; Taylor, 1984; Wentz, 1979). Inquiry methods usually entail the construction and use of a questionnaire.

The major problem faced by the researcher with behavioural questionnaires is that of transforming qualitative responses into quantitative ones. This is inherently an arbitrary process, involving personal judgement and subjective criteria. Behavioural data are amenable to mathematical and statistical manipulation only to a limited extent.

The only metric data that can emerge from qualitative variables are frequency distributions, in which the numbers of respondents giving a particular qualitative response are counted. The modal class was chosen in this study as the measure of central tendency because it is the measure of central tendency to which the terms 'typical' or 'usual' may be applied (Guilford, 1965; Hampton, 1965). This measure was important since pollution control policy applies to the whole industry and consequently it is important to sample the majority viewpoint. However, simply measuring what individuals believe about the attributes possesed by an object or an idea is not sufficient to assess a person's attitude towards that object or idea. We must rather ascertain the importance of various attributes of objects or ideas to the individual. In recognition of data coding and scoring problems associated with the measurement of attitude and preference data, special scaling techniques have been developed for the analysis of such data.

A number of attitude scaling models have been developed which attempt to measure two components of attitude, namely value and intensity (Churchill, 1983; Taylor, 1984). All these scaling techniques are however unidimensional, in that objects, ideas or respondents are positioned along some linear continuum (Green and Carmone, 1969; Wentz, 1979). Many of the concepts that we wish to measure, for example, preferences among pollution control policy options, require multidimensional decisions. Multivariate statistical techniques can be used to unscramble the effects of multiple variables acting simultaneously.

Multivariate analysis techniques can be divided into functional and structural methods. When the variables cannot be divided into dependent and independent classes, then, the structural methods of multivariate analysis must be used (Sheth, 1971). The most appropriate technique for discovering how people make choices among multiattribute alternatives was found to be multidimensional unfolding (Green and Carmone, 1969; Muller, 1988). According to Muller (1988), when multidimensional unfolding is applied to preference rankings of respondents it can be regarded as a special case of non-metric multidimensional scaling. Multi-dimensional scaling is a powerful descriptive technique, or more precisely, a set of techniques for measuring peoples' perceptions of the similarity of stimuli (objects or ideas) and their preferences among these stimuli. Multidimensional scaling attempts to represent psychological distance in terms of geometric distance (Green and Wind, 1973).

The unfolding model is based on the concept of a joint space postulated by Coombs (1964). It is assumed that it is possible to represent (unfold) the preferences of several individuals for a set of stimuli, as points in a common geometric (joint) space. The objective of non-metric multidimensional scaling is to find a configuration in which the rank order of geometric distances between individuals and stimuli best reproduces the original rank order of the preferences of those individuals for the stimuli (Green and Carmone, 1969).

Many computer algorithms (solution systems) for non-metric scaling are available today (Blake, 1982). Any computer program for non-metric multidimensional scaling which has the facility to specify a separate monotonic transformation (i.e. preserve the original preference rankings), for each individual could, in theory, be used to perform an unfolding analysis (Muller,

1988). The unfolding algorithm used in this study was developed by Dr Muller for use with preference data (Meyer and Muller, 1990, in press). This procedure was based on the unfolding model given by Schönemann and Wang (1972) and a computational procedure for this model given by Wang *et al.* (1975).

The output of such computer programs, is typically a two-dimensional preference map which can be interpreted by visual inspection (Churchill, 1983). Multidimensional unfolding, as is the case with mon-metric multidimensional scaling, attempts to represent psychological distance in terms of geometric distance (Green and Wind, 1973). An individual's response that one pair of stimuli is more similar than another pair can be construed as indicating that the psychological distance between the stimuli in the one pair is less than the psychological distance in the other pair. The perceived similarities between stimuli can be derived by comparing interstimulus distances in the joint space.

Examination of the joint space suggests that certain stimuli may be considered sufficiently similar to be classified as members of the same set. Similarly, respondents may also be located in clusters within this space. The specification of these sets or clusters can be made by judgement once the stimuli and respondents have been mapped in the joint space (Wentz, 1979).

The strength of the multidimensional unfolding technique lies in its ability to represent the preferences of respondents for a number of multiatribute stimuli in a summary form that is relatively easy to interpret. The relative importance of key attributes of stimuli that underlie the choices of respondents can then be inferred from the spatial arrangement of respondents and stimuli. The simultaneous conceptualization of the rank ordered preferences of a number of individuals would not normally be possible due to human cognitive limitations. Another advantage of using the multidimensional unfolding technique is that the task required of respondents is very simple. Data collection involves the ranking of stimuli in order of preference (Muller, 1988).

The research population comprised twenty-seven senior managers of the demersal and pelagic fish processing industry sectors. Respondents were chosen on the basis of two criteria. Firstly, they had to be actively involved in making large capital investments in waste and pollution control technology. Secondly, all respondents were required to hold senior management positions in either the demersal or pelagic fish processing industry. In order to ensure that the research population was correctly selected and complete, a chain referral method of identification of respondents was used (Bailey, 1982). This involved asking the chief executive officers of the various fish processing companies to nominate the managers in their companies, who were involved in waste and pollution control investment decisions. The nominated managers were then used as informants to identify other managers in their companies who qualified for inclusion in this study. This process was then repeated, with each of the managers who qualified for inclusion in the study, until the total research population had been identified.

The self-administered mail-questionnaire was chosen for a number of reasons, as the means to collect the required information in the present study. Respondents who have busy schedules are able to fill out mail-questionnaires at their convenience, and so give proper consideration to questions that require well thought out responses. Furthermore, mail-questionnaires also have the advantage that the respondents can maintain their anonymity, an important factor when sensitive information is being solicited.

Two mail-type questionnaires were constructed to survey the opinions and viewpoints of managers of the fish processing industry in order to establish why current pollution control policies do not seem to be adequate. The first questionnaire was used to establish the factors that influence pollution control investments as well as pollution control policy preferences of fish processing industry managers. This questionnaire was composed primarily of fixed-alternative questions to facilitate the collection of the data for multidimensional unfolding analysis. Open-ended questions were used to probe more complex issues (Bailey, 1982; Churchill, 1983).

The content of the individual questions that comprised the first questionnaire was based on information that was gathered during informal interviews and from published sources. This information pertained to strategic investments that companies had to make in order to ensure their survival, as well as investments in waste control and pollution control equipment. Information was also collected about various pollution control policy options. This information served as the basis for questions aimed at establishing which of the pollution control options that could be adopted by the South African government, were the most preferred. All the questions presented to respondents were of the undisguised type, that is, no attempt was made to conceal the purpose of the study from the respondents (Bailey, 1982). Questions are sometimes disguised to avoid normative responses to sensitive questions.

The objective of the second questionnaire was to affirm or refute the researcher's interpretation of the findings of the first questionnaire. The second questionnaire comprised the summary findings of the first questionnaire and preliminary conclusions drawn from these findings. This questionnaire did not have the same degree of structure as the first questionnaire as the researcher wanted the respondents to comment in their own words on these findings and state to what extent they were in agreement with the researcher's preliminary conclusions. This questionnaire also provided a second opportunity for non-respondents to the first questionnaire to state their viewpoints.

Both questionnaires were subjected to two pretests in order to eliminate any confusing or ambiguous questions. Questionnaires were also translated into Afrikaans so that respondents could answer in the language of their choice. Although mail-type questionnaires are designed to be self-administered, the first questionnaire was presented personally to each respondent. This was done to enable the researcher to ensure that the respondents had been correctly selected and to encourage them to cooperate. Furthermore, presenting the first questionnaire in person provided each respondent with an opportunity to clarify points of confusion, as well as to complete the questionnaire in the presence of the researcher if they wished to do so. Irrespective of whether a respondent completed the first questionnaire in the presence of the researcher, he was given a pre-addressed envelope in which to return the completed questionnaire.

The second questionnaire consisting of the research findings and preliminary conclusions was mailed directly to all the members of the research population. An addressed envelope was included to enable all respondents to again submit anonymous replies. This was done in order to encourage frankness on sensitive issues (Ferber and Verdoorn, 1962; Montero, 1974).

The response rate to mail-questionnaires is generally low (Bailey, 1982; Churchill, 1983; Wentz, 1979). Therefore incentives were provided to encourage respondents to return their completed questionnaires (Erdos, 1970). These incentives included the opportunity for the fish processing industry to express their viewpoints to government administrators regarding the

impact of current pollution control legislation on their operations and to state their preferences for various pollution control policies.

Every effort was made to ensure the maximum response rate to both questionnaires. This was done by means of a strategy of deadlines, reminder letters and follow-up phone calls (Goldstein and Kroll, 1957; Roberts *et al.*, 1978; Scott, 1961). Response rates are discussed fully in section 5.1.

1.5 SCOPE AND LIMITATIONS OF THE PRESENT STUDY

1.5.1 Scope Of The Present Study

The present study samples the opinions and views of senior managers of the South African and South West African fish processing industry concerning pollution control investments and pollution control policy within their industry. This study surveys the total population of senior managers, within the demersal and pelagic sectors of the fish processing industry, who are actively involved in making waste control and pollution control investments. The study is confined to pollution generated during production from the twenty-one land-based demersal and pelagic fish factories. Other seafood processing factories, which process rock lobster and abalone are not included in this study because investigations revealed that their effluent flows are of low volume and are not regarded as a problem (Water Research Commission, 1983).

1.5.2 Limitations Of The Present Study.

Firstly, exploratory and descriptive research designs are not particularly useful in establishing the existence of causal relationships. In the case of *ex post facto* research one starts with the observation of the dependent variable, namely behaviour related to pollution control and then searches retrospectively for explanations. Hence one is limited to supplying evidence of concomitant variation. This is because of a lack of evidence about the time order of occurrence of the variables, and the difficulty of excluding other possible explanations (Churchill, 1983).

Secondly, companies are generally not willing to divulge information about their activities to government or other organizations unless such information is required by law. Part of this practice is based on sound competitive grounds. Companies do not want to reveal any information that may give their rivals an advantage. More often companies are secretive out of a fear of negative public reaction, or for fear of costly restrictive government intervention.

Thus, little information is offered to the public by most companies, and specific requests are not likely to elicit more than a general response that is favourable to the company (Stephenson, 1975). Initial contact with senior management of the fish processing industry was characterised by suspicion of possible 'hidden' motives behind the present study. There was a general reluctance to provide any information that could be 'used against the industry'.

The researcher was able to overcome the suspicions of the fish processing industry management and secure their cooperation by presenting them with the first questionnaire in person. This provided the researcher with the opportunity to allay the fears and suspicions of industry management, as well as to convince them of the legitimacy of the study. Furthermore the researcher was able to point out to management the benefits of participating in this study.

1.6 POLLUTION ABATEMENT AND ECONOMICS

Pollution and waste cannot be destroyed. It can only be transformed or moved from one location to another. The major contributor to fish factory pollution in terms of volume is bloodwater (Water Research Commission, 1983; 1988). Dry off-loading systems when operated correctly, that is without the addition of water to facilitate off-loading, have led to a dramatic improvement in water quality in the vicinity of fish factories (Shannon, 1975). However, the blowers used to generate the suction can be very noisy and are often a source of complaints (Kies pers. comm., 1986). This demonstrates the integrated nature of the pollution problem. Another example of this phenomenon is that deodorisers, which are designed to remove smells, produce an effluent which itself requires treatment (Moore, 1974).

Total utilization of raw materials has been proposed as the key to future fish factory waste management (Anon, 1975b; Piggot, 1980; Zall and Hood, 1980). By developing integrated industrial complexes the wastes of one industry can serve as the resource base for an other (Pailthorp, 1977). Effluent treatment programmes instituted by the pelagic sector of the industry, aimed at recovering suspended solids, have provided an additional source of revenue (Anon, 1975a). This revenue has been used in some cases to offset the costs of these effluent treatment systems.

Odours, a natural concomitant of the fishing industry, require expensive high technology solutions for their total elimination. Such expenditures are difficult to justify on economic grounds considering the seasonal nature of the industry. Incorrect operating procedures and plant breakdowns do result in intermittent pollution incidents. These incidents can be eliminated only by the removal of the industry from the area. Significant social disruption would accompany such action.

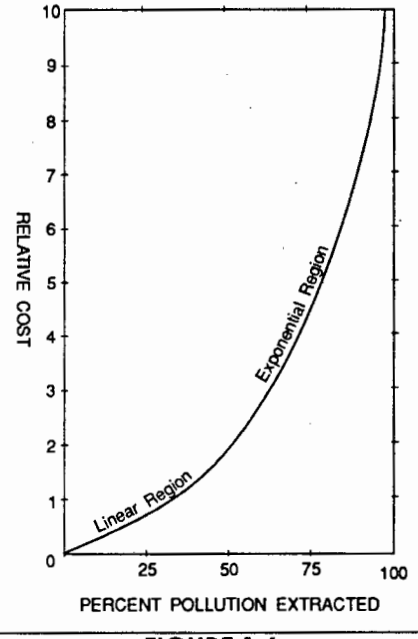


FIGURE 1.6
The variation in the cost of pollution extraction as related to the relative amount of pollution extracted.
Source: Williams, 1979, p9

Fish factory pollution does not present any special technological obstacles to its treatment. The problem is essentially an economic one. It must be remembered however, that although technology indicates what level of abatement can be achieved, economic considerations offer a far more reliable guide as to what will be done.

Pollution control costs have three unique characteristics. Firstly, the costs of reducing any type of pollution tends to increase more than proportionally with the amount of pollution removed (Figure 1.6.).

Secondly, the costs of pollution control vary substantially from one source to another and are highly dependent on geographical location. Thirdly, there are large number of control technologies for each type of pollution problem, each with a different set of costs and abatement efficiencies (Donnan, 1979).

1.7 SUMMARY

This study investigates the opinions and viewpoints of the management of the South African and South West African fish processing industries regarding pollution control investments and pollution control policy. It is a multidisciplinary investigation of the influence that legal, social and economic factors have on the waste control and pollution control investments that the industry is required to make from time to time. In addition this study investigates the pollution control policy approaches that the industry would like to see the government adopt.

Studies have shown that the South African coastline is relatively unpolluted when compared with the coastlines of the northern hemisphere except for areas where coastal utilization is high. Over the past three decades contamination of the sea by fish factories especially during summer and autumn still accounts for the major, albeit, localized source of pollution along the west coast of southern Africa. Public response to perceived pollution of the environment is usually to call on government to regulate the activities of the offending industry.

Environmental regulations usually require firms to make investments in waste and pollution control systems. Such investment decisions are usually the responsibility of the top management of a company. A knowledge of the factors that top management considers when making investments in waste control and pollution control equipment provides for an understanding of the actions of the fish processing industry with respect to pollution control. Such knowledge could also be used in order to influence polluters to consider the social costs of their production decisions.

The need to reformulate current South African pollution control policy with respect to fish processing, is indicated by the unsatisfactory pollution abatement performance of the industry today. Clumsily drafted and in appropriate regulations, however, serve no-one's interests as they may impede legitimate business without improving the wellbeing of society. Before existing policy can be reformulated so as to influence management of the Southern African fish processing industry to make the necessary investments in waste and pollution control, certain information needs to be gathered.

Thus the major objectives of the present study are:

- To identify the factors which influence senior managers of the Southern African fish processing industry when investments in waste and pollution control systems are required.

- To discover which policy options senior managers of the Southern African fish processing industry would prefer to see the South African government adopt for the control of pollution from land based fish factories.

Only by knowing how and why managers of fish processing companies behave as they do can we fully understand the pollution problem and take appropriate remedial action. Attitude is often used as an important explanatory variable in creating models of behaviour. The major problem with behavioural data is that of transforming qualitative responses into quantitative ones. A number of attitude scaling models have been developed to overcome these problems. However, most of these models are unidimensional. The phenomena of interest in this study, namely, investment decisions and policy preferences involve multidimensional choices. Multi-dimensional unfolding was found to be an appropriate multivariate statistical technique to discover the hidden structure underlying the choices among multiattribute concepts. An *ex post facto* research design was used to investigate the attitudes and preferences of the fish processing industry with regard to pollution control.

Two self-administered mail-questionnaires were constructed. The objective of the first personally administered questionnaire, was to gather information about pollution control investments and policy preferences from the senior managers of the fish processing industry. The second questionnaire, which was mailed directly to the same managers, was used to verify the researcher's interpretation of findings of the first questionnaire and to test the preliminary conclusions drawn from these findings.

The first chapter concludes with some information on the economics of pollution abatement.

Chapter two describes the identification of sources of information, factors that led to the choice of a research design and the selection of data gathering methods in greater detail. The techniques used to process and analyse the collected data are then given. This chapter concludes with the research schedule that was adopted in this study.

Chapters three and four describe the development and construction of the first questionnaire. The analysed results of the first questionnaire are presented in chapters five and six. Chapter five is concerned with the relative importance of factors in influencing waste and pollution control investments. Chapter six deals with the evaluation of existing pollution control legislation and policy preferences of the industry managers. These two chapters also contain a description of the development of the sections in the second questionnaire that were aimed at verifying the findings and preliminary conclusion drawn from the first questionnaire.

Chapter seven presents an integrated discussion together with the conclusions drawn about the factors that influence waste control and pollution control investment decisions and the policy preferences of the managers of the fish processing industry.

CHAPTER 2

Research Design

This chapter describes the sources of information, the identification of respondents, the factors that led to the choice of a research design, and the selection of appropriate data gathering methods. The techniques used to process and analyse the collected data are then given. This chapter concludes with the research schedule that was adopted in this study.

2.1 INTRODUCTION

In order to establish why current South African government pollution control policy directed at land-based fish factories is unsatisfactory, it is necessary to examine the actions of the management of the fish processing industry with regard to pollution control. Investments in waste and pollution control, compelled by law or by public pressure, make demands on the financial resources of manufacturing concerns. Such demands may result in a diversion of capital from programmes which promise greater financial returns. This diversion of capital could have implications for the growth and development of the whole organization. Therefore waste and pollution control investment decisions are usually the domain of top management.

Top management is concerned with the strategy of the business rather than with business tactics. Kotler (1980) states that the strategic management process involves the development and maintenance of a viable relationship between the organization and its environment. The

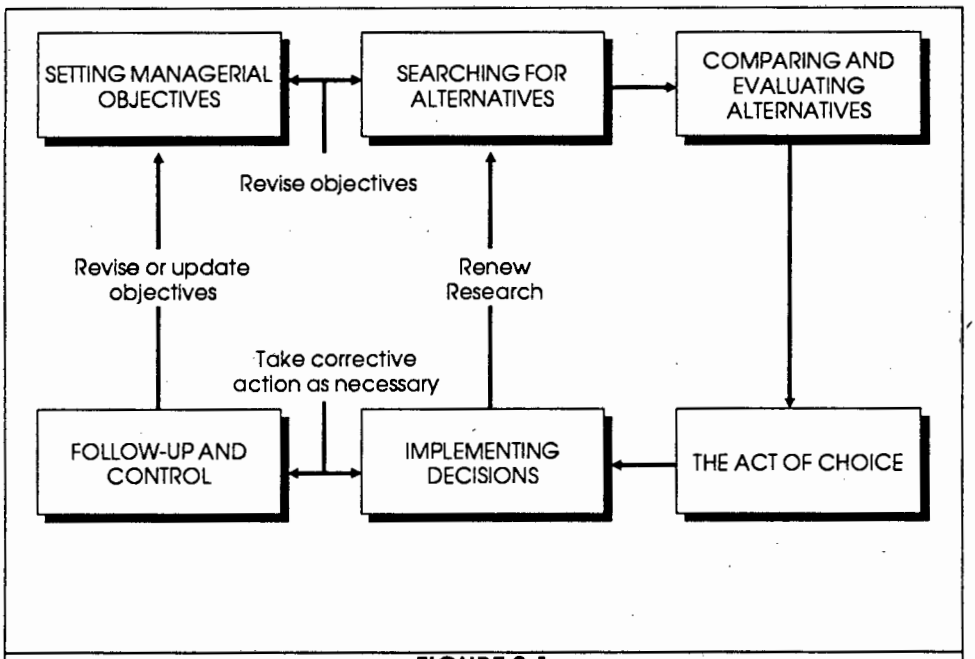


FIGURE 2.1
The decision-making process
Source: Harrison 1981, p 25

strategy adopted by an organization will be influenced by the perceptions, motives, goals and constraints of top management. Thus in order to understand the actions of the fish processing industry with respect to pollution control it is necessary to gain an insight into the factors that influence managerial decision-making (Figure 2.1.).

Behavioural studies on attitudes and perceptions can provide useful insights into the relationships between pollution control policy and other factors that could influence managers to invest in pollution control and waste control systems. The researcher therefore decided to systematically sample the viewpoints and opinions of managers of the fish processing industry regarding waste control and pollution control. Although descriptive research designs can yield useful information about the distribution of an opinion or attitude within a population, such designs generally provide little insight into the relationship between attitudes and observed behaviour.

The researcher therefore decided to make use of an *ex post facto* research design in order to investigate possible cause-and-effect relationships between attitudes expressed by fish processing industry managers and their actions with regard to pollution control. It must nevertheless be remembered that expressed attitudes and actual behaviour may conflict since the determinants of human behaviour are too complex to be accounted for by a single predictor variable. Nonetheless, despite inconsistencies it seems reasonable to assume that there is a positive correlation between attitudes and behaviour (Taylor, 1984; Wentz, 1979).

Literature searches were directed at discovering the existence of studies concerned with the attitudes and opinions of business executives with regard to various aspects of pollution control. Comprehensive manual and computerised literature searches were conducted in the fields of pollution, business, engineering, sociology and the environmental sciences. It soon became apparent to the researcher that although many publications existed on the effects of pollution and its control, very few were concerned directly with the pollution control investment decisions or the attitudes of managers in this regard. Nonetheless, useful information was collected on factors that could influence such decisions. Information was also gathered about various means that could be used to collect data relevant to this study. This information is given below in this chapter as well as in chapters three and four which deal specifically with the construction of data collection instruments.

The paucity of published information led the researcher to conduct unstructured interviews with people who were knowledgeable about pollution control and the fishing industry. These interviews took the form of informal discussions with members of the fish processing industry, government pollution control agencies and research institutes concerned with the fishing industry. The researcher used these interviews to gain an insight into the possible relationship between government pollution control policy and its impact on the fish processing industry. It also became apparent from the discussions that ensued that the study needed to be expanded to include the strategic responses of fishing companies to threats and opportunities in the business environment. This was necessary in order to place management behaviour with regard to pollution control, in its proper perspective.

Experts in the fields of attitudinal research and questionnaire construction were also consulted. Their advice was sought with regard to the suitability of various research designs and

data collection methods for the investigation of managerial decision-making. Their suggestions have been incorporated and are discussed below in the relevant sections of this study.

2.2 THE RESEARCH POPULATION

An informal interview with Mr A Silverman (1987), a director of one of the pelagic sector fishing companies confirmed that waste control and pollution control investments were the responsibility of senior management. He was of the opinion that such investments were not made by a single person nor confined to one level in the organizational hierarchy. Mr Silverman estimated that the total population of managers within the combined demersal and pelagic industry sectors that would be involved in these investment decisions would number approximately thirty.

In view of the estimated total number of managers concerned with waste control and pollution control investment decisions, the researcher decided to survey the entire population of managers. The advantage of a complete population survey over that of a sample is that the source of error is confined to non-sampling error. Surveys involving population samples, in contrast to the total population, are subject to random error and statistical bias in addition to non-sampling error. Problems were however encountered in locating the population elements and determining the exact size of the census.

Verbal inquiries directed at fish processing industry managers confirmed that waste control and pollution control investment decisions are not necessarily made at the same level in every company because they usually involve the input of a number of people. The variation in organizational structure of the companies in the fishing industry made it difficult to identify potential respondents. The researcher therefore decided to write a letter (Appendix II A) to the chief executive officers of the ten companies that controlled the twenty-one factories of the fish processing industry. This letter outlined the objectives of the present study and included a request for the names and contact telephone numbers of all senior managers who were involved in waste control and pollution control investment decisions. The letter was printed on the official stationary of the Department of Environment Affairs and signed by the Director of the Sea Fisheries Research Institute. This was done in order to indicate the authority of the organization sponsoring the study and to encourage the industry to cooperate (Bailey, 1982; Churchill, 1983).

Respondents were chosen on the basis of two criteria. Firstly, the nominated respondents had to be actively involved in making large capital investments in waste and pollution control technology. Secondly all respondents were required to hold senior management positions in either the demersal or pelagic fish processing industry.

In order to ensure that the research population was correctly selected and complete, a chain referral method of identification, based on a technique described as 'snowballing' by Bailey (1982), was used. This technique involves using the members of a defined population as informants to identify other members of the population who share similar characteristics. Each nominated respondent was asked to give the names of all other persons in their own companies that met the requirements for inclusion in the research population. This process was repeated with each person identified by the original nominees until no further potential respondents were identified.

A list of thirty potential respondents was compiled for the combined demersal and pelagic sectors of the fish processing industry. Two respondents were excluded from the study prior to the survey because they were found to be only peripherally involved in the financial aspects of waste control and pollution control investment decisions. One other respondent was not surveyed because of ill-health. Thus a final list of 27 managers involved in waste and pollution control investments was compiled.

Additional demographic information was collected from respondents during the course of the study. This information was used to classify the respondents according to industry sector, functional position in the organizational hierarchy, years of experience in the industry, and direct financial shareholding in the companies that they managed. This information was also gathered for the purpose of providing possible explanations for recorded differences among the expressed viewpoints and opinions of respondents.

2.3 RESEARCH METHODS

Surveys are the most appropriate means of collecting information on perceptions, attitudes, motives, and intentions (Bailey, 1982; Churchill, 1983; Wentz, 1979). Survey data can either be gathered by means of observation or by inquiry. Inquiry involves the direct questioning of respondents, and is the most common way of sampling viewpoints and opinions of people on a wide range of issues (Bailey, 1982; Churchill, 1983; Taylor, 1984; Wentz, 1979). Inquiry methods usually entail the construction and use of a questionnaire. Inquiry data can be gathered in three ways, namely, by personal interview, by telephone or by mail-questionnaire.

The personal interview is the most flexible survey method but also the most time consuming and hence may not be suited to obtaining information from busy executives. Its chief virtue is its ability to accommodate unstructured and more complicated questions. A further advantage of this approach is that one can achieve a greater reduction of non-sampling errors than with the use of telephone and mail-questionnaires. This is because it is easier for a respondent to put down a telephone or to ignore a mail-questionnaire. Telephone interviews are similar to personal interviews but their format is less flexible and the quantity of data that can be gathered from a respondent is more limited. Their obvious advantage is that information can be obtained quickly.

The mail-questionnaire was chosen for a number of reasons as the most appropriate means by which to collect the required information in the present study. Firstly, respondents are able to fill out mail-questionnaires at their convenience and so give proper consideration to questions that require well thoughtout responses. This was considered to be an important consideration in the present study as it became apparent during informal interviews with some members of the industry that their busy schedules would not allow them sufficient time to complete a questionnaire in the presence of the interviewer. Secondly, mail-questionnaires also have the advantage that the respondents can maintain their anonymity. This can be an important factor when sensitive information is being solicited from a respondent. Mail-questionnaires are usually accompanied by an explanatory letter and a return envelope (Bailey, 1982; Churchill, 1983).

The major disadvantage of the mail-questionnaire is the length of time taken to receive replies. Another disadvantage is that there is the likelihood of mistakes and omissions. This type of questionnaire is also impractical for asking unstructured and complicated questions. Further-

TABLE 2.3.1
Some advantages and disadvantages of inquiry methods

PERSONAL INTERVIEW

Advantages

1. Very flexible.
2. Ability to accomodate unstructured questions.
3. Low non-sampling error.

Disadvantages.

1. Very time consuming.

TELEPHONE INTERVIEW

Advantages

1. Similar to personal interview.
2. Fast method of obtaining information.

Disadvantages

1. Less flexible than personal interview.
2. Amount of data that can be gathered is limited.

MAIL-QUESTIONNAIRE.

Advantages

1. Can be completed at respondent's convenience.
2. Respondent anonymity can be ensured on sensitive issues.

Disadvantages.

1. Poor response rates.
2. Time taken for respondents to return questionnaires.

more, response rates to mail-questionnaires are relatively poor when compared with personal and telephone administered questionnaires (Bailey, 1982; Churchill, 1983). Table 2.3.1 summarises the advantages and disadvantages of the various inquiry methods.

Non-response, which can be defined as the failure of one or more selected population elements to reply to an inquiry, can seriously bias survey data. A partial solution to the non-response problem is to offer an incentive to respondents to return their questionnaires (Erdos, 1970). An incentive was provided to encourage respondents to participate in this study. This incentive was in the form of an opportunity for the respondents to make their personal viewpoints on the impact of pollution control policy known to government and to find out what the general feeling prevailing in the industry was with respect to pollution control. In order to ensure a high response rate, a strategy of follow-up reminders was used (Bailey, 1982). This strategy will be described in section 2.5. Furthermore the anonymity of all respondents was assured in order to encourage respondents to reply to sensitive questions, with no risk of

embarrassing themselves or their companies. The development and construction of the two questionnaires that were used in this study are given in subsequent chapters.

2.4 FACTORS INFLUENCING THE CHOICE OF DATA PROCESSING METHODS

2.4.1 Approaches To The Measurement Of Attitudes

The collection of behavioural data burdens the researcher with problems that are seldom encountered when gathering demographic and economic information. Isolating and evaluating the psychological and sociological forces that influence behaviour can require numerous techniques, some of which are very complex. With the exception of awareness tests, which measure knowledge, behavioural questionnaires do not have right or wrong (externally verifiable) answers. The major problem faced by the researcher with behavioural questionnaires is that of transforming qualitative responses into quantitative ones. This is inherently an arbitrary process, involving personal judgement and subjective criteria. Value judgments, attitudes and preference ratings are non-metric (non-parametric) data. In order to assign numbers to respondents answers, numerical scales must be prepared which indicate what numerical value should be assigned to a given answer. This process is known as coding. Such behavioural data are amenable to mathematical and statistical manipulation to a limited extent only.

According to Uhl and Schoner (1969), opinions can be regarded as verbal expressions of attitudes. Attitude may be defined as a predisposition to act in a certain way in certain situations towards certain subjects. An attitude may have no basis in reality, yet it may still play a major role in determining behaviour. Hence it is a logical subject for investigation. The measurement of attitudes is thus central to the understanding of behaviour of the management of the fish processing industry with regard to pollution control.

Attitude is often described as having four components, namely, cognition, a value system, evaluation and intensity. Cognition refers to the individuals state of awareness with respect to a given subject. It varies from ignorance to casual awareness to detailed knowledge and can include both real and imagined information. Cognition is affected by the individuals value system which serves as an information filter and introduces perceptual bias into the store of knowledge. The individual's value system is a higher order of personal preferences. Value systems vary between individuals, but are sufficiently similar within given social, economic or ethnic class to allow some generalizations. An evaluation is the results from the application of one's value system to objects or ideas. Evaluation or attitude extremity is the component of attitude that is most measured because it may often aid in the understanding of behavioral patterns. Intensity refers to the strength and rigidity of an attitude (Taylor, 1984; Wentz, 1979).

Most of the major attitude methodologies are concerned with the measurement of attitude extremity (Taylor, 1984). It must be stressed that attitudinal extremity is not the same as attitudinal intensity. The usual conceptualization of attitudinal extremity is a dimension running from positive through zero to negative. This implies that attitude can be measured on a ratio scale. However, in practice, this is not usually attempted. This is because of the difficulty in

establishing the zero point of the scale. Therefore the imposed scaling model that is used to measure attitudinal extremity is usually of the interval or ordinal variety.

In preparing any type of scale, two qualitative criteria must be met. The scale must be (1) intelligible to the respondents and (2) discriminatory i.e. it must differentiate between different levels of intensity or between different categories of objects or ideas. These criteria are usually not difficult to meet. Besides meeting these criteria one must also choose between a ratio, interval, ordinal and nominal scale.

In nominal scales the values are simply names, with no mathematical significance, which are used for identification purposes. Nominal data can be converted into metric form, for example, by the use of dichotomous variables. A dichotomous variable is one with two discrete levels such as yes and no.

An ordinal scale of ranking alternatives is non-metric and may be used to measure the preferences of individuals. In such scales order alone is significant. Rank ordered scales require respondents to assign an order of preference or priority to each of a number of options using ordinal values, first, second, third and so on. These rankings show the order but not the degree of his preferences. There is no meaningful interval between items. Although the highest ranked option is preferred above any other alternative, the ordinal scale gives no idea as to how much more preferable it is. With ordinal and nominal scales, one can do little more than count responses. The only metric data that can emerge from qualitative variables are frequency distributions, in which the numbers of respondents giving a particular qualitative response are counted. The resultant data are parametric with respect to the respondents, as long as the respondents themselves are interchangeable i.e. similar with respect to the variable under study. Frequency-distribution data describe the respondent population and not the qualitative variable. Nunnally (1978) defined measurement as the assignment of numbers to objects in order to represent the quantity of attributes they possess. The definition implies that we measure the attributes of objects and **not** the objects themselves. This definition of measurement can be extended to include the assignment of numbers to represent the attributes of ideas.

Raw data can however be converted into more useful information by the use of descriptive statistics. The mode was chosen as the measure of central tendency in this study. The mode may be defined as that value of the variable at which frequency is at a maximum. (Hampton, 1965, p94). It is not affected by extreme values which occur infrequently. The mode is the measure of central tendency to which the terms 'typical' or 'usual' may be applied (Guilford, 1965; Hampton, 1965). The mode is more typical of a distribution than the mean, since the mean may not correspond to any real person. The present study was not concerned with statistical abstraction, but with the real characteristics of the majority of the population. This measure was important since pollution control policy applies to the whole industry and consequently it is important to sample the majority viewpoint. In the present study attention was generally focused on the grouped frequency distribution or modal class rather than the actual mode. But, simply measuring what individuals believe about the attributes possessed by an object or and idea is not sufficient to assess a person's attitude towards that object or idea. We must rather ascertain the importance of various attributes of objects or ideas to the individual.

In recognition of data coding and scoring problems associated with the measurement of attitude and preference data, special scaling techniques have been developed for the analysis of

such data. Attitude scales can be used to measure what individuals believe about specific objects or ideas. Attitude-scaling tests generally confront the respondent with a number of provocative statements and ask him to indicate the extent to which he approves or disapproves of them. The objective of attitude-scaling tests is usually to measure attitudes quantitatively with respect to particular subjects. The type of scale used sets limits on how the questionnaire can be scored.

Given that attitude is one of the most pervasive concepts in sociopsychology, it is not surprising to find that a number of methods have been advanced to measure it (Churchill, 1983). Taylor (1984) provides a good review of the major approaches to attitude measurement and the construction of attitude measurement scales. A number of attitude scaling models have been developed which attempt to measure two components of attitude, namely value and intensity. The most common attitude scaling techniques include the Thurstone Attitude Scale (method of equal appearing intervals), the Likert Attitude Scale (summated rating scale), Q Sort (which categorizes respondents according to similarity of attitudes) and the Guttman Attitude Scale (scalogram analysis). All the above scaling techniques are however unidimensional, in that, objects, ideas or respondents are positioned along some linear continuum (Green and Carmone, 1969; Wentz, 1979).

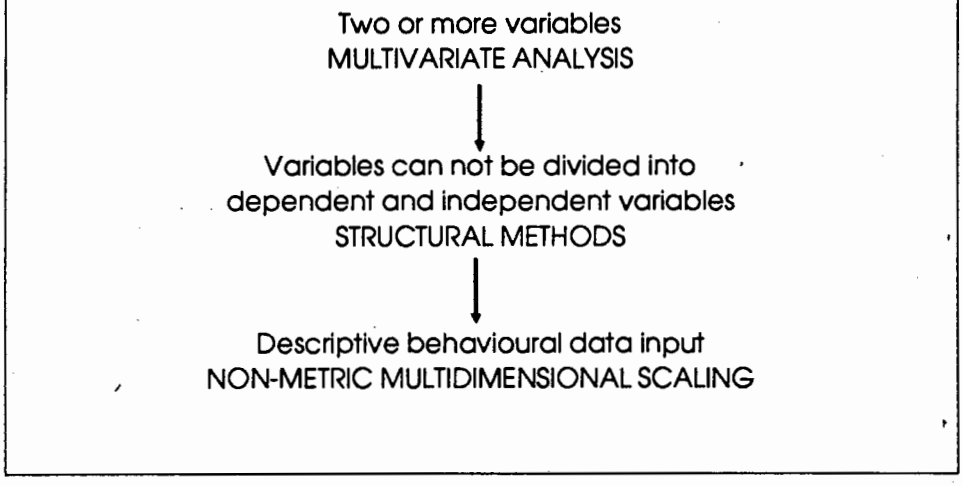
Many of the concepts that we wish to measure are really multidimensional, being composed of two or more variables. Investments in pollution control and other capital equipment, as well as preferences for various pollution control policy instruments, require multidimensional decisions. Ways have been developed for overcoming the limitations of unidimensional attitude scaling techniques used for determining how individuals approach such decisions. One such way is to ask individuals to make summary judgements about multi-attribute objects or ideas, for example, by ranking them in order of importance, and then, attempting to infer which attributes were used by individuals in forming those judgements (Churchill, 1983). This approach was adopted in the present study to investigate the relative importance of various factors that underlie the decision-making process.

Evidence suggests that people tend to simplify choices among complex options so as to reduce cognitive strain and information overload. Both Simon (1957) and Lindblom (1959) agree that cognitive limitations of the decision-maker weigh against detailed consideration of many complex alternatives. Many psychological factors contribute to cognitive limitations. These include the intelligence of the decision-maker (Taylor and Dunnette, 1974), his age (Weir, 1964), his need for achievement (McGuire, 1964; Siegel, 1957) and whether he tends to accept or avoid uncertainty (Acheson, 1975; Cove 1973; Cunningham *et al.*, 1985).

Multivariate statistical techniques can be used to unscramble the simultaneous effects of multiple variables acting simultaneously. Multivariate analysis techniques can be divided into functional and structural methods. Functional or dependence methods seek to specify the relationship between one or more known dependent variables and two or more independent variables. Structural or interdependence methods seek to group objects or ideas together. That is, they take a large number of items and place them into meaningful groups according to characteristics. Structural methods reveal relationships and associations that are not otherwise apparent. Multivariate analysis can thus be used to reveal underlying structure of choices.

The selection of a multivariate method is largely determined by the nature of the variables. When the variables cannot be divided into dependent and independent classes, then, the structural

TABLE 2.4.1 (*a*)
Factors influencing the choice of a statistical method



methods of multivariate analysis are appropriate (Sheth, 1971, p15). Two commonly encountered multivariate structural methods, not requiring a metric input, which can be used for diagnostic research into perceptions and preferences of respondents, are conjoint analysis and non-metric multidimentional scaling. Table 2.4.1 (*a*) summarises the factors that led to the choice of a statistical method to analyses the data. Conjoint analysis and multidimensional scaling (MDS) are powerful descriptive techniques for the analysis of preference and perceptions data (Blake, 1982).

Conjoint analysis is a technique in which a respondent's valuations of attributes are inferred from the preferences they express for various combinations of these attributes (Churchill, 1983). Conjoint analysis is used to measure how people make trade-offs among different attributes that describe a given object or idea. Conjoint analysis measures a person's utilities (part-worths) of attributes that together define his or her preference for a particular object or idea.

Multi-dimensional scaling is a technique, or more precisely a set of techniques for measuring peoples' perceptions of the similarity of stimuli (objects or ideas) and their preferences among these stimuli. Multidimensional scaling attempts to represent psychological distance in terms of geometric distance (Green and Wind, 1973). MDS procedures produce perceptual maps of these relationships in multidimensional space, and as such, are useful for discovering the hidden structure underlying stimuli (Wentz, 1979). The space itself is usually defined in terms of two orthagonal (at right angles) axes called attributes which describe the objects (Figure 2.4.1 (*b*)). The relative distances between the objects (stimuli) in this attribute space are one dimensional measurements of the psychological differences between objects.

Earlier unidimensional attitude scaling techniques emphasized the order relationship of pairs of stimuli. These stimuli were drawn either from the same set as in the case of Thurstone's (1959) law of comparative judgement, or from different sets as in Guttman's (1944) scalogram analysis. An individual's response that one pair of stimuli are more similar than another pair can

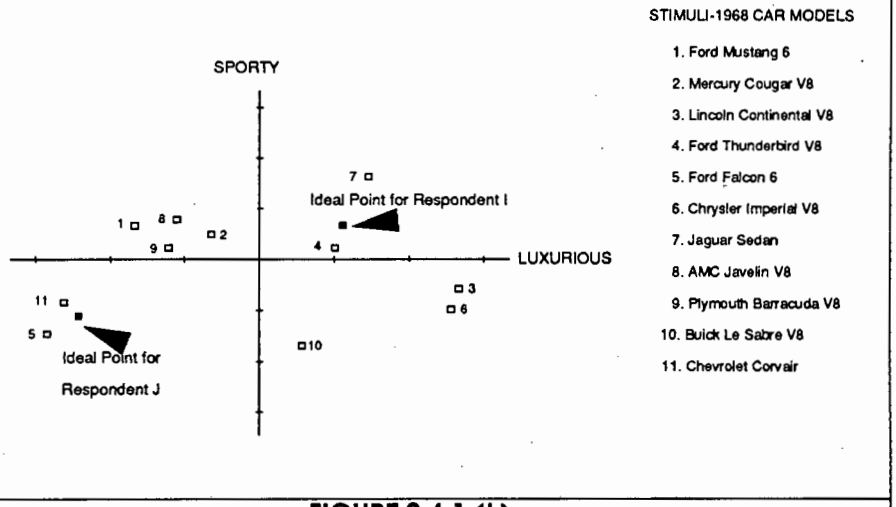


FIGURE 2.4.1 (*b*)
An illustration of a multidimensional space
Source: Adapted from Green et al., 1969 pp 159–180

be construed as indicating that the psychological distance between the stimuli in the one pair is less than the psychological distance in the other pair.

It would seem then, that psychological distance may be appropriate in analysing similarities data, where pairs of points are drawn from the same set, or preference data, where the pairs of points are drawn from two different sets. In either case, the unidimensional aspect of such data relates to an ordering of psychological distances (dissimilarities) along a linear continuum. Such dissimilarity measures may require more than one dimension to contain the configuration of points whose ranks of interpoint distances best match the original rank orders of dissimilarities (Green and Carmone, 1969).

The early multidimensional scaling methods developed by behavioural scientists in the early 1960s (Shephard, 1962) were attempts to overcome the problems of measuring and interpreting perception and preference. The conventional one-dimensional scales seemed inadequate and the behavioural scientists were frustrated by the non-metric nature of most perception and preference data. Furthermore these researchers sought techniques that could transform such information into metric data. Multidimensional scaling techniques deal with both these problems.

2.4.2 Multidimensional Unfolding

The term 'unfolding' was first applied to the analysis of preference data. According to Muller (1988), when multidimensional unfolding is applied to preference rankings of respondents it can be regarded as a special case of non-metric multidimensional scaling. The objective of non-metric multidimensional scaling is to find a configuration whose rank order of distances best reproduces the original rank order of the input dissimilarities data.

The emphasis in the present study was on establishing the relative importance of various factors in influencing the investment decisions and policy preferences of fish processing industry management. Multidimensional unfolding is a suitable technique for discovering the factors that

underlie the preferences of a group of individuals for a number of multiattribute objects or concepts (Green and Carmone, 1969). It has been used to measure peoples' perceptions of the similarity of multiattribute objects and concepts and their preferences among these objects or concepts. The perceptual maps produced by the use of the multidimensional unfolding technique characterise these relationships in multidimensional space. These maps can aid in the discovery of how people make choices among multiattribute alternatives. This is an important consideration because choice making is essential to any decision-making process. Choice-making is governed by the perceptions of the decision-maker and the context in which the choice is made.

The unfolding model is based on the concept of a joint space postulated by Coombs (1964). It is assumed that it is possible to represent the preferences of several individuals for each of a set of stimuli, as points in a common geometric (joint) space. The points in this space corresponding to the individuals are called ideal points. It is assumed that an individual's ideal point corresponds to his ideal stimulus, and that the closer a stimulus lies to this ideal point, the higher that person's preference for that stimulus will be. Under this interpretation the individual's (decreasing) rank order of the real stimuli would reflect their increasing psychological distance from his ideal point, i.e. real stimulus points nearer the ideal would be preferred to stimulus points farther from the ideal. For each respondent the order relation is again on pairs of points, each pair having a point in common, i.e. that person's ideal point (Coombs, 1964). Thus given a set of N individuals' orderings for n stimuli, the objective becomes to unfold the preference data to obtain a joint space of persons and stimuli such that the rank order of stimuli distances from each ideal point, in turn, 'closely corresponds' with the original matrix of preference data (Green and Carmone, 1969).

MDS techniques are however very sophisticated and unmanageable without the use of a computer. Many computer algorithms (solution systems) for non-metric scaling are available today, and some of the more common ones are reviewed by Blake (1982). Any computer program for non-metric multidimensional scaling which has the facility to specify a separate monotonic transformation (i.e. preserve the original preference rankings), for each individual could in theory be used to perform an unfolding analysis (Muller, 1988). Given n ranked stimuli and n – 1 dimensional space, it would be possible to plot these objects rather arbitrarily and still preserve rank ordered relationships. The objective of such programs is to find the minimum dimensionality necessary to capture the expressed order relationships. Greenacre and Underhill (1982) describe scaling as transforming data points of high dimensionality into points of much lower dimensionality and presenting the output in joint space in such a way that one's interpretation of the points is the same as one's intuitive interpretation of physical space.

It is seldom possible to achieve perfect monotonicity, in which statistical findings are consistent with sound theory and common sense during such transformations. The extent to which the monotonicity constraint is violated (stress), can be calculated. It represents a measure of the lack of fit for each analysis with a particular number of dimensions. The fit in two dimensions generally appears to be adequate to represent the preference rankings of a group of respondents for a number of stimuli (Churchill, 1983). There is usually a substantial improvement in fit from one dimension to two dimensions, but only a slight additional improvement as the number of dimensions is increased to three or even four.

The unfolding algorithm used in this study was developed by Dr Muller of the National Institute for Personnel Research, South Africa, for use with preference data (Meyer and Muller, 1990, in press). This procedure was developed from the unfolding model given by Schönemann and Wang (1972) and a computational procedure for this model given by Wang *et al.*, (1975). This procedure was originally developed for paired comparison preference data and is based on the maximization of a continuous likelihood function (Muller, 1984). Metric models of this type explicitly specify a continuous function linking distances in the joint space to observed choice probabilities. This can greatly simplify the computational aspects of an unfolding procedure. The same approach can be applied to ranked data using a specified model for ranking, and multinomial, instead of binomial distributions, to obtain a likelihood function appropriate to this type of data (Muller, 1983). The computer program that was used in the present study to position the stimuli and respondents in the joint space, NUNF 31, was developed by Dr Muller who also performed the unfolding analysis. The computer unfolding analaysis of the ranked preference data generated by the three composite questions, is given in Appendix IV (C and E) and Appendix V (D).

The output of such computer programs, as is the case with multidimensional scaling, are typically two-dimensional perceptual or preference maps. These maps represent the joint space and provide useful information. Firstly information can be gained on the perceived similarities between stimuli by comparing interstimulus distances. Secondly, this technique may be used to group respondents on the basis of the similarity of their perceptions. Thirdly, the order of preference of each respondent for each of the stimuli can be derived by measuring the geometric distance between each stimulus and that respondent's ideal point. The preference order is inversely related to the ranked geometric distances between each stimulus and the respondent's ideal point.

Perceptual maps generated by unfolding analysis can be interpreted by visual inspection (Churchill, 1983). Examination of the attribute (joint) space suggests that certain stimuli may be considered sufficiently similar to be classified as members of the same set. Similarly, respondents may also be located in clusters within this space. The specification of these sets or clusters can be made by judgement once the stimuli and respondents have been mapped in the joint space (Wentz, 1979). In order to highlight the spatial relationships between respondents and the stimuli in this study, fields were superimposed on these maps. These fields enclosed those stimuli which were independently rated by the respondents as being the most important. Furthermore, the ideal point of each respondent was labelled according to the sector of the fishing industry to which he belonged. This was done in order to highlight any differences in perceptions regarding pollution control investments and policy preferences of the managers of the demersal and pelagic sectors of the industry.

The strength of the multidimensional unfolding technique lies in its ability to represent the preferences of respondents for a number of multiatribute stimuli in a summary form that is relatively easy to interpret. The importance of factors or attributes of stimuli that underlie the choices of respondents can then be inferred from the spatial arrangement of respondents and stimuli. The simultaneous conceptualization of the rank ordered preferences of a number of individuals would not normally be possible due to human cognitive limitations. Another advantage of using the multidimensional unfolding technique is that the task required of

respondents is very simple. Data collection involves the ranking of stimuli in order of preference. One of the most important features of this technique is its ability to generate a metric output (interval scaled) from a non-metric input (Green and Carmone, 1969).

There are however a number of limitations that must be borne in mind when using such techniques. The measure of how well an analytical tool works is the measurement of its worth (Wentz, 1979). Sometimes multivariate analysis works poorly or not at all. In the case of multidimensional unfolding, for example, if respondents are not using the same dimensions to evaluate multiattribute stimuli, severe problems may arise. In such cases, the algorithm chosen to analyse the information may not be capable of accurately capturing the expressed rank ordered preference relationships without violating the monotonicity constraint so severely as to render the output of such analyses of little diagnostic use. Aaker and Day (1980), point out that perceptions may not be homogeneous for all respondents. Observed differences in preferences may therefore be confounded by differences in perception. They propose careful selection of groups of respondents on the basis of individual responses or by prior knowledge of their characteristics. This was done in the present study. Although respondents were drawn from two sectors of the fish processing industry, both groups of managers were engaged in similar activities and shared many characteristics in common. Furthermore, in order to ensure that all the respondents evaluated the stimuli in the same context when rank ordering their preferences, the context of each stimulus presented to the respondents was made explicit.

Although it is possible to derive an order of stimulus preference and to group stimuli and respondents on the basis of similarities using multidimensional unfolding, it is not however possible to say by how much more one stimulus is preferred over an other. Thus caution must be exercised when interpreting the output of perceptual maps since it is the inter-stimulus, inter-respondent and stimulus-respondent distances, obtained as a co-product of the unfolding analysis that is important. In interpreting the results of an unfolding analysis one must remember that geometric distances between a respondent and the stimulus points are inversely related to the relative preferences for that individual. Similarly two people with ideal points close to each other will have the 'same' order of preference for the stimuli but in absolute terms it is possible for one respondent to like all the stimuli while the other dislikes all of them (Muller, 1988).

From the practical point of view multivariate analyses cannot be performed without the use of a computer. No procedure based on a mathematical model can hope to fully explain the complexity of human behaviour. Hence expressed attitudes and intentions, as inferred from preference data, frequently conflict with actual behaviour. Nonetheless, despite these inconsistencies it seems reasonable to assume that there is a positive correlation between preferences, attitudes, intentions and behavior (Green and Carmone, 1969).

2.5 THE RESEARCH SCHEDULE

The sequence of activities and events that took place during this study is now given in order to orientate the reader. After completion of an extensive literature search, informal and unstructured interviews were held with government officials who were concerned with the administration of pollution control policy, and with three members of the fishing industry. The purpose of these interviews was to focus the scope of the present study.

Prior to the commencement of the main study it was decided to establish the nature and magnitude of the pollution problem within the Southern African fish processing industry. This was approached as a panel survey in which government officials tasked with monitoring the pollution and production processes of the industry were asked to assess the pollution control effectiveness of the industry in terms of what could reasonably be expected from the industry. The results of this study, which showed that a pollution problem did exist, are reported in Appendix I.

A draft questionnaire was then constructed to survey the opinions and viewpoints of senior managers in the demersal and pelagic sectors of the fish processing industry with regard to pollution control. The aim of this questionnaire was, firstly, to investigate the factors that influenced the managers of the industry to invest in waste and pollution control systems and to understand their behaviour with regard to pollution control. Secondly, this questionnaire was aimed at establishing the preferences of these managers for various pollution control policy options. The development and construction of this questionnaire is given in detail in the following chapter.

The draft questionnaire was then typed and translated into Afrikaans, so that it was available in both official languages of South Africa. It was then pretested on thirty respondents, with some knowledge of pollution control or fish processing, in order to identify frustrating and confusing questions. Modifications were made to the draft questionnaire after each administration. A final draft questionnaire incorporating all the changes suggested by the thirty respondents was then compiled, typed and translated into both official languages.

The final draft questionnaire was then administered in a second pretest (pilot test) to fifteen respondents who were either knowledgeable about the fishing industry or pollution, or both. This pretest was carried out under conditions similar to those that would be used in the field to collect data from the managers of the fish processing industry. The data collected from this questionnaire was analysed using the identical methods that were to be used on the real data.

None of the respondents used in the two pretests were drawn from the the research population. This was because the entire research population was to be surveyed and it was assumed that any pre-exposure to the questionnaires could have introduced bias into the responses of the research population.

Minor modifications and revisions were then made to the final draft questionnaire to eliminate any points of confusion and ambiguities. This questionnaire was then translated into Afrikaans as well so that respondents could receive a questionnaire in the language of their choice. Both editions of the questionnaire were then typed, proof read and bound in booklet form to facilitate handling and to improve their appearance (Appendix II B).

A letter was then written to the chief executive officers of all the demersal and pelagic fishing companies outlining the aims and objectives of this study (Appendix II A). They were asked to supply the names and telephone numbers of all the senior management executives involved in making investments in waste and pollution control. Appointments for the researcher to present all the nominated managers with the questionnaire, in person, were arranged telephonically. The respondents were given a stamped and addressed envelope in which to return the completed mail-type (self-administered) questionnaire. This was done to preserve the anonymity of the respondents and in order to encourage frankness in their replies.

Each respondent was given a deadline of one calendar month from the date of receipt of the questionnaire to complete and return it to the researcher. One week after the expiry of the deadline, A reminder letter was sent to all respondents (Appendix II C). A final follow-up telephone call was made ten days after sending the reminder letter in which respondents were asked to submit their questionnaires if they had not already done so. The reason behind the strategy of reminder letters and follow-up telephone calls was in order to maximize the number of replies and minimize the non-response error.

The completed questionnaires were then edited, coded and tabulated prior to analysis. A summary report consisting of the findings of the questionnaire and preliminary conclusions drawn from these findings was then compiled. This report served as the basis of the second questionnaire.

The objective of the second questionnaire was to verify the findings and preliminary findings of the first questionnaire. The typed draft (in English and Afrikaans versions) of the second questionnaire was then pretested on the thirty respondents used to pretest the first questionnaire. After the necessary revision, the final draft of the second questionnaire was again pretested under field conditions, on the fifteen respondents who were regarded as knowledgeable about the fishing industry, pollution control or both.

Final modifications were made to the second questionnaire which was then also translated into Afrikaans, prior to typing, proof reading and being put into booklet form (Appendix III A). The second questionnaire was then mailed directly to all the respondents (including those who failed to return the first questionnaire). The questionnaires were sent to the respondents in the language of their choice. This had been established when the respondents had been presented with the first questionnaire.

A deadline of one calendar month was set for the return of the second questionnaire. One week after the expiry date a follow-up reminder letter was sent to all respondents (Appendix III B). This letter included a final deadline and a statement to the effect that all respondents who failed to return a completed questionnaire by the due date would be deemed to be in full agreement with the findings and preliminary conclusions presented therein.

The findings of both questionnaires are presented in chapters five and six of this study. The following two chapters discuss the content, development and construction of the first questionnaire in greater detail.

CHAPTER 3

Questionnaire Development and Construction: Part I

3.1 FACTORS IN QUESTIONNAIRE CONSTRUCTION

Two mail-questionnaires (self-administered) were used in the present study to survey the opinions and viewpoints of fish processing industry management with regard to pollution control. The objective of the first questionnaire was to gather information about waste control and pollution control investment decisions as well as about the preferences of these managers for various pollution control policy approaches. The objective of the second questionnaire was to verify the findings and preliminary conclusions drawn from the data collected in the first questionnaire. The second questionnaire also provided non-respondents to the first questionnaire with a second opportunity to make their views explicit.

This chapter begins with an overview of the construction of the **first** questionnaire. The factors that could influence managers of the fish processing industry to invest in pollution control and waste control systems are then examined. Chapter four continues with the description of the construction of the first questionnaire and deals specifically with the viewpoints of these managers regarding current pollution control legislation and their preferences for various pollution control policy options.

Questionnaire construction is an iterative process. Rarely is it possible to develop a questionnaire in a step-by-step manner, without some iteration and looping. The first step in questionnaire construction involves the specification of the information that is required. The information needs are defined by the research objectives which were given in section 1.3. A number of decisions then have to be taken regarding the type of questions to be used, their wording, sequence and response form.

Whether or not a respondent will give the correct information is generally a function of the amount of work required in producing an answer and the sensitivity of an issue. In cases where this effort may be excessive or cause irritation, it may be necessary to generalize the question so as not to alienate the respondent from the rest of the study (Erdos, 1970; Oppenheim, 1966; Payne, 1951). The amount of effort required by respondents to the present study in producing an answer was decreased considerably by means of fixed-alternative questions.

Fixed alternative questions are most productive when the possible replies are well known, limited in number and clear cut. Structured questions have the advantage that all respondents reply to the same question and replies are therefore comparable (Kidder and Campbell, 1970). They are appropriate for securing factual information as well as for eliciting established opinions about specific issues (Table 3.1.1). A major advantage of fixed-alternative questions is that they are simple to administer, tabulate, code and analyse (Bailey, 1982; Churchill, 1983).

Fixed-alternative questions which were used extensively in the construction of the first questionnaire, were either of the multichotomous or scaled type. Multichotomous questions were used to gather from respondents, factual and biographical data such as years of experience.

TABLE 3.1.1
Advantages and disadvantages of fixed-alternative questions

ADVANTAGES.

1. High degree of standardization.
2. Easier to code and analyse.
3. Respondent clear as to what information is required.
4. Irrelevant responses kept to a minimum.
5. Higher response-rate to sensitive questions.
6. Less work required of the respondent.

DISADVANTAGES.

1. Easier for respondent to 'create' a response.
2. Response categories may not reflect a respondent's position.
3. Variation between respondents may be reduced.
4. Greater opportunities for clerical errors by respondents.

Fixed-alternative questions were also used to get respondents to rank their preferences as a prerequisite for multidimensional unfolding analysis. Scaled questions were used to sample the opinions and viewpoints of respondents with regard to specific issues. In the case of both types of fixed alternative questions care was taken to ensure that the alternatives presented to respondents were mutually exclusive (Figure 3.1.2). Fixed-alternative questions are objective since they effectively eliminate scorer bias (Anastasi, 1968).

PLEASE CIRCLE THE NUMBER THAT BEST DESCRIBES YOUR ANSWER.

How many years experience do you have in the fish processing industry?

1. 0 - 4 years
2. 5 - 9 years
3. 10 - 14 years
4. 15 - 19 years
5. 20 - 24 years
6. 25 and more years

1	2	3	4	5	6

FIGURE 3.1.2
Example of multichotomous fixed-alternative question.

Fixed alternative questions are reliable i.e. internally consistent between similar groups, because the framework of reference is often obvious from the alternatives. This helps to clarify the question. During the pretesting of the first questionnaire it became apparent that not all respondents were using the same criteria to evaluate the alternatives presented to them in each question. This appeared to be due to the alternatives not being clearly defined. This problem was overcome by making explicit those alternatives that appeared to present problems. For example, instead of merely asking respondents about the investment priority that they assigned to employee benefits in relation to other investments, a concrete example of employee benefits, namely housing schemes, was provided.

The reliability of fixed alternative questions is however associated with a loss of validity. This can occur when the answers provided do not reflect the true position of a respondent, due to the omission of an appropriate response. Two steps were taken in order to ensure that the loss of validity was kept to a minimum. Firstly, extensive prior research was undertaken involving a comprehensive literature search and informal consultations with people who were knowledgeable about the fish processing industry or pollution control policy, in order to ensure that the alternatives presented were complete. The people who were consulted in this regard were mainly drawn from the pretest population. Secondly, a contingency category (Other : Please specify...) was provided in all questions that required respondents to state their preferences among listed alternatives.

Several types of bias which exist can restrict validity of answers to questions (Bailey, 1982; Churchill, 1983; Taylor, 1984). Such biases are not always due to the limitations of the research instrument or to bias introduced by the researcher during the interpretation of responses. Bias may also result from the interaction of the respondent and the data collection instrument. This type of bias is known as 'response bias' and is due to a tendency on the part of a respondent to alter responses to items in the questionnaire so that item scores indicate something other than what they were intended to measure (Guilford, 1967).

One of the most common types of response bias is that of falsification. This is the deliberate systematic distortion of responses by a respondent who is intent on creating a particular impression of himself in terms of the scored results (Gordon and Gross, 1978). This type of bias may occur when a respondent alters the facts to provide socially desirable answers in order to portray himself in the best possible light (Wentz, 1979). A related bias is that of role selection by respondents (Webb *et al.*, 1966). This involves the selection of one of a number of 'true selves' or 'proper behaviours' available to a respondent. The testing context could bias a respondent towards a particular role. It is possible that some individuals are strongly influenced by normative pressures, while for others the dominant influence comes from internalized attitudes. In another group of people behaviour may be dependent on the instrumentality of the attitude in satisfying certain needs. Some people may be able to tolerate much dissonance between internal attitudes and overt behaviour if in return they can satisfy certain needs (Taylor, 1984).

Objective techniques confront the respondent with direct questions based on the assumption that the respondent is both able and willing to reveal a behavioural pattern and to give reasons for his actions. In such cases all answers to questions are accepted at face value. Objective techniques work well when the research deals with subjects that do not involve the subject's

self-image or have a high emotional content. They can be useful in defining wholly rational behavioural patterns and in identifying functional reasons for a respondents actions. If the respondent can remain anonymous, objective techniques can also be used in research on more sensitive matters. However in order to guarantee anonymity, researchers are limited to using mail- questionnaires with a fairly structured format.

Another method for eliciting sensitive information is to use disguised questions (Bailey, 1982; Churchill, 1983). Such questions are designed to conceal the true purpose of the question from the respondent. Disguised questions were not used in the present study. This was because the sophistication of the respondents would have made it difficult to design such questions without compounding the initial suspicions expressed by some of the research population about the 'hidden' purpose for which the data was to be used. Any attempts to collect data by means of disguised, questions that were discovered by respondents, could have seriously affected the validity of the entire study as this could have led to some respondents withdrawing and others providing normative replies.

Some authors are of the opinion that even though the validity of fixed-alternative questions may be affected to some degree by response bias, such questions should not be discounted as a means of measuring the underlying attitude variable. They believe that the amount of unwanted variance introduced by fixed alternative questions is more than compensated for by the high degree of reliability and relevance to the attitudinal domain (Kidder and Campbell, 1970; Taylor, 1984).

Unstructured open-ended questions were used in the first questionnaire to probe more complex issues in which the possible responses could not be adequately covered by fixed-alternative questions. Unstructured open-ended questions are especially suited to exploratory research (Wentz, 1979). The objective of this type of question is to get a respondent to freely express his opinion or viewpoint (Table 3.1.3). According to Bailey (1982), the response to such questions may be a more accurate representation of a respondent's true position on some issue. However open-ended questions can create difficulties in coding and analysis because the

TABLE 3.1.3
Advantages and disadvantages of open-ended questions

ADVANTAGES.

1. Can be used when all possible responses are not known.
2. Allow respondents to answer adequately.
3. Allow probing of complex issues.
4. Allow more opportunity for self expression.

DISADVANTAGES

1. Collection of irrelevant information.
2. Analysis is not simple since data not standardized.
3. Coding may be difficult since subjective.
4. Certain level of communications skills required by respondent.

collected data is not standardized resulting in the researcher having to infer a respondent's position. This in turn could affect the validity and reliability of results (Collins and Kalton, 1980; Lemon, 1973).

Prior to the administration of any questionnaire on the intended population, it is necessary to pretest draft questionnaire. The objective of pretesting questionnaires is to identify and modify any frustrating, confusing or easily misunderstood questions that could prevent the intended respondents from providing the required information (Bailey, 1982, Churchill, 1983; Wentz, 1979). Misunderstandings can be a source of non-response errors. Such errors are caused by the failure of one or more selected population elements to reply to a question. Non-response errors can seriously bias data. The actual modifications and improvements that were made after pretesting, are discussed below together with the preparation and development of the specific questions. Therefore only the general pretesting procedure and modifications made to the first questionnaire will be discussed here.

Normally a pretest is performed on a small sample of the population of interest, prior to administering the questionnaire on a larger sample of the same population. Although it is usual practice to pretest questionnaires on individuals who share as many characteristics as possible with the intended research population (Bailey, 1982; Churchill, 1983), this was not done in the present study. The reason was that the entire research population was to be surveyed and it was assumed that any pre-exposure to the questionnaire, even in a draft form, could have introduced bias into their responses to the final questionnaire.

A draft of the first questionnaire was presented in person and individually to thirty people with some knowledge of pollution control, fish processing or both. During the personal administration of this draft questionnaire each person was asked about difficulties they encountered in understanding the questions, as well as about the wording and specific terminology that was used in their compilation. The questionnaire was then amended after each administration to incorporate the suggested improvements, prior to being presented to the next person. As this sequential procedure progressed, the number of necessary amendments per administration of the draft questionnaire decreased.

Particular attention was paid to the wording of questions as it became obvious that some questions needed much reading and rereading to be understood. Furthermore, in order to ensure that respondents knew precisely what was required of them the questionnaire was translated into Afrikaans. This was done because Afrikaans was the first language of many of the respondents in the intended research population.

The order in which questions were originally presented to respondents corresponded to the order in which the research objectives were presented in section 1.3. Furthermore, a 'funnel' approach was adopted in that broader questions preceded questions dealing with specific issues. For example, questions pertaining to the relative importance of investments in environmental protection, were asked before specific questions regarding specific factors that influence investments in waste control equipment.

During the pretesting of the first questionnaire some respondents expressed the opinion that the industry might not be willing to divulge information regarding the effect of the business environment on their operations or strategic investment priorities. The view was expressed that the gathering of information about strategic investments in order to place environmental

protection investments in perspective might be construed as an attempt to elicit information for other purposes not connected to this study. Therefore, in order not to risk alienating respondents, potentially sensitive questions were placed later in the questionnaire.

Besides ensuring anonymity, a number of measures were also taken to elicit answers to sensitive questions (Ferber and Verdoorn, 1962; Locander and Burton, 1976; Montero, 1974; Sudman and Braburn, 1973). Attention was paid to the way in which questions were phrased. For example, when asking about discharging wastes, care was be taken to avoid implying the social undesirability of such actions. Rather than asking respondents about the actual expenditure of their companies on pollution control, respondents were asked to choose an alternative from a number of given response categories representing different levels of expenditure.

Steps that were taken to ensure that the questionnaire was as concise as possible also had an effect on the question order. These steps included the grouping of questions that required respondents to perform similar tasks. For example, all the questions requiring respondents to indicate their agreement or disagreement with provocative statements were combined into the same section of the questionnaire. This enabled the instructions to be given once only. This step resulted in a decrease of the total length of questionnaire. There is presumably also less resistance to a short than a long questionnaire.

After making the necessary changes to the draft questionnaire, a final draft of the first questionnaire was prepared and a pilot test performed on a group of fifteen persons with expert knowledge of either the fish processing industry, pollution control or both. These experts were drawn from the government departments of Health (air pollution), Water Affairs (water pollution) and Environment Affairs (Sea Fisheries Research Institute) as well as from the Fishing Industries Research Institute. This pilot test was presented personally to these experts who were asked to complete it in the presence of the researcher. The first questionnaire took most respondents to the pilot test approximately forty minutes to complete with a standard deviation of about fifteen minutes. The data collected from the pilot test was also analysed to ensure that the statistical procedures chosen for this study were appropriate. Final amendments were then

TABLE 3.1.4
Steps in questionnaire construction

1. Specify the required information.
2. Determine the question content, type, response form, wording, and sequence.
3. Determine the method of questionnaire administration.
4. Determine the physical characteristics of the questionnaire.
5. Re-examine steps 1 - 4 and revise where necessary.
6. Pretest draft questionnaire.
7. Revise draft questionnaire.
8. Pilot test revised draft questionnaire under field conditions, including the analysis of data.
9. Final revision of questionnaire.

made to the first questionnaire prior to using it to gather data from the research population. Table 3.1.4 summarises the steps in questionnaire construction.

The development, content, structure and modification of specific questions relating to the factors that could influence managers of the fish processing industry to invest in waste and pollution control is presented below.

3.2 STRATEGIC INVESTMENT PRIORITIES

The need for investments in waste and pollution control programmes cannot be considered independently of other demands made on an organization's resources. Managers therefore need to gather reliable and objective information about the threats and opportunities present in the business environment. Managers must relate this information to the capabilities of their companies. Only then, can they make the optimum allocation of the resources at their disposal (Miller *et al.*, 1985; Uliana and Marcus, 1982). A company's survival is dependant on the ability of its managers to make timely and appropriate adaptations to a complex and changing environment.

The objective of the first question was to establish the priority of waste and pollution control investments in relation to other strategic investments that the management of the fish processing industry could make. As strategic investments are largely dependent on factors prevailing in the general business environment, it was initially decided to present respondents with two artificial business environments in order to establish the effect of factors in the business environment on the investment priorities of the fish processing industry.

Two scenarios were constructed for South Africa, based primarily on economic considerations (Roukens De Lange *et al.*, 1986; Spies, 1984; Sunter, 1987; Warwick pers. comm., 1986). The first scenario described a recessionary business climate based on Gross Domestic Product (GDP) of 2%. The second scenario was based on a High growth GDP model of 5%. Both scenarios presented explicit forecasts dealing with fixed investment levels, balance of payments, interest rates, taxation, consumer spending, inflation, trade sanctions, labour relations, unemployment and political stability.

The idea behind the two scenarios was firstly, to present a common frame of reference for each respondent, and secondly, to establish to what extent the state of the economy influenced the priority assigned to investments in environmental protection. The relative importance of various strategic investments was to be established in the following way. A list of investment options was to be compiled and presented to respondents. The respondents would then be asked to rank these investments in order of priority according to the conditions given in each scenario.

It soon became evident during the first pretesting of the questionnaire that both scenarios were unrealistic. The recessionary scenario was too pessimistic and the high growth scenario was too optimistic. Furthermore neither scenario dealt specifically with the conditions that were relevant to the fish processing industry. Rather than attempt to construct more realistic scenarios, the researcher decided to allow the managers of the fish processing industry to construct a single scenario based on their own perceptions of the future to the year 2000.

Respondents were to be asked to consider the following factors: economic growth, interest rates, tax rates, sanctions, labour relations, and government regulations. In order to make the scenario more relevant to the fish processing industry factors such as, quotas, catch per unit

C1. IN THE PERIOD BETWEEN NOW AND THE YEAR 2000, WHAT DO YOU BELIEVE TO BE THE MAJOR STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS OR YOUR SECTOR OF THE INDUSTRY?

(e.g. an opportunity could be the development of a non-quota species fishery and a threat could be a rise in the costs of key inputs e.g. fuel)

STRENGTHS

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WEAKNESSES

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THREATS

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OPPORTUNITIES

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FIGURE 3.2
Question C1

effort, cost of key inputs, consumer demands, and profitability were included. The intention was then to ask respondents to rate each of these issues according to whether they perceived them to be improving, staying the same, or worsening. Respondents would then be required to rank a number of given strategic investments according to their perceptions about the future. This approach was also abandoned during the pretesting stage. The researcher found that although this approach may have provided the same framework of reference to respondents with regard to the business environment, these factors were too broad to be of use to respondents in assigning priorities to investments.

The approach finally decided upon was to ask the respondents to perform a **vulnerability analysis** prior to ranking investment priorities. This entailed the respondents listing the perceived internal **strengths** and **weaknesses** (i.e. the capabilities of the industry), and the external **threats** and **opportunities** present in the business environment. Due to the different natures of the demersal and pelagic sectors of the industry, respondents were asked to perform this vulnerability analysis for their sector of the industry (Question C1, Figure 3.2.). The primary objective of this question was to focus the attention of the respondents on specific issues that could influence their priorities with respect to strategic investments for their sector of the industry. A subsidiary objective of this question was to gain an insight into the relationship between factors in the internal and external business environments of fishing companies and the role of these factors in determining investment priorities.

Use was made of unstructured open-ended questions to establish the perceptions of managers regarding the strengths weaknesses threats and opportunities facing their sector of the industry. Unstructured open-ended questions can were used to probe these complex issues because all the possible responses were not known (Churchill, 1983). In order to reduce the amount of irrelevant information that open-ended questions tend to generate, respondents were given an example of the type of information that was required. Furthermore the space provided in which to give their replies was limited to six lines which served as an indication of the amount of detail required. The problem of subjectivity inherent in the coding of the responses to this open-ended question was overcome by simply counting the number of times an issue was mentioned. This frequency count was used to suggest the relative importance of that issue.

3.3 THE RELATIVE IMPORTANCE OF INVESTMENTS IN WASTE AND POLLUTION CONTROL SYSTEMS

Once information has been gathered about the internal and external environment of a business, a number of strategic alternatives can be pursued to enable management to meet their objectives (Byrnes and Chesterton, 1973). Managers may attempt either to modify or remove these constraints set by the business environment or accept these constraints and attempt to achieve their objectives within them.

The strategic management process involves the development and maintenance of a viable relationship between the business and its environment (Kotler, 1980). Drucker (1954) states that industrial organizations need to develop objectives in eight key areas, namely, market share, innovation, productivity, physical and financial resources, profitability, manager performance and development, worker performance and attitude, and social responsibility. All of these

objectives can affect an organization's survival and effectiveness. Companies therefore pursue a number of objectives concurrently.

According to Bross (1986), fishing is a high risk activity that is dependent on the weather and the skills of fishermen. Consequently, the fishing industry is subject to random fluctuations in both yield and price (Cunningham *et al.*, 1985). Such fluctuations could create financial problems for some fishing companies (Siegfried, 1986). Being a highly capital intensive industry, the fishing industry requires a high volume of throughput to maintain profitability (Firth, 1985; Siegfried, 1986). Without profitability a business cannot maintain an adequate level of investment in assets that are needed for the business to compete effectively and to grow (Friedland, 1986).

South Africa has seen a significant decline in corporate profitability over the last few years. Political upheaval and poor economic planning has lead to a net out flow of capital from South Africa since 1976 (Miller, *et al.*, 1978). This has resulted in a significant decline in corporate profitability, especially over the last few years, due to the weakening of the rand against foreign currencies, high inflation and high interest. High interest rates have serious implications with respect to the acquisition of new technology as such acquisitions are often financed by credit (Friedland, 1986).

In addition to the poor general economic conditions prevailing in South Africa, the fishing industry is faced with escalating costs and low catches per unit effort. According to Stuttaford (1985a), fuel accounts for more than 50% of the operating costs of the trawl industry. Similar costs are incurred in the pelagic industry which uses fuel not only to catch fish but to power the boilers and dryers used in fish meal production. These problems are exacerbated from time to time, by fishing concessions awarded to foreign trawlers to operate in South African waters. Such concessions are believed to contribute to a falling catch per unit effort (Anon, 1984). The rise in production costs experienced by the industry has negative implications not only for the competitive position of the South African fishing industry in relation to other fishing industries but also for the competitive position of fisheries products in relation to substitute food products (Bell and Kinoshita, 1973). This rise in costs may have facilitated the ability of other emergent fishing nations to sell their fish on South Africa's traditional markets (Anon, 1984).

Modernization can improve the profitability of an industrial concern in two ways. Firstly, new technology may improve yields with existing raw materials. **Waste recovery systems** may be of importance in this regard since the total number fish that may be caught in any fishing season is limited by quota. Thus the less wastage the more product a company has to sell (Royston, 1979). Secondly, technological improvements can result in lower operating costs and thus allow for the production of certain products at competitive prices.

Potgieter (1986) estimates that over 84% of the pelagic fleet will have to be replaced over the next twenty years at a discounted cost of more than R90 000 000. He states that experience has shown that pelagic vessels can be maintained in a seaworthy condition for about twenty years before costs become prohibitive. After twenty years such vessels cannot be upgraded by the installation of new technologies without major reconstruction. The average age of trawlers in the demersal fleet as at January of 1984 was 15,75 years for the deep sea fleet and 21 years for the inshore fleet (Stuttaford, 1985b). Based on a life expectancy of 15 years, the average age of the demersal fleet should ideally be 7.5 years (Stuttaford, 1985b) It would therefore appear

that the modernization of the fishing fleet and other related production assets will be a major investment priority of the Southern African fishing industry (Potgieter, 1985; 1986; Stuttaford, 1985b).

Diversification is another option often employed by fishing companies to improve profitability (Cunningham *et al.*, 1985). Diversification entails the development of new products and markets. Political pressure in the form of trade sanctions has forced the South African fishing industry to explore new markets for its products (Penrith, 1986). Furthermore, Potgieter (1985) predicts that there will be a shift in emphasis, within the pelagic sector, from the production of animal feeds in favour of products for direct human consumption. Although such products tend to be more labour intensive as the fish cannot be handled in bulk as is the case with fish meal production, products for human consumption generate more revenue.

A strategy, that can be used to improve profitability, which is closely related to the strategic option of diversification, is that of relocation of fishing effort. This may be achieved by fishing companies either concentrating their efforts on alternative species or shifting their fishing grounds to improve catch per unit effort. With regard to the former Potgieter (1985) believes that the last of the under utilized fish resources in southern African waters such as tuna (*Thunnus* sp.), squid (*Loligo reynaudi*) and certain species of mesopelagic fish, will be more fully exploited.

In contrast to diversification, a company may chose to **specialize**, that is, to focus more narrowly on existing products and markets. Specialization is an attractive proposition only in cases where companies have a monopoly or specific advantage over competitors. Specialization, however does not seem a viable option for the Southern African fish processing industry as a whole. This is due to ever changing consumer preferences and high production costs, which could result in the industry becoming less competitive, both in terms of other fisheries products and substitute food stuffs (Bell and Kinoshita, 1973; Macloed, 1983).

In the event of the fish processing industry deciding to specialize or diversify, investments will have to be made in the fields of **research and development**. Such investments are needed if the industry is to exploit future opportunities successfully. In this regard, Potgieter (1985) believes that the industry will need to concentrate on acquiring expertise in the exploitation of alternative species as well developing processing technologies capable of producing new products in order to satisfy consumer demands.

Fishing has become technologically more sophisticated over the past forty years (Whitmarsh, 1977). This is also true of the South African fishing industry, where South African government fiscal and monetary policy has promoted investments in capital equipment and automation rather than the use of labour (McGregor, 1985; Relly, 1986). Nonetheless as the fishing industry makes the transition from the mechanical into the micro-electronic age, the industry will have to make investments in **job creation and training** if it is to remain effective (Anon, 1982b; Anon, 1985a). At present most of the workers in the fishing industry are drawn from the coloured population group and are unskilled (Prosch, 1985).

The relative shortage of skilled labour results in high wages being paid to skilled employees. This in turn leads to demands from the labour unions for wage increases for their unskilled workers that are far in excess of productivity gains (Miller *et al.*, 1985). There is a perception among the managers of the manufacturing industry in South Africa that labour problems and

the cost of **employee benefits** pose a threat to prosperity. A survey of one thousand businesses in the Cape Province of South Africa found that labour problems were regarded as the third highest threat to profitability after inflation and higher taxation (Hood, 1988; Friedland, 1988; Page, 1988a; Page, 1988b). It appears that the labour unions will continue to exert pressure on industry for improved remuneration and employee benefits. Thus it can logically be expected that industry will make investments in employee benefits in the interests of improved labour relations.

According to Burson (1974), the boundary between what's good for the environment and what's good for business is no longer quite so clear. An enterprise can no longer make sound economic decisions without taking into account the environmental consequences of its acts. The way in which a company copes with its pollution problems affects its balance sheet, its profit and loss statement, its price earnings ratio, its ability to raise capital at competitive rates and maybe even its ability to sell its wares.

Business originally did only what society primarily required, namely, satisfying the needs and wants of people for goods and services at affordable prices. Over the years this basic contract has gone beyond the context of the market place. Today it is argued that business is the root cause of many of the problems confronting society and must therefore be held responsible for solving them (Lufkin, 1974). Public response to perceived pollution of the environment has been to call on government to regulate the activities of the offending industry (Pentreath, 1978; Senecca and Taussig, 1979). Pollution control regulations could force the fish processing industry to install expensive pollution control systems at an inopportune time. This could result in the curtailment of other more financially attractive ventures. Thus the fishing industry may decide to make preemptive investments in **pollution control** in order to reduce public pressure and the need for further regulations.

In the years ahead, conditions prevailing in the general business environment will influence the choice of objectives and appropriate strategies of the fish processing industry. However, distortions in the economy due to factors such as very high rates of inflation or taxation could result in sub-optimal developments in the industry. Even though there may be an increasing demand for fish and fisheries products, should the financial returns become marginal fishing companies may continue to diversify their operations into **areas unrelated to fishing** where returns may be higher (Potgieter, 1985). For example, Fishing companies may become investment holding companies in a high interest rate economic climate, rather than putting their profits back into fishing where returns may not be as high. Cunningham *et al.* (1985) is of the opinion that if the market price were to fall below average variable costs, some firms could be expected to withdraw from the fishing industry.

In summary, there is a need to examine the strategic investments that a fishing companies could make in order to establish the relative importance of investments in waste and pollution control systems. Probable strategic investment options include, modernization, diversification, specialization, research and development, job creation and training, employee benefits, waste and pollution control, and investments unrelated to fishing. These options discussed above formed the basis for questions C2 and C3 (Figure 3.3.).

Companies are understandably sensitive about divulging information about the details of strategic plans since this could impact their competitive advantage. Therefore likely strategic

C2. BASED ON YOUR PERCEPTIONS OF THE FUTURE, IN WHICH OF THE FOLLOWING AREAS WOULD YOU BE LIKELY TO MAKE SIGNIFICANT CAPITAL INVESTMENTS?

Please tick in the appropriate space
U = Unlikely
L = Likely
V = Very likely

	U	L	V
A. DIVERSIFICATION (new products for new markets)			
B. SPECIALIZATION (Focus more narrowly on existing products and markets)			
C. EMPLOYEE BENEFITS (e.g. housing schemes)			
D. JOB CREATION AND TRAINING			
E. POLLUTION CONTROL			
F. MODERNIZATION PROGRAMMES (ship replacement and/or upgrading production facilities)			
G. WASTE/MATERIALS RECOVERY SYSTEMS			
H. INVESTMENTS IN ENTERPRISES UNRELATED TO FISHING			
I. RESEARCH AND DEVELOPMENT			
J. OTHER: PLEASE SPECIFY			

C3. BASED ON YOUR VIEW OF THE FUTURE (TO THE YEAR 2000), PLEASE RANK ALL NINE OPTIONS LISTED ABOVE (A - I) ACCORDING TO YOUR PERCEIVED INVESTMENT PRIORITIES.

1 = Highest priority; 9 = Lowest priority.

1 . . . 2 . . . 3 . . . 4 . . . 5 . . . 6 . . . 7 . . . 8 . . . 9 . . .

FIGURE 3.3
Question C2 and question C3

investment options were generalized into categories of investments. Managers were then asked to order the categories according to personal investment priorities rather than being asked about the specific investment priorities of their companies. The questions relating to industry perception of the future and strategic investment priorities were also presented later in the questionnaire so as not to alienate those respondents who may have been suspicious as to an imaginary concealed purpose of the questionnaire.

Each respondent was asked to rate and rank the list of possible strategic investment options in order of personal priority, based on his own perceptions of the future of the fish processing industry to the year 2000. Structured fixed-alternative questions were used in this question. The rank ordered preferences were analysed using the multidimensional unfolding technique out-

lined in chapter two. The ratings relating to the probability of investments were tabulated so that the relative importance of various strategic investment priorities could be established.

3.4 FACTORS INFLUENCING WASTE AND POLLUTION CONTROL INVESTMENTS

The fish processing industry is required from time to time to make capital investments in waste control and pollution control systems. Such investments may result from public demands for a cleaner environment, or from changes in environmental policy. Although many factors may influence the decisions of management of the fish processing industry to invest in abatement equipment, it was assumed that some factors may be more important than others in influencing such decisions. A knowledge of the factors that are considered by management to be important in such decisions could contribute to the understanding of the actions taken by the industry to prevent and control pollution. Furthermore, such knowledge could also be of use in influencing the management of the fish processing industry to take the necessary steps to improve their abatement performance.

A distinction needs to be made between pollution control equipment and waste control equipment. Although both do result in a reduction of pollution, the latter has made a direct contribution to profits in terms of the material recovered from fish processing wastes. These profits have been used to off-set the costs of investing in waste control or materials recovery systems (Anon, 1975a; Water Research Commission, 1988). The distinction between waste and pollution control equipment is somewhat artificial in that investments in pollution control could represent a substantial saving in terms of fines avoided. However, such penalties appear to be seldom invoked in South Africa. Hence the distinction between waste and pollution control equipment, on financial grounds, appears to be valid. The researcher therefore decided to establish the relative importance of financial, legal and social considerations to the management of the fish processing industry management in making investments in waste and pollution control equipment.

Certain developments in the business environment are increasingly influencing management decision-making (Kotler, 1980). These developments include the growth of public interest groups, increasing amount of legislation and more rigorous enforcement of **anti-pollution regulations**. Although there is mounting pressure on business to introduce the social costs of production into the decision making process, it is normally only when the organization comes into conflict with the community that the organization is called to account for its actions. (Bridges *et al.*, 1971; Kotler, 1980).

In locations closer to metropolitan areas, the community in the vicinity of a fish factory is usually composed predominantly of people who have no connections with the industry. Pressure from residents and rate payers in these areas has been effective in getting management of the fish processing industry to modify their operations so as to reduce pollution. Public pressure and a negative **company image**, has resulted in technological innovations such as the installation of indirect fish meal driers, which have decreased the need for large scrubbing plants; improvements to deodorisers; modifications to scum tanks; and evaporation of all liquid entering the factory. Some managers claim, however, that the cost of evaporation and other means used to

reduce waste exceeds the value of the recovered product (Anon, 1974; Anon, 1975a; Anon, 1982b).

According to Downer (1976), it is generally assumed that firms make investment decisions on the basis of the net present value of future income that investments will generate. Downer (1976), made a study of the methodology employed by 70 major Canadian corporations when making capital investment decisions. He found that business acumen was frequently substituted for formal financial calculations. Mintzberg *et al.* (1976) agree that decision-making by managers is not necessarily scientific and systematic. They state that studies have shown that most managers are action orientated and dislike reflective activities. Consequently important decisions may be made on the basis of 'soft' information such as gossip, hearsay and speculation. Ferrar (1974) however, does not believe that this is how investment decisions in pollution control equipment are made. He suggests that investments in pollution control are extremely sensitive to financial calculations. Such calculations, for example, the net present value of investments, would include the estimation of the value of **fines and penalties avoided** by the company by the acquisition of such equipment.

Likewise it appears that financial calculations of **return on investment** are of importance in waste control investment decisions, particularly in terms of the value of the recovered product (Anon, 1975a; Anon, 1982b). In this respect it must be pointed out that **quota size** may play a role in decisions to invest in waste control equipment from the point of view that waste control systems are a means of maximizing utilization of a seasonally limited resource. The potential **competitive advantage** that could be achieved, by the installation of waste control equipment, over those companies that do not, could be an important consideration. On the other hand if the quota is set too low, waste recovery may not be an economically viable option.

When companies are compelled by law to install waste control equipment, the managers may seek ways to mitigate the financial impact of such investments. This may be especially true in those cases where the financial returns from such investments may be marginal. Under such conditions **existing financial incentives** within the Income Tax Act may be of some importance in investments of this nature. Another option for reducing the direct cost to firms of legally mandated expenditure according to Kefalas and Carrol (1976/7), is to **pass these costs on to customers.** This option may be attractive to managers as it may have the least adverse effect on the **profitability of a company** especially when the installation and operating **costs of the system** are high. In the case of public companies high production costs could translate into lower dividends being paid out to **share holders.** This could in turn result in share holders withdrawing their capital.

The **pollution prevention** capabilities of waste control systems, may be of importance in decisions to invest in waste control systems. These systems may have the potential to pay for themselves, whereas dedicated pollution control systems cannot generate revenue. According to Royston (1979), business tends to regard pollution control as a major financial burden to be avoided as long as possible and then to be undertaken only very reluctantly. This may be because expenditures on pollution control are designed to affect the long-term quality of life but add nothing materially to short-term productivity (Sihler and Meiburg, 1977).

The issues involved in waste control investment decisions presented above formed the basis for questions A1 and A2 (Figure 3.4.1). These questions were aimed at establishing the relative

A1. HOW IMPORTANT ARE EACH OF THE FOLLOWING FACTORS IN INFLUENCING YOUR DECISION TO INVEST IN WASTE CONTROL EQUIPMENT?

Investments in waste control equipment can off-set costs either partially or wholly in terms of materials recovered.

Please tick in the appropriate space
U = Unimportant
M = Moderately important
V = Very important

	U	M	V
A. SPECIFIC ANTI-POLLUTION REGULATIONS (in terms of the value of fines avoided)			
B. QUOTA SIZE (waste control equipment can improve yield of the fixed amount of raw material that the company has to process)			
C. RETURN ON INVESTMENT (value of product recovered)			
D. PREVENTION OF POLLUTION (protection of the local environment)			
E. PROFITABILITY OF THE COMPANY			
F. COST OF THE WASTE CONTROL SYSTEM (capital, installation and operating)			
G. COMPANY IMAGE (complaints from the public)			
H. COMPETITIVE ADVANTAGE (of installing a waste recovery system)			
I. EXISTING FINANCIAL INCENTIVES (initial allowances, depreciation etc.)			
J. THE ABILITY TO PASS COSTS ON TO CUSTOMERS			
K. INTERESTS OF COMPANY SHARE HOLDERS			
L. OTHER: PLEASE SPECIFY			

A2. AFTER CONSIDERATION OF THE FACTORS (A - K) LISTED ABOVE, PLEASE RANK ALL ELEVEN OF THE FACTORS IN ORDER OF THEIR IMPORTANCE TO YOU WHEN MAKING CAPITAL INVESTMENT DECISIONS IN WASTE CONTROL TECHNOLOGY.

1 = most important; 11 = least important, e.g. if you feel that G is the most important factor, write it in the space next to 1 and so on.

1 . . . 2 . . . 3 . . . 4 . . . 5 . . . 6 . . . 7 . . . 8 . . . 9 . . . 10 . . . 11 . . .

FIGURE 3.4.1
Question A1 and question A2

importance of economic, social and legal factors to managers of the fish processing industry when making investments in waste control equipment. The economic factors included the cost of the system, return on investment, quota size, the profitability of the company, existing financial incentives, competitive advantage and the interests of the share holders. Social factors included the ability to pass on costs to customers, prevention of pollution and company image. The role played by law in investment decisions was represented by anti-pollution regulations. Although the above factors were presented separately to respondents for evaluation in question A1, in reality some of these factors are interdependent to some degree. The aim of presenting each of these factors separately was primarily to highlight whether social, economic or legal

PLEASE INDICATE TO WHAT EXTENT YOUR ARE IN AGREEMENT WITH THE FOLLOWING STATEMENT.

Please circle the appropriate number
1 = Strongly agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly disagree

E7. QUOTA RESTRICTIONS HAVE SIGNIFICANTLY INFLUENCED INVESTMENT IN WASTE RECOVERY SYSTEMS

1	2	3	4	5

FIGURE 3.4.2
Question E7

factors had the greatest influence in the waste control investment decisions of fish processing industry management.

Respondents were asked to rate and rank the various factors involved in waste control investment decisions in order of their perceived importance of such decisions. The relative importance of the various factors was obtained by counting the number of times that each factor was rated as very important by respondents. The ranked factors were analysed by multidimensional unfolding analysis in order to generate perceptual maps to discover the structure underlying such investment decisions.

A separate question (E7, Figure 3.4.2) was constructed to investigate the effect of quota restrictions in influencing investments in waste recovery. This was done in order to investigate the relationship between quota size and the viability of such investments.

3.5 FISH PROCESSING INDUSTRY MANAGEMENT OPINION AND VIEWPOINT REGARDING ASPECTS OF POLLUTION CONTROL

In order to gain an insight into the reasons for the poor pollution abatement performance of many factories within the industry, the researcher decided to probe some issues relating to pollution control directly so that respondents' viewpoints and opinions would not have to be inferred.

The first issue that needed to be addressed was that of the perceived relationship between untreated factory wastes and harm to the marine environment (question E9; Figure 3.5.1). It seems reasonable to assume that the attitudes of managers of the fish processing industry regarding the necessity for expenditure on pollution control will be largely dependent on their beliefs about the damage that untreated wastes can cause. It seems likely as well that the perceptions of managers in regarding the potential harmfulness of untreated wastes will also

PLEASE INDICATE TO WHAT EXTENT YOUR ARE IN AGREEMENT WITH THE FOLLOWING STATEMENT.

Please circle the appropriate number
1 = Strongly agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly disagree

E9. UNTREATED FISH FACTORY EFFLUENT CAN RESULT IN SIGNIFICANT HARM TO THE MARINE ENVIRONMENT.

1	2	3	4	5

FIGURE 3.5.1
Question E9

play a role in their assessment of whether their expenditure on pollution control has been economically justifiable (Question E4, Figure 3.5.2).

An issue related to the perceptions of managers regarding the perceived economic justification of pollution control expenditure, is that of the impact of legally mandated costs. Some industrial managers have claimed that environmental protection legislation has contributed to

PLEASE INDICATE TO WHAT EXTENT YOUR ARE IN AGREEMENT WITH THE FOLLOWING STATEMENT.

Please circle the appropriate number
1 = Strongly agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly disagree

E4. OUR COMPANY'S EXPENDITURE ON POLLUTION CONTROL HAS BEEN ECONOMICALLY JUSTIFIABLE

1	2	3	4	5

FIGURE 3.5.2
Question E4

PLEASE INDICATE TO WHAT EXTENT YOUR ARE IN AGREEMENT WITH THE FOLLOWING STATEMENT.

Please circle the appropriate number
1 = Strongly agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly disagree

E6. POLLUTION CONTROL REGULATIONS CONTRIBUTE SIGNIFICANTLY TO INCREASED PRODUCTION COSTS.

1	2	3	4	5

FIGURE 3.5.3
Question E6

unemployment, fuelled inflation, stifled investment and economic growth and hindered economic efficiency (Leonard *et al.*, 1977). In order to establish whether similar views were held by managers of the fish processing industry, managers were asked about the perceived relationship between pollution control regulations and production costs (Question E6, Figure 3.5.3).

F1. WHAT PERCENTAGE OF YOUR COMPANY'S ANNUAL BUDGETED EXPENDITURE DO YOU ESTIMATE IS SPENT ON POLLUTION CONTROL?
(Averaged over a five-year period)

CAPITAL EXPENDITURE		OPERATING EXPENDITURE	
0–4 %	☐	0–4 %	☐
5–9 %	☐	5–9 %	☐
10–14 %	☐	10–14 %	☐
15–19 %	☐	15–19 %	☐
Over 20 %	☐	Over 20 %	☐
Cannot be estimated	☐	Cannot be estimated	☐
Cannot be divulged	☐	Cannot be divulged	☐

FIGURE 3.5.4
Question F1

The researcher felt that it would be of value to substantiate the viewpoints of managers regarding the relationship between pollution control expenditure and production costs. Managers were therefore asked to estimate the average percentage of budgeted expenditure allocated to pollution control (Question F1, Figure 3.5.4). They were asked to estimate this average percentage over a five year period in terms of both capital and operating expenditure as investments in pollution control tend to be made on an irregular basis (Royston, 1979).

This chapter has presented an overview of the construction of the first questionnaire. The development of specific questions, based on factors that could influence managers of the fish processing industry to invest in pollution and waste control systems, were then described.

CHAPTER 4

Questionnaire Development and Construction: Part II

This chapter continues the description of the preparation of the first questionnaire. Pollution control policy issues are examined with a view to establishing the deficiencies of current policy. The discussion is then directed at the various policy options that could be used to control pollution as a prelude to establishing the preferred policy options of the fish processing industry.

4.1 FISH PROCESSING INDUSTRY MANAGEMENT VIEWPOINT ON CURRENT POLLUTION CONTROL LEGISLATION

During informal discussions with senior executives in the fish processing industry, concern was expressed about the ability of the industry to comply with certain provisions of existing legislation. Claims were also made that insufficient consultation had taken place between the industry and the government prior to the promulgation of new regulations (Malherbe pers. comm., 1987; Silverman pers. comm., 1987). It was therefore decided to investigate these issues to establish whether such views were representative of the fish processing industry management. The viewpoints and opinions of the Southern African fish processing industry management regarding current pollution control legislation are important because they may suggest possible explanations for the inadequacy of this policy to control fish factory pollution.

A study conducted by Kefalas and Carrol (1976/7), surveyed American business executive opinion regarding the Federal Administration's environmental protection policy. The Kefalas and Carrol study served as the basis for some of the questions used in the present study to survey the viewpoints of the Southern African fish processing industry management with regard to pollution control legislation.

Provisions of a large number of South African parliamentary acts, provincial ordinances and local by-laws are concerned with the control of pollution in fish processing industry. The researcher therefore decided to establish what the general perceptions of managers were regarding all the legislation pertinent to the industry, rather than attempting to establish the perceptions held about specific laws and regulations.

A question of Kefalas and Carrol (1976/7) concerned with the realism and timeliness of environmental protection was expanded to include other aspects of legislation. This was done in order to highlight other possible problems with current pollution control policy. Managers were asked to give their general impressions about existing pollution control legislation with regard to **realism, timing of regulation implementation, fairness in implementation, severity or leniency of penalties, flexibility as to the method of controlling pollution, complexity of laws and regulations, number of regulations** and **the opportunity for industry input into the compilation of regulations.** Managers were required to give their impressions about existing pollution control legislation in terms of each of the above issues. In order to do this, managers

D1. HOW DO YOU FEEL ABOUT EXISTING POLLUTION CONTROL LEGISLATION WITH REGARD TO THE FOLLOWING ISSUES?

Please circle the category which best describes each issue.

A. REALISM
very unrealistic unrealistic realistic very realistic

B. TIMING OF REGULATION IMPLEMENTATION
very premature premature timely overdue

C. FAIRNESS IN IMPLEMENTATION
very unfair unfair fair very fair

D. PENALTIES
very severe severe adequate lenient very lenient

E. FLEXIBILITY (as to method of controlling pollution)
very inflexible inflexible adequate flexible very flexible

F. NUMBER OF REGULATIONS
far too many too many enough too few far too few

G. COMPLEXITY OF LAWS AND REGULATIONS
very complex complex adequate simple very simple

H. OPPORTUNITY FOR INDUSTRY INPUT INTO COMPILATION OF REGULATIONS
very limited limited adequate excessive

FIGURE 4.1.1
Question D1

PLEASE INDICATE TO WHAT EXTENT YOUR ARE IN AGREEMENT WITH THE FOLLOWING STATEMENT.

Please circle the appropriate number
1 = Strongly agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly disagree

E2. IT IS THE WAY THAT THE LAW IS APPLIED RATHER THAN THE LAW ITSELF THAT CREATES PROBLEMS.

1	2	3	4	5

FIGURE 4.1.2
Question E2

PLEASE INDICATE TO WHAT EXTENT YOUR ARE IN AGREEMENT WITH THE FOLLOWING STATEMENT.

Please circle the appropriate number
1 = Strongly agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly disagree

E5. THE GOVERNMENT WILL ONLY TAKE PERSISTENT OFFENDERS TO COURT PREFERRING TO SETTLE MOST DISPUTES BY NEGOTIATION.

1	2	3	4	5

FIGURE 4.1.3
Question E5

were required to choose a response, from a list of alternatives, that was closest to their own position with regard to each issue (Question D1, Figure 4.1.1).

South African environmental laws are generally regarded as satisfactory legal instruments for positive action (Pentreath, 1978; Rabie and Erasmus, 1983). The fault appears to lie in the way in which these laws are enforced. Sporadic, selective or inadequate enforcement can lead to a situation in which the industry ignores the efforts of government with relative impunity, secure in the knowledge that government will only take the most blatant offenders to court (Blackman and Baumol, 1980; Forster, 1976).

In view of the above suggestion that the problem with current environmental policy was one of administration and not the law itself, the researcher decided to establish whether this view was also held by the managers of the fish processing industry (Question E2, figure 4.1.2)

In addition, managers were specifically asked if they believed that the government would prefer to prosecute or negotiate with offenders (Question E5, Figure 4.1.3).

Managers were questioned as to whether they believed that the discharge of untreated wastes should remain a criminal offence (Question E8, Figure 4.1.4).

This question was included to augment the question (E9, given above in section 3.5.) concerning the perceived relationship between the discharge of untreated wastes and harm to the marine environment. Both of these questions were included to provide an insight into fundamental attitudes held by respondents about the perceived need for pollution control measures taken by the fish processing industry.

PLEASE INDICATE TO WHAT EXTENT YOUR ARE IN AGREEMENT WITH THE FOLLOWING STATEMENT.

Please circle the appropriate number
1 = Strongly agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly disagree

E8. THE DISCHARGE OF UNTREATED WASTES FROM FISH FACTORIES SHOULD REMAIN A CRIMINAL

1	2	3	4	5

FIGURE 4.1.4
Question E8

4.2 POLLUTION CONTROL POLICY PREFERENCES OF FISH PROCESSING INDUSTRY MANAGEMENT

The highlighting of general problem areas within current pollution control legislation is important from the point of view of developing better regulations. It is however also necessary to examine specific policy instruments with the objective of identifying those policy options which are most likely to achieve the goal of protecting the environment from pollution. A knowledge of fishing industry preferences as to the pollution control policies that they would prefer the government to adopt could contribute to the formulation of more effective policy.

According to Johnson (1972) policies that are perceived by industry to be fair and reasonable are more likely to be complied with than policies that are perceived to be too stringent or economically crippling. However, policies that serve the interests of the industry, may not necessarily serve the best interests of society. Nonetheless preferred policies should be given serious consideration, particularly when pollution control policy may be rendered ineffective due to government administrative deficiencies (Rabie and Erasmus, 1983).

Pollution control can be achieved using any one of a number of policy approaches applied either alone or in combination. Pollution control policies may be directed at controlling pollution directly by regulating the technology that may be used in production or directed at the residuals produced. Another approach that could be used, while not specifically aimed at controlling pollution, may achieve similar results. This approach involves limiting the quantities of resources that may be used in production. Pollution control can also be achieved by holding people accountable for the negative social costs that are imposed on others as a result of their activities. The major policy options that can be used to control pollution are given below. These options were presented to management of the fish processing industry in order to ascertain their personal preferences among the various policy options (Figure 4.2.).

B1. WHICH OF THE FOLLOWING POLICY OPTIONS WOULD YOU LIKE TO SEE USED AS THE PRINCIPAL MEANS OF PROMOTING POLLUTION CONTROL IN THE FUTURE?

Investments in pollution control equipment do not contribute directly to profit and do not form part of the process of manufacture e.g. scrubbing towers to prevent air pollution.

Please tick the appropriate space: Y = Yes; U = Uncertain; N = No

	Y	U	N
A. PERMIT SYSTEM BASED ON THE SPECIFICATION OF (APPROVED) PRODUCTION EQUIPMENT WITH A PENALTY FOR PERMIT CONTRAVENTION (e.g. Atmospheric Pollution Prevention Act; choice of equipment limited)			
B. PERMIT SYSTEM BASED ON MAXIMUM LEVEL OF WASTE THAT MAY BE DISCHARGED WITH A PENALTY FOR PERMIT CONTRAVENTION (e.g. Water Act; the method of achievement left to the individual company)			
C. PRIVATE LAW REMEDIES (which allow for individual victims of pollution to sue the polluter for compensation or to apply for an interdict)			
D. FINANCIAL INCENTIVES IN THE INCOME TAX ACT (e.g. tax credits, initial allowances and depreciation for approved investments in anti-pollution equipment. At present the Act only applies to equipment used in the process of manufacture)			
E. LEGISLATION BASED ON THE EFFECTS OF POLLUTION (e.g. the Sea Fisheries Act which makes it an offence for any one to discharge anything to sea that may have adverse effects on the marine environment; guilt is presumed until the contrary is proved)			
F. COMPULSORY INSURANCE (for compensating victims of pollution)			
G. INPUT SURCHARGES ON RAW MATERIALS (levy on the raw materials used in production)			
H. EFFLUENT / EMISSION CHARGES (residuals tax)			
I. NON-COMPLIANCE PENALTIES (to remove the economic advantage of not complying with pre-set discharge conditions)			
J. SUBSIDIES AND GRANTS FOR APPROVED ANTI-POLLUTION EQUIPMENT			
K. SUBSIDIES FOR APPROVED IN-PLANT MODIFICATIONS TO IMPROVE EFFICIENCY (and thereby improving effluent quality; at present no such incentive exists)			
L. GOVERNMENT EXPROPRIATION OF OBSOLETE POLLUTION PRODUCING EQUIPMENT (compensation received to be used to off-set the cost of new more efficient equipment)			
M. TAX ON PRODUCTION OUTPUT OR RESTRICTING THE QUANTITY OF GOODS PRODUCED (reducing pollution by decreasing production)			
N. MARKETABLE POLLUTION PERMIT SYSTEM (A fixed number of rights to pollute up to a specified level in a region are obtained from government by bidding. Companies that manage to decrease their pollution to below the level for which they hold a right, may sell the surplus pollution capacity to other companies wishing to enter the region or use it for their own expansion)			
O. OTHER: PLEASE SPECIFY			

FIGURE 4.2 (*a*)
Question B1

B2. PLEASE RANK ALL FOURTEEN OF THE POLLUTION CONTROL POLICY OPTIONS (A - N) IN ORDER OF PREFERENCE, THAT YOU WOULD LIKE TO SEE USED AS THE PRINCIPAL MEANS OF PROMOTING POLLUTION CONTROL.

1 = most preferred; 14 = least preferred.

1 . . . 2 . . . 3 . . . 4 . . . 5 . . . 6 . . . 7 . . . 8 . . . 9 . . . 10 . . . 11 . . . 12 . . . 13 . . . 14 . . . 15 . . .

FIGURE 4.2 (*b*)
Question B2

Respondents were asked which of the policy options presented above, in the form of a composite fixed-alternative question, they would like to see used as the principal means of promoting **pollution** control (Questions B1 and B2, Figure 4.2.). Respondents were required to rate and rank these options in order of preference. The ratings were tabulated to show those pollution control policy options that were the most preferred. The rank ordered preferences were analysed using multidimensional unfolding analysis to investigate the structure underlying the preferences of the managers of the fish processing industry.

The key attributes of the major pollution control policy approaches have been presented below. This has been done in order to gain an understanding of why certain pollution control policy options are favoured by the managers of the fish processing industry, whereas others are not.

4.2.1 Controlling The Pollution Source

Pollution control policy may be aimed directly at the pollution source. Source controls may promote acquisition and use of specific equipment or processes. Regulatory legislation incorporates numerous mechanisms for the control of environmental problems. Legislation in this category is usually prescriptive in that a process, procedure, result or inter-relationship is set out. The legitimate pursuance of certain activities under a regulatory system is usually subject to licencing or registration incorporated in a permit system.

Permit systems are often based on standards which are related to the quality of the receiving environment (Hirvonen and Côte, 1986). Standards however, may not be based on scientific knowledge and indeed be arbitrary. 'A standard can be defined as a legally enforceable minimum requirement established by an authority' (Lusher, 1984). Essentially two types of standards are used in South Africa. These are the **environmental quality standard** and the **specification standard**.

The environmental quality standard indicates what reduction in liquid discharges must be achieved. The choice of method and equipment, needed to achieve the standard, is usually left up to the individual company. In South Africa, general and special standards are prescribed for effluents.

Provision is made in terms of the Water Act 54 of 1956 for firms wishing to discharge an effluent to obtain an exemption from the Department of Water Affairs before the commencement

of production. This exemption would conditionally release such firms from complying with either the general or special standards.

Specification standards can be applied to the technology used in production. Equipment used in production may be specified on the grounds that it is capable of reducing pollution by a known amount. Specification standards differ from quality standards in that the primary determination of allowable contaminants is based on analysis at source and not on actual concentrations in the receiving environment. Specification standards may however reflect extrapolations of criteria that define the desired use of the receiving environment.

In South Africa a system of emission quality control standards has been considered impractical except in the case of smoke from boilers and other fuel burning appliances (Fuggle and Rabie, 1983). Consequently the Atmospheric Pollution Prevention Act 45 of 1965 makes provision for the Chief Air Pollution Officer to issue a registration certificate to industries wishing to operate scheduled processes. These registration certificates specify the use of the best practicable technology (BPT), which reflects an application of demonstrable and sound treatment technology that is affordable by the relevant sector of the industry (Freeman, 1980; Hirvonen and Côte, 1986).

Industrial noise can be controlled by means of performance standards which specify the maximum noise level allowable. Noise can also be controlled by the specification of the technology that may be used. Industrial noise in South Africa can be regulated either in terms of the Machinery and Occupational Safety Act 6 of 1983 or by means of by-laws in which standards are not prescribed but reliance is placed on vague subjective descriptions such as 'excessive noise' (Semmelink and Rabie, 1983).

Regulatory legislation is usually supported by the application of the criminal penalty. This penalty can be invoked when the conditions set out in the permit are not being adhered to or that a person is engaging in a scheduled process without a licence (Fuggle and Rabie, 1983). The most important aspect of the permit system is that it is possible to take preventative action before harm is done. Furthermore, a licence to operate could include provisions whereby the licence could be suspended or cancelled for not complying with its conditions.

Enforcement of regulatory legislation could be made more effective if the courts, in addition to the normal fine, were to determine the monetary advantage gained by the convicted person in the commission of the offence and impose a fine equal to that amount (Blackman and Baumol, 1980; Brady and Cunningham, 1981; Miller, 1980; Rabie and Erasmus (1983), suggest that in **non-compliance penalties** could be extended to include the confiscation of products and equipment used in their manufacture. However, Skinner (1973) is of the opinion that a person who is punished is not necessarily less inclined to behave in a given way. He is more likely to learn how to avoid punishment.

Administrative deficiencies and occasional outright failures of the regulatory approach, have led some regulatory authorities to investigate programmes that employ pricing incentives to control pollution (Blackman and Baumol, 1980; Brady and Cunningham, 1981). Some authors believe that since the origin of environmental problems lies in economic activity, economic incentives can be used to solve these problems (Drucker, 1977; Krier and Bell, 1980; Pigou, 1950; Rosencranz, 1981).

Economic incentives comprise measures taken by government to encourage industry to comply with the law. The concept behind the use of economic incentives is to alter the relative prices for engaging in various activities in such a way as to make it less costly to comply with regulations than to ignore them (da Cunha, 1982; Brady and Cunningham, 1981). Fiscal measures are specific in that the government can target the financial inducement at specific industries to encourage them to invest in specific technology, use specific fuels, or even to locate their operations in specific areas (Delogu, 1976; Downer, 1976; Brady and Cunningham, 1981). Positive investment incentives lower the costs of making certain purchases. Downer (1976, p3) defines an investment incentive as a financial advantage given to a firm, either in the form of a cash grant or by some alteration in the size or timing of the firm's tax payments, in return for making a specified type of investment. The most common positive financial incentives are **income tax allowances** and **subsidies**, both of which have many features in common.

The most common incentives within the South African Income Tax Act 58 of 1962, are accelerated depreciation (wear and tear) allowances, investment exemptions and investment tax credits (Silke *et al.*, 1982, p9). At present there are no provisions in this Act for dedicated pollution control equipment. In order to qualify for the allowances in the Income Tax Act (sections 11(e), 12(1) and 12(2)), the equipment must form part of he process of manufacture.

Various tax incentives, particularly those aimed at stimulating economic growth, have resulted in a marked reduction of South African corporate tax payments. The government has not been able to accurately quantify the loss of revenue resulting from the granting of such allowances (Margo, 1987; Miltz, 1984). This has led to the recommendation that the government should give direct subsidies rather than use the tax system for activities that it wishes to promote (Margo, 1987). According to James and Nobes (1978), subsidies are attractive policy instruments because they are quantifiable. Furthermore, a high degree of specificity and control can be built into them.

Some authors are in favour of some short term financial assistance for companies which built their production facilities under one set of regulations, and are at some later date are required to improve their abatement performance (Koppernaes, 1975; Passer, 1971; Nelson, 1973). In these cases where factories are unable to meet the new level of abatement performance that is required, Fuggle and Rabie (1983) propose that two other options could be considered. Firstly, where upgrading is not economically feasible, the plants concerned could be allowed to operate at less than the desired level for the rest of their economic lives. Secondly, if the authorities should decide that the first option is not acceptable they could **expropriate** the obsolete equipment. In the case of government expropriation, the compensation received could be used to offset some of the costs of acquiring new technology.

4.2.2 Controlling The Residuals Of Production

Another approach to controlling pollution from fish factories is to target legislation at the residuals of production. Legal instruments in this category include statutory legislation which incorporates direct controls, private law delictual remedies and residuals charge systems.

Statutory law is enacted by Parliament and bodies to which power has been delegated (Miller *et al.*, 1978). Most of the laws for the protection of the environment in South Africa fall into this category. Such laws provide for the direct control of pollution. Direct controls have

also been the mainstay of environmental policy in the United States and Europe. Direct controls have been termed a 'command and control approach' and incorporate prohibitory legislation (Deland, 1980). Prohibition involves the total legislative ban on various activities. Such legislation is usually supported by the application of the criminal penalty as a primary or independent sanction (Rabie and Erasmus, 1983).

South African legislation pertaining to pollution originating from the activities of the fishing industry is contained in a number of parliamentary acts, provincial ordinances, local by-laws, and ministerial regulations. **Prohibitory legislation** pertaining to the fish processing industry appears to be aimed at controlling pollution which results from the activities of the industry and which could have **adverse effects** on the environment. Such regulations are usually justified by government relying on the public health argument that suspected negative effects are a sufficient basis for compelling abatement (Grima, 1976; Hagevik, 1970).

The use of direct controls to protect the environment supported by the criminal sanction appears to be an inefficient coercive tool. This is because the accused is protected in many ways. The burden of proof and evidentiary requirements are very onerous and present formidable standards that have to be met in order to secure a conviction (Rabie and Erasmus, 1983; Rabie and Lusher, 1986; Willard, 1981). Amendments have however been made to some South African laws to facilitate the position of the authorities.

A 1972 amendment to the Water Act 54 of 1956 (section 23 (1)) improved the position of the government considerably with respect to securing a conviction. In order to secure a conviction in terms of this Act, the state has only to prove that the accused's action could render water less fit for the purposes for which it is or could ordinarily be used. The mere potential threat of pollution is enough to attract liability (Rabie and Lusher, 1986). An amendment to the Sea Fisheries Act 58 of 1973 has similarly improved the position of the state. The presumption is made in terms of this amendment that pollution occurring within eight kilometers of a fish factory was or is being caused by that factory until the contrary is proved.

Common law procedures can also be used to control and prevent pollution. Common law involves custom, judicial precedent and legal treatises. The delictual remedies afforded by the *actio legis aquiliae* and the *actio injuriarum* are available to those who have been adversely affected by pollution (Rabie and Erasmus, 1983). When the residuals of production result in the violation of a person's property rights that person is able to obtain an **interdict** to restrain the activities of the polluter. A victim of pollution may also seek redress in the form of **compensation.**

The interdict is potentially one of the most valuable remedies in the field of environmental protection. This is because it is designed to regulate future conduct. In order to obtain an interdict, one must prove unlawful conduct or the threat of such conduct. An interdict has been used to restrain activities that cause pollution in a number of South African cases. For example, during 1987, an interdict was used to stop the operation of a pet-food company in the western Cape, which was creating an odour nuisance (Anon, 1987a; Anon, 1987c; Tucker pers. comm., 1987).

According to Fiksel (1986), common law procedures appear to be the most reasonable means of dealing with compensating the victims of pollution. However, before damages can be recovered from a defendant, it is necessary to prove fault (*mens rea*) on the part of the defendant. Courts in some states in the United States of America have relaxed the proof of causation

requirement by shifting the burden to the defendant who must prove his innocence (Fiksel, 1986). This measure has eased the difficulties associated with compensation claims.

Rabie and Erasmus (1983), agree that a case may be made for reversing the onus of proof by requiring the defendant to prove absence of fault on his part or even more radically dropping the requirement of fault and introducing liability for the operation of certain processes. Another possible option that could be used to control pollution would be to replace delictual liability with **compulsory insurance.**

Another option for controlling pollution, is to tax the residuals of production by means of **effluent and emissions charges** (Ferrar and Horst, 1974). An effluent or emission charge can be defined as a tax introduced with the primary purpose of discouraging an environmentally undesirable course of action (Forster, 1976). The charge system, allows each company to decide on whether or not to treat their effluents and emissions. Firms that are able to reduce their effluents and emissions at a cost that is less than the residuals charge, could rationally be expected to do so. Those that can not, and elect to pay the charge, will continue to have an incentive to reduce their discharges (Bidwell, 1982; Baumol, 1974).

The residuals charge system has not been used in South Africa. Three demersal fish factories based in Cape Town, do however pay for discharging their effluents into municipal sewers. These charges are in effect user fees as they are not primarily intended to discourage the use of the environment for the discharge of wastes (da Chuna, 1982; Foster, 1976). User fees are simply a proper price for the use of a public resource, and are usually imposed to recover treatment costs.

4.2.3 Pollution Control By Manipulation Of Production Levels

Pollution resulting from industrial processes can be controlled indirectly by manipulating the quantity of materials consumed in the manufacturing process or the quantity of goods produced. This can be achieved in a number of ways. The amount of raw material available for processing could be limited by means of quotas. The Southern African fish processing industry, is already subject to resource control in the form of quotas. Quotas are granted in accordance with provisions of the Sea Fisheries Act 58 of 1973. These quotas specify the total number of tons of particular fish species that may be removed from the sea in any fishing season by each fishing company (Grindley and Rabie, 1983).

As is the case with residuals taxes, the price mechanism can be used to achieve social goals. Abstraction charges and **input surcharges** are policy options that can be employed to discourage the use of certain environmental resources (Brady and Cunningham, 1981; Baumol, 1974; Delogu, 1976; Hoskins, 1971). It was Pigou (1950) who noted that the marginal direct costs to firms of producing products may not be the same as the cost to society. Divergences between the marginal direct costs of production and the social costs resulting from pollution can, in theory, be eliminated by imposing a **tax on the output of production** which gave rise to the pollution (Tisdell, 1982/3). A more direct means of decreasing production levels is to place a **restriction on the quantity of goods produced.**

4.2.4 Pollution Control Using Environmental Planning Options

Bekerman (1975) is of the opinion that it is acceptable to make use of the environment for the disposal of wastes generated during production provided that the gain in goods desired by society exceeds the loss of the environment by society. Planning controls can be used to prescribe conditions relating to permissible activities or acceptable discharges in specific geographical areas. Zoning and other land use restrictions are important regulatory tools. In South Africa, legislation dealing with land use planning is incorporated within the Physical Planning Act 88 of 1967. Although not specifically aimed at controlling pollution, this Act can be used to control the location of pollution sources. Provision is also made in the Atmospheric Pollution Prevention Act 45 of 1965, which requires that the locality of the proposed source be taken into account before the granting of permission to set up certain types of production facilities.

An innovative approach to pollution control is that of extending private ownership rights to include the right to discharge pollutants into the environment (Howe and Lee, 1983). The government could decide on a maximum allowable level of a particular pollutant for a particular environment. This level could be based on the assimilative capacity of that environment (Grima, 1976; Hahn, 1982). The total assimilative capacity for a particular geographical region could then be partitioned into a fixed number of pollution rights. Each right would entitle the holder to discharge specified pollutants up to a predetermined level. Ownership rights could be strengthened and formalized into a **market of transferable discharge permits** (Brady and Cunningham, 1981; Campbell *et al.*, 1972).

Marketable pollution rights could be distributed free of charge or be acquired from government by competitive bidding when the market is started (Brady and Cunningham, 1981; Hahn, 1982). Once the market comes into operation, existing pollution sources have an incentive to reduce their emissions below current levels. Each pollution source that is able to reduce its emissions below its current levels would then have two options. The first option would be to sell-off the unused portion of its existing rights, at a profit, to new firms wishing to enter the region. The second option would be to retain its surplus abatement possibilities, for subsequent expansion of its own production facilities (Hahn, 1982).

A modified market in pollution rights, namely the 'off-set policy', has been in operation in the United States of America since the end of 1976. This policy which was formulated by the Environmental Protection Agency, was based on a ruling in the U.S. Clean Air Act (Blackman and Baumol, 1980). It was designed to avert a complete halt in development in areas unable to sustain additional pollution sources. This policy makes provision for a new pollution source to enter an area only if other pollution sources reduce their emissions enough to 'off-set' that of the new source. To date however most of the 'off-sets' have been between different units belonging to the same company (Rosencranz, 1981).

4.3 EQUITY AND EFFICIENCY CONSIDERATIONS OF POLLUTION CONTROL POLICY OPTIONS

The pollution control policy options presented above have vastly different equity and efficiency implications for society and members of the industry. These implications are dependant on who ultimately pays for cleaning up the environment and whether such policy options are applied uniformly or on a case-by-case basis.

Some authors feel that tax incentives and subsidies are not efficient ways of reducing pollution because they amount to grants awarded to polluters and their customers (da Cunha, 1982; Delogu, 1976; Grima, 1976; Hagevik, 1970; Passer, 1971; Prud'homme, 1977). Such schemes violate the 'polluter pays' principle (Senecca and Taussig, 1979; Shapiro, 1977). The question is really one of how the public, that is, as **taxpayers** or **consumers**, will pay the social costs of production. In order to address this issue, respondents were asked whether they believed that the taxpayer or company's customers should pay for the protection of the environment (Question E1, Figure 4.3.1).

PLEASE INDICATE TO WHAT EXTENT YOUR ARE IN AGREEMENT WITH THE FOLLOWING STATEMENT.

Please circle the appropriate number
1 = Strongly agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly disagree

E1. TAX PAYERS RATHER THAN COMPANY CUSTOMERS SHOULD PAY FOR THE PROTECTION OF THE ENVIRONMENT

1	2	3	4	5

FIGURE 4.3.1
Question E1

The major flaw in legislation that requires all pollution sources to reduce discharges uniformly, is that they are inequitable because they do not take the variation in costs that would be incurred by various companies into account (Alexander, 1984; Hagevik, 1970). A further problem with uniform requirement for all dischargers, is that it does not take the assimilative capacity of the receiving environment into account. This could lead to the required reduction in discharges being too stringent in some cases and too lenient in others. Respondents were therefore asked for their opinion as to whether regulations should be applied on a **case-by-case** basis or by means of a **uniform standard** (Question E3, Figure 4.3.2).

PLEASE INDICATE TO WHAT EXTENT YOUR ARE IN AGREEMENT WITH THE FOLLOWING STATEMENT.

Please circle the appropriate number
1 = Strongly agree
2 = Agree
3 = Uncertain
4 = Disagree
5 = Strongly disagree

E3. POLLUTION CONTROL SHOULD BE APPLIED ON A CASE BY CASE BASIS RATHER THAN BY MEANS OF UNIFORM STANDARDS

1	2	3	4	5

FIGURE 4.3.2
Question E3

This chapter continued with the description of the preparation of the sections of the first questionnaire that were concerned with policy issues. The development of questions that were used to establish the viewpoints of managers regarding deficiencies of current legislative approaches was given. The discussion was then directed at the various pollution control policy options that fish processing industry management may prefer the government to adopt as a means of promoting pollution control. The major attributes of these pollution control policy options were presented in order to gain an insight into the possible preferences of the fish processing industry managers.

CHAPTER 5

The Relative Importance of Factors in Influencing Waste and Pollution Control Investments of Senior Management of the Fish Processing Industry

The information presented in this and the following chapter (six), was derived from the replies to the first questionnaire (Appendix II B). The first questionnaire surveyed the viewpoints and opinions of fish processing industry management concerning waste and pollution control investment decisions as well as their preferences for various pollution control policies.

A description of the development and findings of the relevant sections of the second questionnaire is presented in this and the following chapter. This was considered appropriate because the primary objective of the second questionnaire was to give the respondents the opportunity to refute or affirm the findings and preliminary conclusions drawn from their responses to the first questionnaire. It was therefore decided to discuss the construction of the second questionnaire as well as the information gathered from the second questionnaire together with the findings of the first questionnaire.

This chapter begins with a description of the development of the second questionnaire. Information pertaining to response rates of the two questionnaires as well as the demographic information that was used to classify respondents into groups on the basis of their responses to questions is then given. The greater part of this chapter is concerned with the opinions and viewpoints of managers of the fish processing industry with regard to waste and pollution control investment decisions. The respondents' evaluation of current pollution control legislation and their preferences for various pollution control policy options is dealt with in the following chapter.

5.1 THE DEVELOPMENT AND CONSTRUCTION OF THE SECOND QUESTIONNAIRE

The first draft of the second questionnaire initially consisted of a list of the major findings in point form drawn from the first questionnaire. Respondents were required simply to state whether they agreed, disagreed or were uncertain with regard to each of the findings. This approach was abandoned because it forced respondents to choose among three categories of responses, none of which may have accurately reflected a particular respondent's viewpoint. Furthermore, simply presenting the findings did not provide an adequate framework of reference for respondents in which to evaluate the findings. In order to overcome these problems the researcher decided to present the summary findings in greater detail and in context. This summary was sent to the respondents together with a request, contained in a covering letter, to comment on any issue which they wished. A column was provided for comments adjacent to the findings. This approach for eliciting information, in effect, represents an unstructured type of questionnaire comprising open-ended questions. In this case initial stimuli, namely a number

of statements, are presented to respondents. Respondents are then free to formulate their own responses.

To ensure that some quantifiable responses were elicited, a number of preliminary conclusions were drawn by the researcher from the data contained in the first questionnaire and were presented to the respondents for their evaluation. The respondents were required to indicate to what extent they were in agreement with these conclusions. Respondents were required to choose an appropriate response category from a list of alternatives representing different levels of agreement (Questionnaire II, Appendix III A).

The first pretest of the second questionnaire was carried out using the same population that was used to pretest the first questionnaire (see section 3.1). They comprised thirty people with some knowledge of the fish processing industry, pollution control, or both. The major objectives of this pretest were to ensure that the findings of the study and instructions to respondents were understandable, and to eliminate unforseen difficulties that respondents could encounter during completion of this questionnaire.

The following changes were made after pretesting the questionnaire. Firstly, the summary report was reorganized in order to group related issues into specific topics e.g. Pollution control policy preference. Initially the findings were presented in the same order as they occurred in the first questionnaire. This made it difficult for respondents to follow the logic of the summary report. Secondly, The major questions of research (e.g. How does the industry feel about existing pollution control legislation?), that gave rise to the findings, were included in order to help the respondents decide whether or not the questions had been adequately dealt with. This step was regarded by some of the pretest population as an essential prerequisite for evaluating of the findings. Thirdly the number of agreement categories provided for respondents to evaluate the preliminary conclusions were expanded from three to five, namely, strongly agree, agree, uncertain, disagree and strongly disagree. This was done in order to get an indication of the different levels of conviction that respondents held about the preliminary conclusions drawn by the researcher. Respondents were also required to indicate the sector of the industry to which they belonged. This was deemed necessary since there appeared to be significant differences of opinion between respondents from different industry sectors with regard to certain issues in the first questionnaire.

After the above changes had been made to the draft questionnaire, it was translated into Afrikaans and pilot tested using the same fifteen respondents who pilot tested the final draft of the first questionnaire (see section 3.1.). Besides minor editorial and spelling corrections no further changes needed to be made to the final draft of the first questionnaire. Specific changes that were made to the first draft of the second questionnaire, have not been discussed here. Specific changes made during the construction of the second questionnaire are given below together with the questions that were constructed in order to test the preliminary conclusions drawn from the first questionnaire.

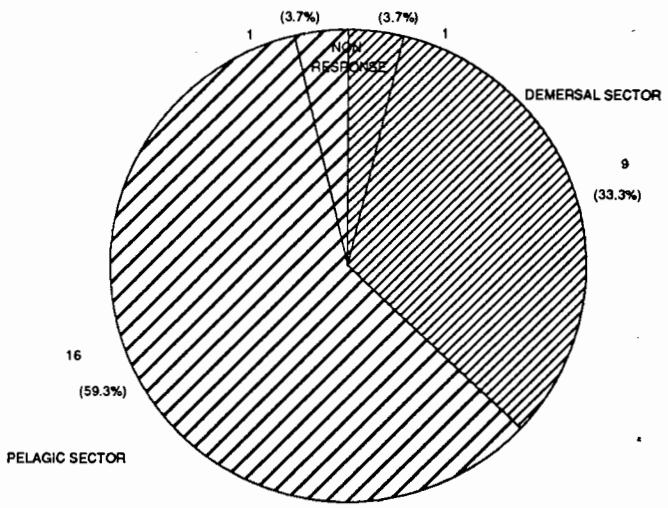

FIGURE 5.2.1
Classification of respondents according to fishing industry sector

5.2 GENERAL INFORMATION

5.2.1 Response Rate To Questionnaires

Twenty five of the population of twenty-seven (92.6%) of senior fish processing industry managers involved in making investments in waste and pollution control systems returned the first questionnaire. Nine respondents were affiliated to the demersal sector of the industry and the remaining sixteen were drawn from the pelagic sector (Figure 5.2.1)

According to Wentz (1979) if the non-response is less than 5% or it can be established that non-respondents can be assumed to have the same set of relevant characteristics as the rest of the research population, then the non-response error can safely be ignored. Two of the non-respondents who failed to return the first questionnaire identified themselves during the follow-up telephone calls. These two non-respondents, one from each sector of the industry, did not differ in any significant respect from other respondents in terms of the criteria for selection of the population elements. This was established from biographical information published about them in the 1987 Fishing Industry Handbook and Buyers Guide (Stuttaford, 1987). It was therefore assumed that their omission from the study was not likely to introduce any significant bias into the findings of this survey.

During the personal interview at which respondents were presented with the first mail-questionnaire, some of the respondents did not wish to answer certain questions, such as question F1, which was directed at establishing the amount of expenditure on pollution control by individual companies. These respondents admitted that they did not wish to answer such questions because they either did not know the answer or because they viewed such questions as a threat, despite assurances that their anonymity would be preserved. In these cases it was decided not to force a response but simply to note such occurrences. Forcing a response could

have 'created' an opinion that was not held prior to the respondent being questioned (Taylor, 1984).

Twenty-two respondents (81.5%) of the total population of twenty-seven managers of the fish processing industry returned the second questionnaire which was aimed at refuting or affirming the findings and conclusions drawn from the fist questionnaire. A final follow-up reminder letter (Appendix III B) mailed to all members of the research population contained a statement to the effect that those respondents who failed to return the completed second questionnaire would be assumed to be in full agreement with the findings and conclusions presented therein. As the respondents were aware from the outset that the findings of this study could influence future government pollution control policy towards the fish processing industry, it was assumed that any incorrect or controversial statements and conclusions would have elicited comment. Therefore the assumption that non-respondents were in full agreement with the findings seems reasonable.

5.2.2 Demographic Characteristics Of Respondents

Demographic information was collected from the research population in the first questionnaire (Appendix II B) for two reasons. Firstly this information served as a check that the respondents had been correctly selected according to the prescribed criteria, namely that the respondents were senior executives who were actively involved in making large capital investments in pollution and waste control equipment. Secondly, demographic information was collected in order to provide possible explanations for differences encountered among the opinions and viewpoints of respondents.

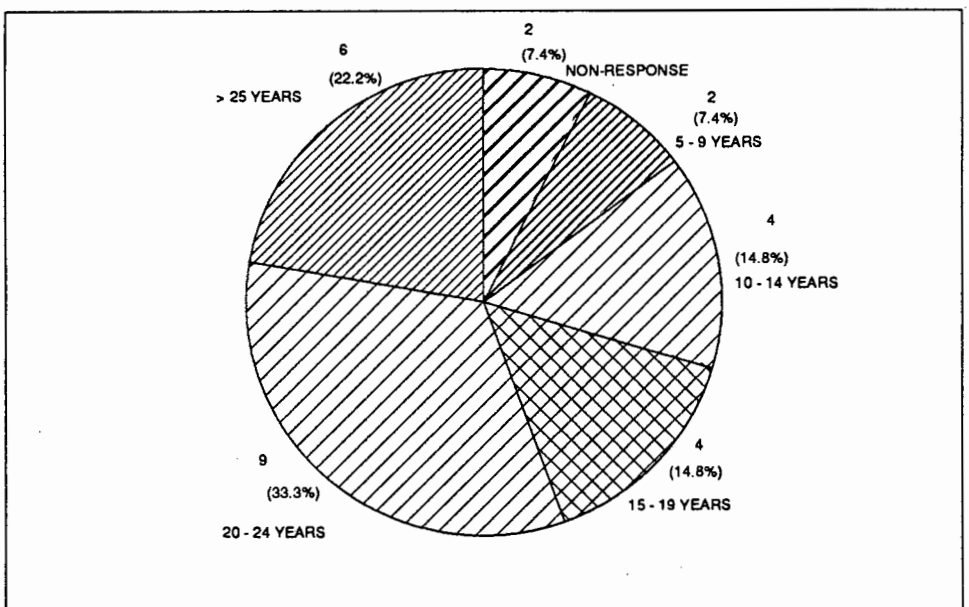

FIGURE 5.2.2(a)
Classification of respondents according to years of experience

5.2.2 (a) Years of experience of respondents in the fish processing industry.

Excluding the two non-respondents to the entire first questionnaire, only two members of the census had less than ten years of experience in the industry (Figure 5.2.2 (*a*)). Fifteen of the respondents had more than twenty years of experience and a total of nineteen respondents had more than fifteen years. This fact is significant because government pressure was applied to the *fish processing* industry only from 1973 onward to prevent and control pollution from their operations (Van Langelaar pers. comm., 1987).

5.2.2 (b) Hierarchal positions held by the respondents in their companies.

Although the rank held by respondents was not directly comparable among the different companies, primarily due to the companies having different organizational structures, this variable was regarded as important for the following reasons. Firstly, it provided an additional check on the authority of a respondent to make significant investments in waste and pollution control equipment. Secondly, it served as an indication as to which levels of management were predominately involved in these investment decisions.

The survey population consisted of seven managing directors, two company directors, three group general managers, three general managers, four factory managers and eight senior executives (Figure 5.2.2 (*b*)). These categories were not, however, mutually exclusive as some respondents were both managing directors of their own companies, as well as being on the board of directors of of the group of fishing companies to which their companies belonged.

5.2.2 (c) Direct financial interests of the respondents in their companies

Thirteen of the respondents held shares in the companies that they managed (Figure 5.2.2 (*c*)). In contrast to the owner-managers, eleven respondents were professional managers, that is, had no direct financial interest in their companies. It was not possible to establish the category to which the remaining three non-respondents to this question belonged.

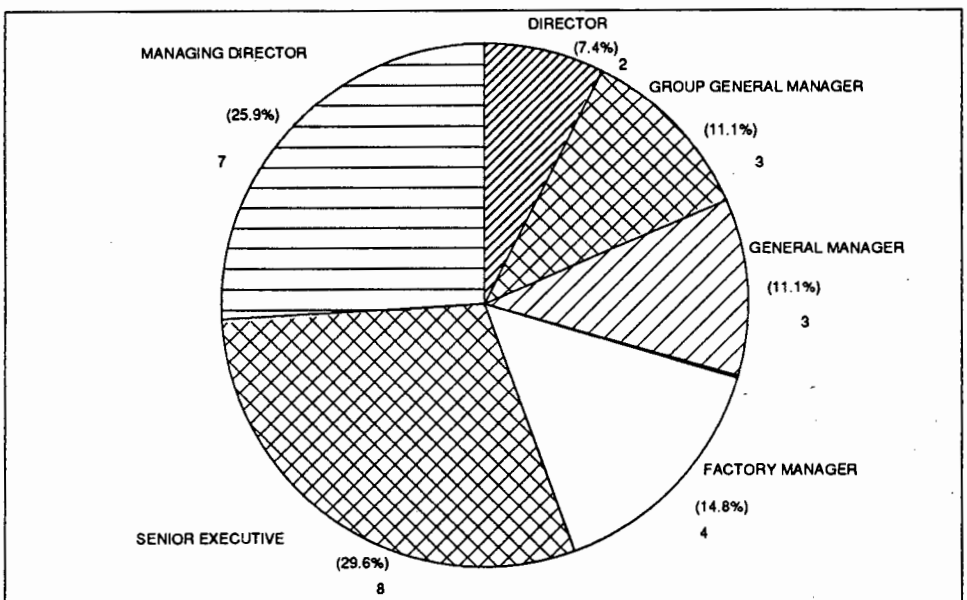

FIGURE 5.2.2(b)
Classification of respondents according to rank

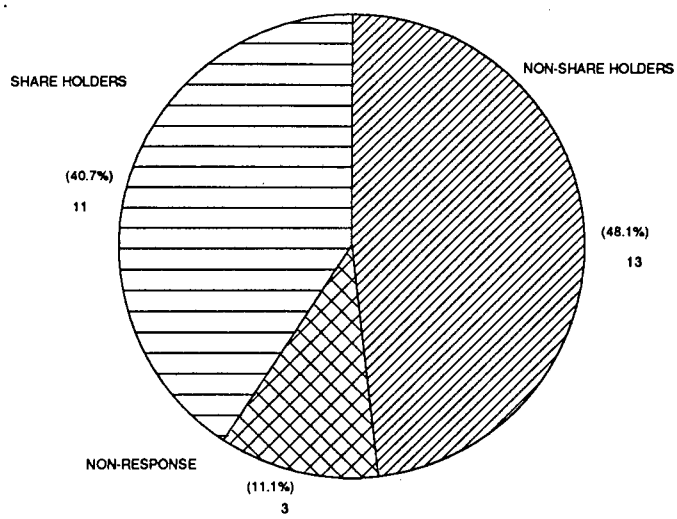

FIGURE 5.2.2(c)
Classification of respondents according to financial interest in their companies

Examination of the demographic and other general information collected from respondents to the first questionnaire appeared to explain, in part, why some respondents held viewpoints and opinions that appeared to differ significantly from those of the majority. One factor, namely the **fishing industry sector** to which a respondent belonged, did appear to play a major role in the determination of viewpoints and opinions. For this reason, the results presented below in both this and the following chapter, are presented separately for each industry sector.

Some suggestions are made as to the possible reasons for recorded differences of opinion that exist between the demersal and pelagic sector respondents. Other factors such as years of experience and corporate rank have been omitted from the presentation of results for reasons of clarity but are referred to when they were believed to have influenced the replies of specific respondents. A full discussion of the information presented in chapters five and six is given in chapter seven.

5.3 FACTORS INFLUENCING STRATEGIC INVESTMENTS

Investments in waste and pollution control systems cannot be considered in isolation from the other strategic investments that the fish processing industry is likely to make. This is because the financial and other resources of any enterprise are limited, and, consequently the rational manager will attempt to allocate these resources in such a way as to bring about the greatest benefit to his company. The allocation of resources will largely be determined by factors prevailing in the business environment (threats and opportunities) and the capabilities of the company (strengths and weaknesses).

The information presented below was extracted from question C1 and represents the strengths, weaknesses, threats and opportunities perceived by managers of the fish processing industry up to the year 2000. Issues that were listed by respondents were scored according to

TABLE 5.3
Strengths, weaknesses, threats and opportunities perceived by senior managers of the fish processing industry to the year 2000

	Number of times cited
STRENGTHS	
Technical Expertise	9
Good fisheries management	6
Sound financial base	5
Marketing Skills	4
Well maintained assets/ Markets for products/Management skills	3
WEAKNESSES	
Out dated and worn assets	6
Seasonal fluctuations	6
Shortage of skilled labour	5
Limited growth due to fixed quota	4
Inadequate long-term planning	2
THREATS	
Cost escalations	17
Arbitrary government changes to quotas	9
Government intervention in operations	7
Trade sanctions	7
Labour unions	5
OPPORTUNITIES	
Non-quota bound species fishery	10
Better utilization of existing quota	9
Recovery of over exploited resources	6
New markets for industry products	4
Aquaculture/Mariculture	3

the frequency with which each of these issues was specifically referred to. The most frequently occurring issues are presented in Table 5.3. and displayed graphically in Figure 5.3.

The strengths of the industry were regarded as its technical expertise, a well managed resource base, a sound financial base, the business skills of its managers and markets for its products. Three respondents were of the opinion that the assets of the industry (production equipment) were well maintained. In contrast to six other respondents who believed that a major weakness of the industry were its assets which they perceived to be worn and outdated.

Seasonal fluctuations, which are beyond the control of the fish processing industry were perceived to be another weakness. Other weaknesses cited included a shortage of skilled labour, the limit imposed on economic growth by (fixed) fishing quotas, and inadequate long term planning.

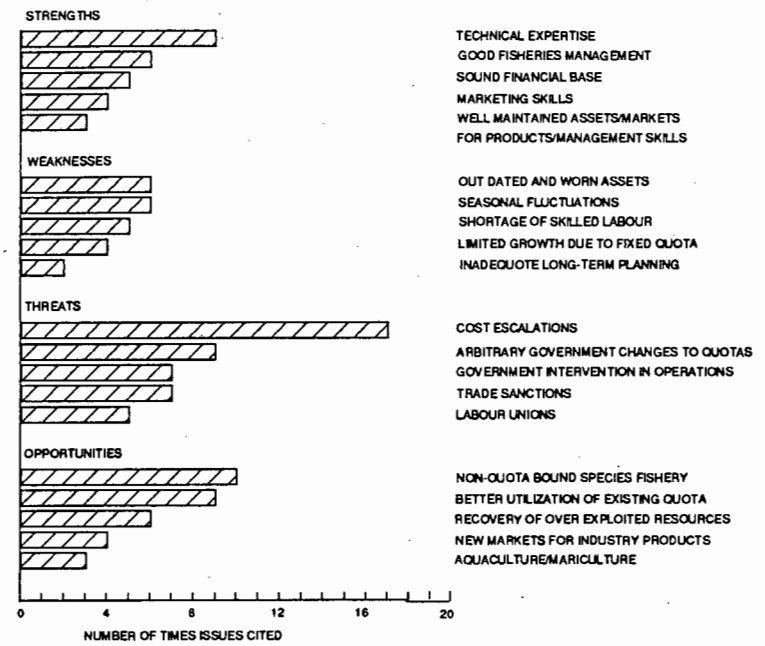

FIGURE 5.3

Strengths, weaknesses, threats and opportunities perceived by senior managers of the fish processing industry to the year 2000.

Cost escalations, due to high interest rates and inflation, were seen by seventeen respondents (68%) to be the major threat facing the industry. Other threats included 'arbitrary' quota reductions and the intervention by government in the day-to-day running of the industry. Trade sanctions, both in terms of the ability of the industry to sell its goods and its ability to acquire new technology were considered to be a threat as were the increasing demands of trade unions, and labour unrest.

Opportunities that the industry were likely to exploit included the development of non-quota-bound species, such as squid and tuna, the better utilization of raw material by developing improved products, and the expectation of an increase in the quota with the stock recovery of certain sought after fish species. In addition to developing new markets, mariculture was perceived also to be an exploitable opportunity.

5.4 STRATEGIC INVESTMENT PRIORITIES OF THE FISH PROCESSING INDUSTRY TO THE YEAR 2000

5.4.1 Probable Strategic Investments Of The Fish Processing Industry To The Year 2000

Based on their perceptions of the strengths, weaknesses, threats and opportunities in the business environment the managers of the fish processing industry would be predisposed to make certain strategic investments. Both sectors of the industry were of the opinion that modernization of both the fleet and factories was the most likely investment priority (Table 5.4.1; Figure 5.4.1). Other investment priorities were seen to be the development of new products for new markets

TABLE 5.4.1
Probable strategic investments of the fish processing industry to the year 2000

Type of investment	Number of times rated as 'very likely'	
	Demersal Sector	Pelagic Sector
Diversification	6	12
Specialization	3	7
Employee benefits	1	7
Job creation & Training	5	9
Pollution control	0	7
Modernization programmes	7	16
Materials recovery (Waste control)	0	4
Investments unrelated to fishing	2	2
Research & Development	3	10
Non-response	1	1

n = 27

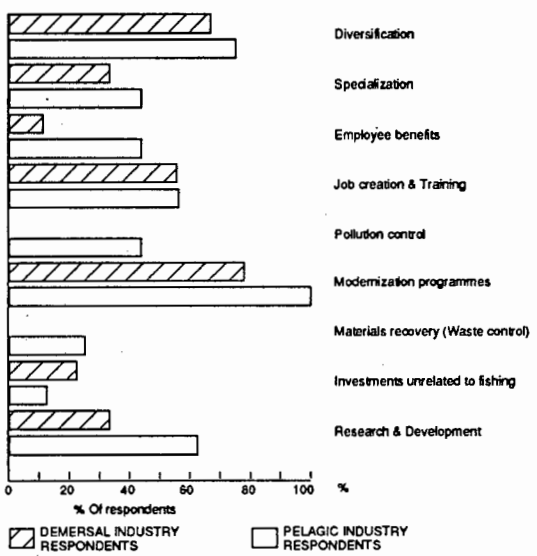

FIGURE 5.4.1
Probable strategic investments of the fish processing industry to the year 2000

(diversification), job creation and training programmes and greater investments in research and development.

None of the demersal sector respondents regarded materials recovery (waste control) or pollution control to be major investment priorities. Seven pelagic sector respondents (43,8%), believed that investments in pollution control equipment were likely.

Some strategic responses by fishing companies to perceived threats and opportunities are more common than other responses, according to Cunningham *et al.* (1985). Biological and geographical relocation of fishing effort has been observed and various ways of reducing costs have been pursued. Diversification in products and markets is a common strategy adopted by many businesses (Macloed, 1983). The members of the fishing industry have also co-operated with one another in first stage marketing of products and in negotiations with government (Stuttaford, 1985b; Tucker pers. comm., 1987).

In the years ahead, conditions prevailing in the business environment will continue to influence the choice of objectives and the selection of appropriate strategies. However, distortions in the economy due to factors such as very high taxation, inflation, or interest rates, could result in sub-optimal developments in the fish processing industry. Even though there may be an increasing demand for fish and fisheries products, should the financial returns become marginal, fishing companies may continue to diversify their operations into enterprises that are unrelated to fishing where returns may be higher (Potgieter, 1985). If the market price were to fall below the average variable costs of production then some companies could be expected to withdraw from the industry (Cunningham *et al.*, 1985).

5.4.2 Unfolding Analysis Of Industry Investment Priorities

Unfolding analysis was used to generate a preference map from the rank ordered investment priorities of respondents for the purpose of gaining insight into the decision-making process. This technique is especially useful in cases where respondents have to make choices involving multi-attribute objects (Appendix IV C, Question C3). Figure 5.4.2 was constructed using the computer generated coordinates given in Appendix IV C.

The output of the unfolding analysis can be interpreted by visual inspection of the spatial relationships of the respondents (represented by numbers) and the investment options that they were required to rank in order of priority. In such perceptual maps psychological distance is represented by geometric distance. The closer a respondent is located to a particular investment option on the perceptual map the greater his preference for that particular option will be. Conversely, options located further away from respondents will be less preferred. Options located in close proximity to each other, on the map, are interpreted as having similar attributes in terms of the unfolding model. Similarly the smaller the geometric distance between respondents on the preference map, the greater the similarity in their investment priorities is likely to be.

The computer algorithm attempts to arrange all the respondents on the map in such a way as to preserve monotonicity i.e. the original rank orderings of the respondents. In effect this means that the option that is most preferred by a respondent will be located the closest to that respondent. The least preferred option will be located at the greatest geometric distance from that respondent when compared to the distances between that respondent and all the other

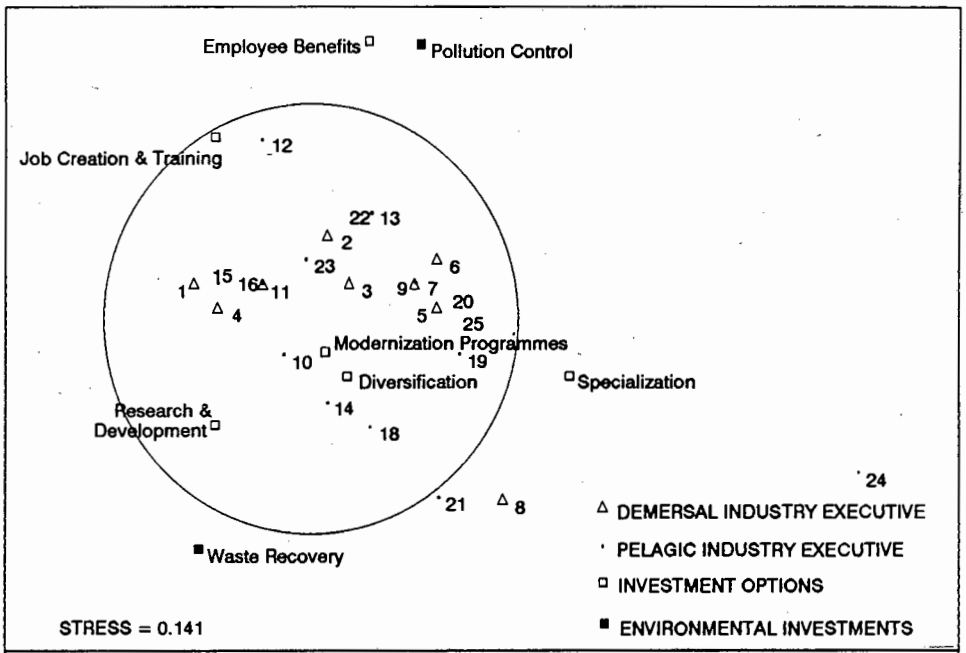

FIGURE 5.4.2

A PERCEPTUAL MAP OF STRATEGIC INVESTMENT PRIORITIES OF FISH PROCESSING INDUSTRY MANAGERS

Psychological distance is represented by geometric distance on the perceptual map. The closer a respondent (represented by a number) is located to an investment option the higher his preference for that option. Respondents that are located close together are interpreted as having similar preferences. Investment options located close together are perceived by respondents as being similar with regard to some attributes. The major investment priorities of respondents (Table 5.4.1) have been enclosed in a field. Investment options that could contribute to environmental protection have been differentiated from other investment options. There appears to be no difference in the distribution of preferences among the demersal and pelagic sector respondents. The stress level of 0.141 indicates that the original rank ordered preferences of respondents have been reproduced with an accuracy of 85.9%.

options. During the unfolding analysis it is seldom possible to achieve perfect monotonicity. The deviation from perfect monotonicity or stress is a measure of the goodness of fit. Although there are no prescribed standards for evaluating the deviation from monotonicity, stress values ranging between 0.00 and 0.15, are generally regarded as being indicative of a good to fair representation of the original rank orderings of respondents (Muller pers. comm., 1988). Stress values greater than 0.20 are considered to be poor.

The unfolding algorithm used in the present study allows for the identification of those individuals or options that contribute the most stress. Stress may be introduced when the dimensions along which respondents are required to evaluate the options are not clear. This could result in respondents not using the same dimensions to evaluate the options. In such cases the stress can be reduced by the elimination of these respondents or options from the analysis when

it can be shown that such options or respondents do not fit the unfolding model (Muller pers. comm., 1988).

During the initial computer processing of the ranked data, the investment option of 'investments unrelated to fishing' and the responses of respondent 017, contributed a disproportionate amount of stress to the total stress value for the unfolding analysis. On closer inspection of the rank orderings of the various investment options (Appendix IV C, Question C 3), it was noted that the respondents appeared to have difficulty in ranking this investment option as was indicated by its almost random positioning between the extremes of most likely and least likely investment priority. This was ascribed to the fact that many fishing companies have diversified their operations and are involved in ventures that have nothing to do with fishing. In other cases fishing companies were subsidiaries of larger companies in which fishing was not the main source of revenue. Accordingly the option of 'investments unrelated to fishing' may have been very important in some cases but of no consequence in others. This created problems in the unfolding analysis as the computer algorithm would have had difficulty in locating 'investments unrelated to fishing' in the two dimensional space without severely violating the monotonicity constraint.

The rank ordered preferences of respondent 017 (Appendix IV C, Question C 3) were a-typical compared to the rank orderings of the rest of the survey population. This may have been due to the relative inexperience of this respondent when compared to other respondents (Appendix IV A). Nineteen of the respondents (76%) had more than fifteen years of experience in the fish processing industry. Respondent 017 had less than fifteen years in the industry. The elimination of this respondent and the option of 'investments unrelated to fishing' resulted in a perceptual map that was able to reproduce the original rank ordered preferences of respondents with an accuracy of 85.9% as indicated by a total stress of 0.141 or 14.1%.

A field, enclosing the more important investment priorities given in Table 5.4.1 and the sector of the industry to which each respondent was affiliated, was superimposed onto the perceptual map. This was done in order to highlight the spatial relationships of the respondents to the most important priorities. Although such maps do not provide an indication of the amount by which one option is preferred over another the respective positions of investments in pollution control and waste control on the perceptual map provide a valuable insight into how such investments are perceived. Both these investments could result in a reduction in pollution levels, and are considered to have a similar investment priority as judged by their geometric distance from the majority of respondents, however these investment options are perceived by the respondents to be very different.

Investments which have the ability to generate income appear to be confined to the lower half of this preference map (Figure 5.4.2), whereas investments which do not contribute directly to profits e.g. employee benefits and pollution control, are located near the top of this map. Visual inspection of the preference map indicates that there appear to be no significant differences between the pelagic and demersal sector respondents in terms of their perceptions regarding investment priorities. This is indicated by the absence of clusters of respondents according to industry sector. Thus it appears that managers of both sectors of the fish processing industry differentiate between investments in waste control and pollution control on the basis of the ability of such investments to generate income.

Among the obstacles encountered by companies in their efforts to define a rational approach to social responsibility is the pressure exerted by the financial community for a steady increase in earnings per share. Consequently managers have become preoccupied with investments that are intended to enhance short term earnings rather than investments that may be needed to ensure a company's long term survival (Gunness, 1975). The situation applies also to the fishing industry. When South African fishing companies use some of their profits to aid economically depressed west coast communities, financial advisors tell share holders to withdraw their financial support and not to accept lower dividends in the interests of funding 'exercises in social responsibility' (Kling, 1985). These financial advisors overlook the fact that the fishing industry is dependent on these communities for its labour and therefore strategic investments by the industry in these communities may be vital to the industry's long term survival.

The fishing industry manager in Southern Africa is responsible not only to the share holders and employees, but also to society in general. The industry provides job opportunities for the people of the west coast where there are few alternative avenues of employment (Grant, 1986). In some locations where the industry is both the principal polluter and major employer, its relationship with the local community has certain schizoid features. This is because on the one hand the industry improves the living standards by providing employment but on the other creates social costs which detract from communal goals (Seddon, 1977).

TABLE 5.4.3
Fishing industry opinion regarding pollution control expenditure and modernization

Respondents' evaluation of the statement that modernization and improved utilization of raw material should decrease the need for additional expenditure on waste and pollution control.

	Number of respondents	
	Demersal Sector	Pelagic Sector
Strongly Agreeing	1	3
Agreeing	6	5
Uncertain	0	3
Disagreeing	2	2
Strongly Disagreeing	0	0
Non-response	1	4

n = 27

Non-respondents were assumed to be in full agreement with the above statement (see Appendix III B)

5.4.3 Verification Of Findings Regarding The Importance Of Pollution Control Expenditure

Respondents were asked for their opinions in the second questionnaire about a hypothesized relationship between modernization and the need for further investment in waste and pollution control equipment. This hypothesis was stated as follows:

'Should the fish processing industry be able to replace its aging assets and further improve its utilization of raw material, the need for further expenditure on waste recovery and pollution control can be expected to diminish'.

The underlying concept in this case being that modernization usually results in more efficient and hence cleaner technology and that better utilization of raw material would diminish the need to recover waste (Table 5.4.3).

Of the twenty two respondents that returned the second questionnaire, fifteen respondents (68.2%) were in agreement, three (13.6%) were uncertain and four (18.2%) disagreed with this statement.

The final reminder letter to respondents (Appendix III B) contained a statement to the effect that those respondents who failed to return the second questionnaire by the due date, would be assumed to be in full agreement with the findings and preliminary conclusions contained therein. On the basis of this assumption the final number of respondents in agreement with the above conclusion would be twenty (74.1%).

5.5 IMPORTANT FACTORS IN WASTE AND POLLUTION CONTROL INVESTMENT DECISIONS

5.5.1 Waste Control Investment Decisions

A distinction, albeit artificial, was made by the researcher between investments in waste control and pollution control equipment. This distinction was based on the direct financial return that could be expected from the material recovered by waste control equipment. Although it is accepted that a saving could also be made in terms of fines and penalties avoided by the installation of pollution control equipment, such investments do not have the potential to generate income.

The industry were asked to rate, in order of importance, (Question A 1, Appendix II B) a number of economic, social and legal factors, that they would consider when making investments in waste control equipment. The number of times that the members of each sector rated a factor as 'very important' is given in Table 5.5.1(*a*) below and presented graphically in Figure 5.5.1 (*a*).

Anti-pollution regulations were rated by 77,8% (seven) of the demersal sector respondents as the most important factor that would influence their decisions to invest in waste control equipment. This factor was followed in order of importance by prevention of pollution which was rated as very important by 66.7% (six) of the demersal sector respondents. In contrast, 81.3% (thirteen) of the pelagic sector respondents appeared to regard profitability of the company as the most important factor in waste control equipment investments. Quota size appeared to be the second most important factor among pelagic sector respondents in that 68.5% (eleven) of this sector's respondents to this survey rated quota size as very important.

TABLE 5.5.1 (a)

The relative importance of factors in influencing waste control investment decisions of fish processing industry managers.

Investment decision factors	Number of times rated as 'very important'	
	Demersal Sector	Pelagic Sector
Anti-pollution regulations	7	2
Quota size	3	11
Return on investment	3	10
Prevention of pollution	6	9
Profitability of the company	3	13
Cost of the system	5	9
Company image	3	10
Competitive advantage	0	1
Tax incentives	0	1
Pass costs on to customers	0	1
Share-holders' interests	2	2
Non-response	1	1
n = 27		

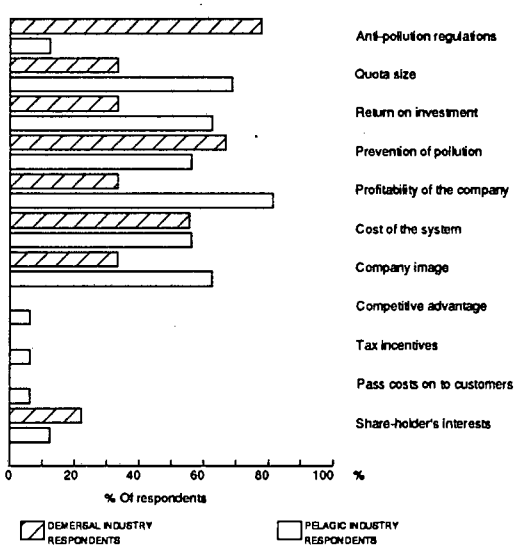

FIGURE 5.5.1 (a)

The relative importance of factors in influencing waste control investment decisions of fish processing industry managers.

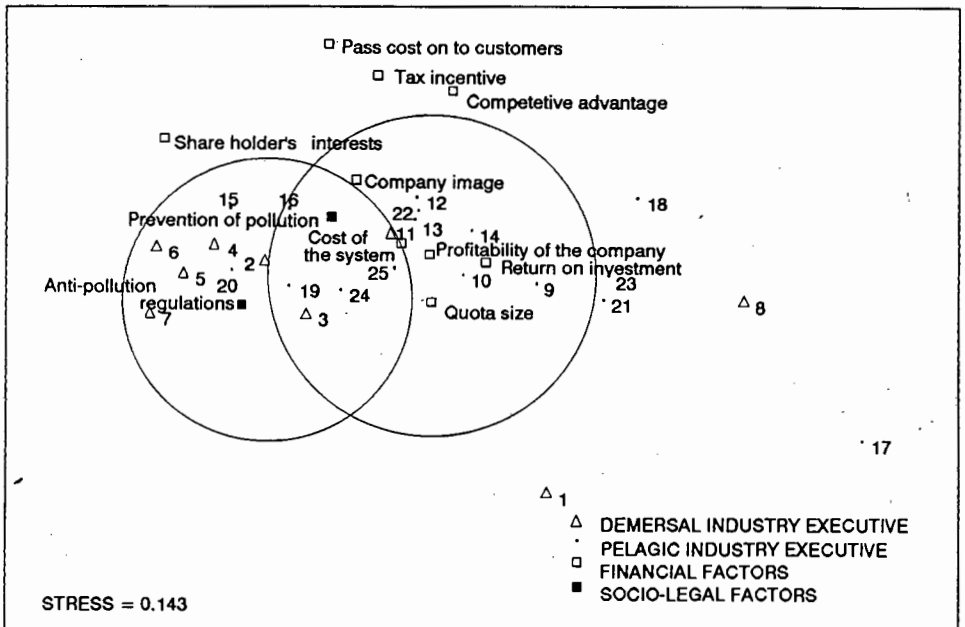

FIGURE 5.5.1 (*b*)

PERCEPTUAL MAP OF THE RELATIVE IMPORTANCE OF FACTORS IN WASTE CONTROL INVESTMENT DECISIONS

Psychological distance is represented by geometric distance on the perceptual map. The closer a respondent (represented by a number) is located to an investment decision factor the greater the importance of that factor in the waste control investment decision process is to that respondent. Respondents that are located close together are interpreted as having similar approaches to decision-making. Investment factors located close together are perceived by respondents as being similar with regard to some attributes. There appears to be a difference in the distribution of viewpoints among the demersal and pelagic sector respondents regarding the relative importance of factors in the investment decision process. Therefore, the factors rated as very important in waste control investments by the respondents of each sector (Table 5.5.1.a.) have been enclosed in separate fields. Socio-legal factors have been differentiated from financial factors. The stress level of 0.143 indicates that the original rank ordered preferences of respondents have been reproduced with an accuracy of 85.7%.

It was of interest to note that according to the demersal sector ratings, the cost of the system, a financial factor, was third in order of importance after a legal and a social factor. In contrast to the demersal sector managers, the managers of the pelagic sector appear to regard anti-pollution regulations of relatively minor importance in influencing the waste control investment decisions. Only two (12.5%) respondents in the pelagic sector rated anti-pollution regulations as a very important factor.

Company image appears to be of greater importance to the pelagic sector respondents than to the demersal sector respondents with 62.5% (ten) and 33.3% (three) of respondents respec-

tively, rating this factor as very important. The interests of share-holders, tax incentives for investing in waste control equipment, the competitive advantage to companies making such investments and the ability to pass the costs of acquiring such systems on to customers, do not appear to influence the decision-making process.

In Summary it would appear that the financial aspects of waste control investment decisions are of greater importance to pelagic sector management, whereas legal and social aspects appear to be more important factors among demersal sector management. This finding suggests that the demersal sector respondents may not consider investments in waste control equipment to be an economically viable proposition.

The apparent difference in perceptions of the managers of the two industry sectors regarding the relative importance of factors in waste control decisions is highlighted in the perceptual map (Figure 5.5.1 (*b*)) generated by unfolding analysis (Appendix IV E).

The sector of the industry to which each (numbered) respondent belonged and a field enclosing the more important factors in waste control investment decisions derived from Table 5.5.1 (*a*) has been superimposed onto the perceptual map. This was done in order to highlight the apparent clusterings of the managers of the demersal sector with social and legal factors and the pelagic sector managers with predominately economic factors. The stress value or departure from perfect monotonicity was 0.143 or 14.3%. Thus the computer unfolding algorithm has been able to capture the original rank ordering of respondents (Appendix IV E, Question A 2), with an accuracy of 85.7%. The elimination prior to multidimensional unfolding analysis, of respondents who contributed the most stress namely, respondents 001, 008 and 017 was considered. Respondents 001 and 008 were the most senior executives in their companies (Appendix IV A)

TABLE 5.5.1 (*b*)
Fishing industry opinion regarding the influence of quota restrictions on the acquisition of waste recovery systems

Respondents' evaluation of the statement that quota restrictions have significantly influenced investments in waste recovery systems.

	Number of respondents	
	Demersal Sector	Pelagic Sector
Strongly Agreeing	1	2
Agreeing	1	7
Uncertain	1	3
Disagreeing	6	3
Strongly Disagreeing	0	1
Non-response	1	1

n = 27

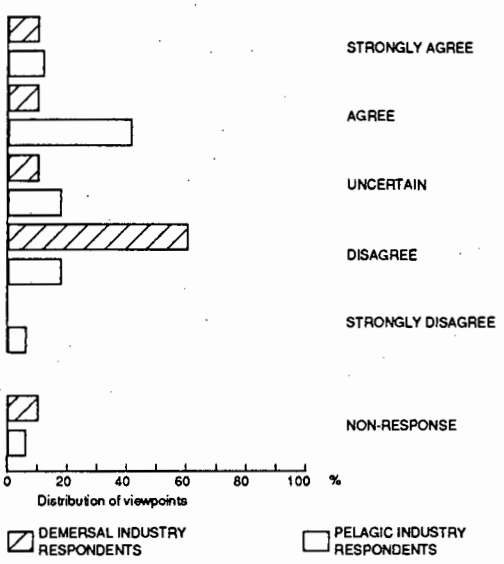

FIGURE 5.5.1 (*c*)
Fishing industry opinion regarding the influence of quota restrictions on the acquisition of waste recovery systems

and as such may not have been as familiar as their subordinates with all the issues in waste control investment decisions. The elimination of respondent 017 only marginally improved the solution of the unfolding problem to yield a stress of 0.139 or 13.9%, so it was therefore decided to include all respondents in the analysis.

As the amount of raw material that the industry may process in any particular fishing season is limited by quotas, it would seem that any waste represents a real financial loss to the industry. Nine (56.3%) of the pelagic sector respondents compared with two (22.2%) of the demersal sector respondents were of the opinion that quota size had significantly influenced their investments in waste recovery systems (Table 5.5.1 (*b*), Figure 5.5.1 (*c*)). This finding suggests that before waste recovery equipment is purchased by the pelagic sector, the amount of waste that can be recovered must be sufficient to offset the costs of acquiring such systems. If the quota is too small, it may be uneconomical to process the waste material.

These findings confirm the importance of the quota size in influencing the decisions of the management of the pelagic sector to invest in waste control systems.

5.5.2 Fish Processing Industry Management Opinion And Viewpoint Regarding Aspects Of Pollution Control

5.5.2 (a) The perceived relationship between untreated effluents and environmental harm

The sampling of opinion regarding the necessity for pollution control is of key importance in understanding the action taken by the fishing industry with regard to pollution control. The opinions of the industry in this regard are reflected in the perceived relationship between untreated effluents and environmental harm (Table 5.5.2 (*a*), Figure 5.5.2 (*a*)).

TABLE 5.5.2 (*a*)
Fishing industry opinion regarding the relationship between untreated effluents and environmental harm

Respondents' evaluation of the statement that untreated fish factory effluents can result in significant harm to the marine environment.

	Number of respondents	
	Demersal Sector	Pelagic Sector
Strongly Agreeing	0	0
Agreeing	5	1
Uncertain	3	6
Disagreeing	0	9
Strongly Disagreeing	1	0
Non-response	1	1

n = 27

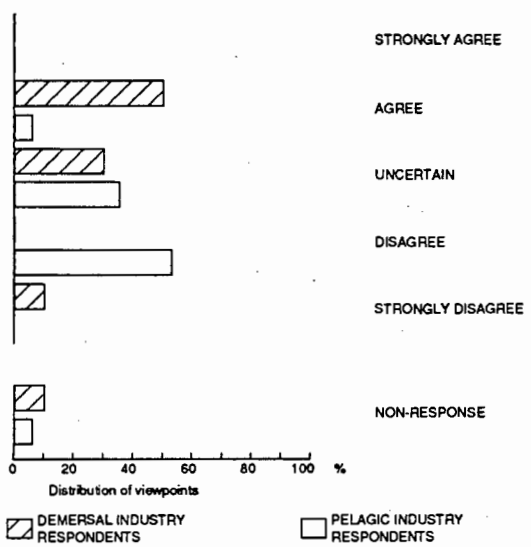

FIGURE 5.5.2 (*a*)
Fishing industry opinion regarding the relationship between untreated effluents and environmental harm

A difference of opinion exists between the two industry sectors about the potential harm that can be done to the environment by the discharge of untreated effluents. The demersal sector respondents believe that untreated effluents can cause harm to the environment whereas the pelagic sector disagree on this point. This finding may be related to the relative amounts of effluent generated by the land-based factories of the two industry sectors. The demersal sector effluents consist mainly of wash-waters which generally do not require treatment. In contrast the concentrated organically rich high volume effluents of the pelagic industry require that this sector of the industry invest in treatment facilities. Consequently, some members of the pelagic sector may adopt the argument that as these effluents are non-toxic and can be naturally dispersed by the sea, that there is no need for acquiring expensive treatment equipment.

5.5.2 (b) Economic justification for pollution control expenditure

No clear indication exists as to whether company expenditure on pollution control was considered to be economically justifiable, in terms of the benefits that firms had received by making such investments, or in terms of the fines and penalties avoided (Table 5.5.2 (*b*), Figure 5.5.2 (*b*)).

These results indicate that some demersal sector respondents were of the opinion that whatever expense they had incurred in controlling pollution was economically justifiable. Conversely, those pelagic sector respondents who had formed an opinion on this issue, believed that this was not so. The majority i.e. thirteen of the twenty two managers that replied to this question were undecided on this issue. This finding could reflect the different views of respondents with regard

TABLE 5.5.2 (*b*)
Fishing industry opinion regarding the economic justification for pollution control expenditure

Respondents' evaluation of the statement that their expenditure on pollution control has been economically justifiable.

	Number of respondents	
	Demersal Sector	Pelagic Sector
Strongly Agreeing	2	0
Agreeing	1	0
Uncertain	3	10
Disagreeing	1	5
Strongly Disagreeing	0	0
Non-response	3	2
n = 27		

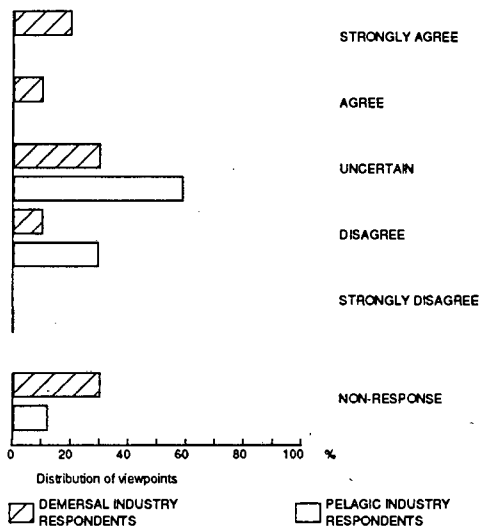

FIGURE 5.5.2 (*b*)
Fishing industry opinion regarding the economic justification for pollution control expenditure.

to the perceived need for pollution control expenditure that their companies had incurred, or the difficulty in estimating the economic benefits from such investments.

5.5.3 The Perceived Relationship Between Pollution Control Regulations And Production Costs

Some industrial managers claim that environmental protection legislation has contributed to unemployment, fueled inflation, stifled investment and economic growth and hindered economic efficiency (Leonard *et al.*, 1977). Doherty (1984) states that these claims are often made by managers in order to disguise declining profitability, costs of modernization and a drop in demand for the goods their companies produce. Studies by Heffernan (1977) have shown that plant closure and resulting unemployment which has been attributed to the pollution control legislation has been limited to marginal profit makers that would have closed in any event. Nonetheless the costs of compliance need to be carefully considered in cases where the closure of individual factories, especially in one-factory-towns, could create social problems due to the relative immobility of the work force with job skills that are not easily transferable.

As far as the financial implications of pollution control regulations were concerned only the pelagic sector respondents believed that such regulations had significantly contributed to costs (Table 5.3.3, Figure 5.3.3).

As one would intuitively expect, voluntary abatement of environmental pollution is a weak and unreliable means of protecting the environment. Baumol (1974) suggests that the same competitive forces which prevent laziness or incompetence also preclude volunteerism on any significant scale. This is because businessmen who choose voluntarily to spend significant amounts on environmental protection are likely to find that they are vulnerable to competitors

TABLE 5.5.3
The perceived relationship between pollution control regulations and production costs

Respondents' evaluation of the statement that pollution control regulations contribute significantly to production costs

	Number of respondents	
	Demersal Sector	Pelagic Sector
Strongly Agreeing	0	2
Agreeing	2	9
Uncertain	2	1
Disagreeing	5	4
Strongly Disagreeing	0	0
Non-response	1	1

n = 27

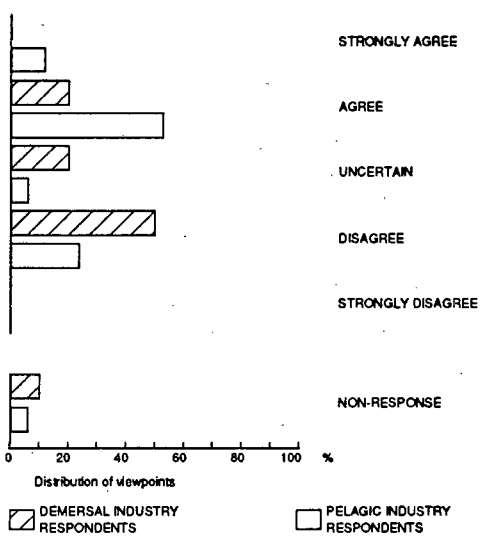

FIGURE 5.5.3
The perceived relationship between pollution control regulations and production costs

who have not incurred similar expenses for pollution control. These competitors can therefore supply their products at a lower price to customers. Vickery (1972) believes that self-regulation by specific groups of polluters will not work because of economic self interest. He is of the opinion that corrective measures need to be applied externally.

Today although modern technologies tend to be more efficient and hence 'cleaner' many companies continue to operate with old equipment because of the costs involved in modernization. Old technologies in use today were selected at a time when energy costs and raw materials were much lower than they are now. Furthermore, the costs of waste disposal were also very low and in some cases could be ignored altogether. Designs were selected to maximise discounted cash flow so that long-term running costs could be sacrificed in favour of reducing initial capital costs (Royston, 1980). Hence older equipment will continue to be a problem unless government intervention in the form of regulations or public pressure compels companies to re-evaluate their investment priorities. While it is accepted that there can be no compromise on abating pollution that has adverse effects on human health, direction is needed on how far to go beyond this baseline (Ling, 1984).

It is unlikely that the South African pelagic fishing industry would have committed as much capital as it did for the installation of dry off-loading equipment had it not been for legislation contained in the 1973 Sea Fisheries Act. This legislation reversed the principle of 'innocent until proven guilty' for any pollution occurring within an eight kilometer radius of a fish factory. This means that the onus is now on the factory to establish its innocence. Even so the provisions of the Sea Fisheries Act which compelled the installation of waste control equipment were accepted with equanimity because it was believed that the material recovered by this equipment would offset the costs of acquisition (Anon, 1973a; Anon, 1975a). Other important innovations in pollution control technology in the fish processing industry have included the installation of indirect fish meal driers (which have decreased the need for large scrubbing plants); improvements to deodorisers, modifications to scum tanks and the evaporation of liquids entering the factories, even though some managers claim that the cost of evaporation exceeds the value of the recovered product (Anon, 1974; Anon, 1975a; Anon, 1982b).

Nobody can deny that pollution control costs money. Apart from the cost that may be incurred in having to compensate the victims of pollution, and the penalties that may be incurred by companies for contravening pollution control regulations, consideration needs to be given to the potential cost of future legislated controls. According to Royston (1979), it is generally agreed that it costs three to four times as much to add on pollution control equipment to an existing plant than to build in to a new plant. It is impossible to predict with any certainty what the cost of future legislated requirements will be except that their impact may be serious.

5.5.4 Estimated Percentage Of The Annual Budget Spent On Pollution Control (Averaged Over A Five-year Period)

Because investments in pollution control equipment tend to be of a sporadic nature not all firms will necessarily incur similar costs in any one year. It was therefore decided to ask the respondents to estimate the percentage of their company's annual budget, averaged over a five year period, that was spent on pollution control (Table 5.5.4, Figure 5.5.4).

TABLE 5.5.4

Estimated percentage of the annual budget spent on pollution control (averaged over a five-year period)

	Number of respondents	
	Demersal Sector	Pelagic Sector
CAPITAL EXPENDITURE		
0–4 %	9	8
5–9 %	0	4
10–14 %	0	2
Non-response	1	3
OPERATING EXPENDITURE		
0–4 %	9	7
5–9 %	0	4
Non-response	1	6
n = 27		

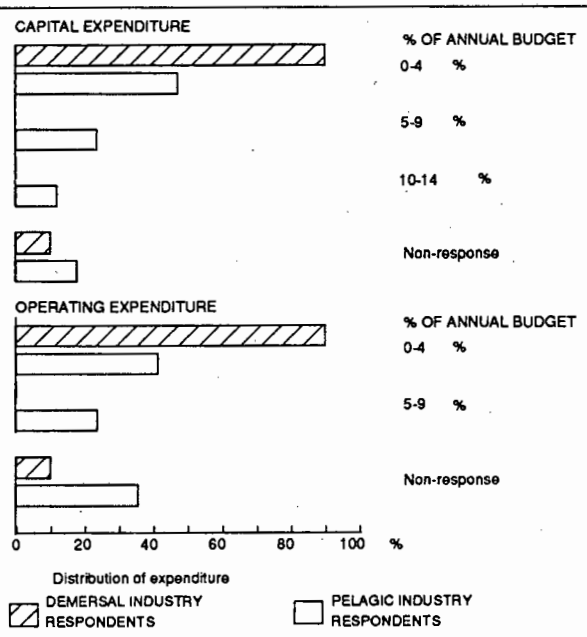

FIGURE 5.5.4

Estimated percentage of the annual budget spent on pollution control (averaged over a five-year period)

Most respondents estimated that their capital expenditure on pollution control, expressed as a percentage of the annual budget, was less than five percent. However, six respondents in the pelagic sector did report a higher expenditure. As far as operating expenditure was concerned a similar pattern was evident with four pelagic sector respondents reporting pollution control costs marginally higher than other respondents. These findings appear to confirm the belief held by the pelagic sector respondents that regulations had increased their production costs (Figure 5.5.3). However, the higher level of expenditure reported by this sector could simply reflect the greater effluent and emission volumes of this industry sector.

5.6 SUMMARY

This chapter began with a description of the development of the second questionnaire. This was considered appropriate because the primary objective of the second questionnaire was to give the respondents the opportunity to refute or affirm the findings and preliminary conclusions drawn from their responses to the first questionnaire. It was therefore decided to discuss the construction of the second questionnaire as well as the information gathered from the second questionnaire together with the findings of the first questionnaire.

A summary report of the findings was sent together with a request contained in a covering letter, to the respondents to comment on any issue in the report that they wished to. A column was provided for comments adjacent to the findings. This approach to eliciting information in effect represents an unstructured type of questionnaire comprised of open-ended questions. However to ensure that some quantifiable responses were elicited, a number of preliminary conclusions were drawn from the data by the researcher and were presented to the respondents for their evaluation. The respondents were required to indicate to what extent they were in agreement with these conclusions.

The major strengths of the fish processing industry were perceived to be the technical expertise of the industry, a well managed fishery and a sound financial base. Weaknesses included worn and outdated assets, seasonal yield fluctuations and a shortage of skilled labour.

Escalations in both capital and operating costs were seen as the major threat facing the industry. Other threats included 'arbitrary' government action with regard to fishing quota allocations, general government intervention in the day-to-day operations of the industry, sanctions and trade union pressure. Both sectors of the industry saw the development of fisheries based on non-quota bound species and the better utilization of existing catches as major opportunities.

Based on their perceptions of future conditions, it appears that the major investment priorities of the fish processing industry to the year 2000, will be asset replacement, the development of new products and new markets, job creation and training, and research and development. Pollution and waste control investments were not viewed as major investment priorities. The respondents were of the opinion that if the industry was able to modernize and improve the utilization of existing catches, the need for additional investments in waste and pollution could be expected to decrease accordingly.

It appears that the decisions of pelagic sector managers to invest in waste control equipment are primarily influenced by financial considerations. Furthermore the quota size was also an

important factor in the decisions of the pelagic sector managers. Conversely, demersal sector managers perceived legal and social considerations to be more important than the financial considerations in influencing their decisions to invest in waste control equipment.

Most demersal sector respondents believe that the discharge of untreated fisheries wastes could cause significant harm to the environment. Pelagic sector respondents did not share this view. There was no consensus among the respondents of either sector as to whether pollution control expenditure had been economically justifiable or not. The majority of the pelagic sector respondents were of the opinion that pollution control regulations had significantly increased production costs. Although both sectors of the industry estimated their pollution control costs to be less than five percent of annual budgeted expenditure, some pelagic sector respondents estimated their costs to be marginally higher.

The following chapter presents the viewpoints of the fish processing industry managers concerning existing pollution control legislation and the policy approaches that they would like to see the government adopt in order to regulate pollution from the land-based operations of the fish processing industry.

CHAPTER 6

Evaluation of Existing Pollution Control Legislation and Policy Preferences of Fish Processing Industry Managers

The responses to questions relating to pollution control policy, are given in this chapter. As with the previous chapter, the responses of the demersal and pelagic sector managers are presented separately. This was done because industry sector appeared to be an important explanatory variable underlying the different viewpoints relating to pollution control policy. The results presented in both this and the previous chapter are fully discussed in chapter seven.

6.1 INDUSTRY ASSESSMENT OF CURRENT POLLUTION CONTROL LEGISLATION

Current pollution control policy does not appear to be adequate to ensure that the fish processing industry improves the quality of its effluents or emissions. It was therefore necessary to examine current legislation in order to highlight possible problems. Such an exercise is of central importance prior to the development of new policy.

Many laws, regulations, ordinances and by-laws govern industrial operations and the steps that must be taken to prevent contamination of the environment. Instead of examining specific laws and regulations, respondents were asked for their general impressions concerning all pollution control legislation that was pertinent to their operations.

6.1.1 Perceived Realism Of Existing Legislation

Seventeen respondents (63%) were of the opinion that existing legislation was realistic. Six respondents (22.2%) disagreed with this opinion (Table 6.1.1, Figure 6.1.1).

6.1.2 Industry Opinion Concerning The Timing Of Implementation Of Existing Regulations

Eighteen respondents (66.7%) believed that regulations to deal with fishing industry pollution had been introduced at the correct time. Four (14.8%) felt that these regulations were premature. Only two respondents (7.4%) felt that these regulations were introduced too late (Table 6.1.2, Figure 6.1.2).

6.1.3 Perceived Fairness In Implementation

According to Rodee *et al.* (1967), regulations limit individual and group action, restrict property rights, affect incomes and generally curb liberties. Only two respondents (7.4%) believed that pollution control regulations pertaining to the fish processing industry were unfair. Nineteen respondents (70.4%) perceived the general body of rules and regulations to be fair (Table 6.1.3, Figure 6.1.3).

TABLE 6.1.1
Perceived realism of existing legislation

	Number of respondents	
	Demersal Sector	Pelagic Sector
Very unrealistic	2	0
Unrealistic	1	3
Realistic	5	11
Very Realistic	0	1
Non respondents	2	2
n = 27		

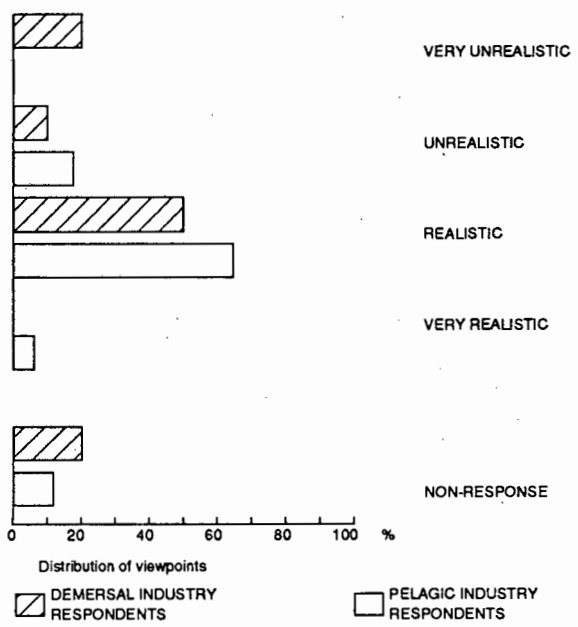

FIGURE 6.1.1
Perceived realism of existing legislation

TABLE 6.1.2
Industry opinion concerning the timing of implementation of existing regulations

	Number of respondents	
	Demersal Sector	Pelagic Sector
Very Premature	0	0
Premature	2	2
Timely	5	13
Overdue	2	0
Non respondents	1	2

n = 27

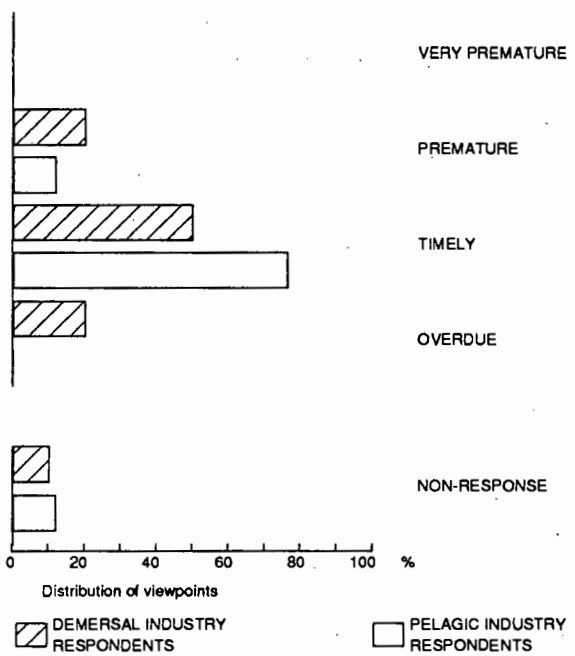

FIGURE 6.1.2
Industry opinion concerning the timing of implementation of existing regulations

TABLE 6.1.3
Perceved fairness in implementation

	Number of respondents	
	Demersal Sector	Pelagic Sector
Very Unfair	0	0
Unfair	2	0
Fair	3	15
Very Fair	1	0
Non-respondents	4	2
n = 27		

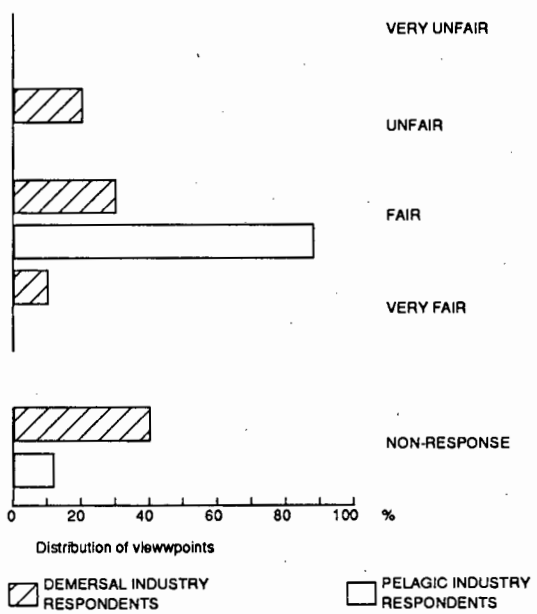

FIGURE 6.1.3
Perceved fairness in implementation

Most respondents are in agreement that current legislation is realistic and that the implementation of legislation was timely and fair.

6.1.4 Perceived Severity Of Penalties

A danger that exists with lenient penalties is that they may come to be regarded as part of the cost of doing business. Rabie and Erasmus (1983) are of the opinion that the deterrent value of fines is inadequate. Penalties provide an indication of the importance that the authorities attach to the protection of the environment. However, punitive measures succeed only when the transgressors are few and the unlawful act is comparatively rare (Drucker, 1977). Skinner (1973), a behavioral psychologist, is of the opinion that a person who is punished is not necessarily less inclined to behave in a given way. He believes that such a person merely learns to avoid punishment.

Although fourteen (51.9%) of the respondents regarded penalties for polluting to be adequate, five members of the pelagic sector (18.5%) believed existing penalties to be lenient. Three (11.1%) demersal sector respondents regarded the exiting penalties to be severe (Table 6.1.4, Figure 6.1.4). Pollution control regulations may be considered by some pelagic sector respondents as having insufficient coercive power to induce them to make additional investments in pollution control equipment. If this is the case, it could explain in part why the abatement performance of some of the factories in this sector is unsatisfactory.

6.1.5 Perceived Flexibility As To Method Of Achieving Compliance With Regulations

The degree of flexibility afforded to the industry in terms of the methods that they may use in order to comply with existing regulations was perceived to be inadequate by only 6 (22.2%) of the respondents (Table 6.1.5, Figure 6.1.5). The finding that forty percent of the demersal sector respondents regard pollution control legislation to be inflexible may indicate a lack of a working knowledge of pollution control regulations. The major pollution control regulations in South Africa are generally flexible in that no effluent treatment methods are prescribed for the fish processing industry (Lusher, 1984). Similarly, even though the equipment that must be used to control emissions is specified, such specifications are usually derived from consultations between the Chief Air Pollution Officer and the fish processing industry (Tucker pers. comm., 1987).

6.1.6 Perceptions Regarding The Number Of Regulations

At least ten South African Parliamentary Acts, one provincial ordinance and several local by-laws have provisions that are applicable to pollution originating from the fish processing industry. Among the body of laws that are applicable to pollution from the fish processing industry are: The Water Act 54 of 1956; The Sea Fisheries Act 58 of 1973; The Dumping At Sea Control Act 73 of 1980; The Sea Shore Act 21 of 1935; The Health Act 63 of 1977; The Transport Services Act 65 of 1981; The International Health Regulations Act 28 of 1974; The Prevention And Combating Of Pollution of the Sea By Oil Act 6 of 1981; The Environmental Conservation Act 100 of 1982; and The Cape Nature Conservation Ordinance 19 of 1974.

TABLE 6.1.4
Perceived severity of penalties

	Number of respondents	
	Demersal Sector	Pelagic Sector
Very Severe	2	0
Severe	1	0
Adequate	4	10
Lenient	0	5
Very Lenient	0	0
Non-respondents	3	2

n = 27

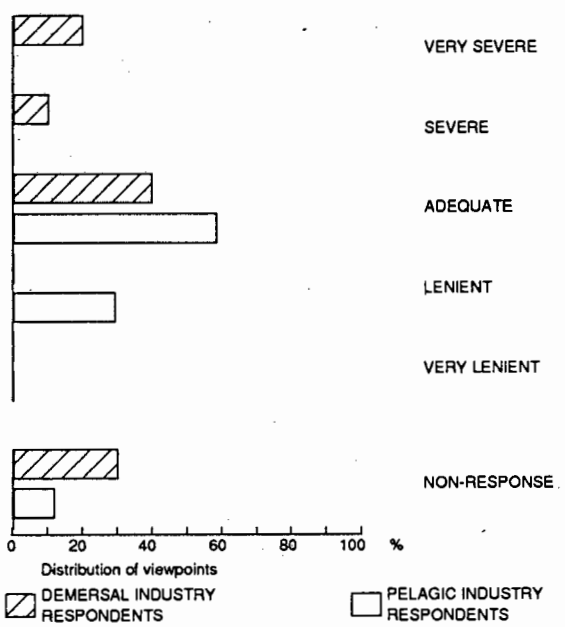

FIGURE 6.1.4
Perceived severity of penalties

TABLE 6.1.5
Perceived flexibility as to method of achieving compliance with regulations

	Number of respondents	
	Demersal Sector	Pelagic Sector
Very Inflexible	1	0
Inflexible	3	2
Adequate	3	7
Flexible	0	5
Very Flexible	0	1
Non-respondents	3	2
n = 27		

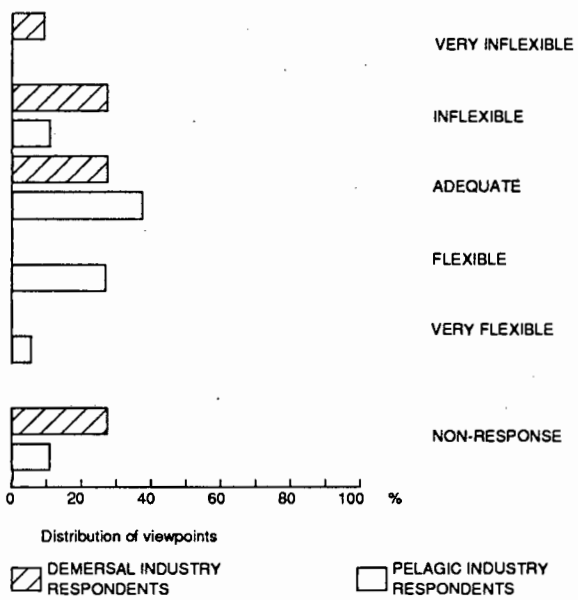

FIGURE 6.1.5
Perceived flexibility as to method of achieving compliance with regulations

Sixteen respondents (59.3%) felt that there were too many regulations. Nine respondents (33.3%) believed that there were enough and only one respondent believed that more regulations were needed (Table 6.1.6, Figure 6.1.6).

6.1.7 Perceived Complexity Of Laws And Regulations

Fourteen of the respondents (51.9%) found existing laws and regulations to be complex. Nine respondents (33.3%) believed that legislation was not too complex to understand or comply with. None of the respondents thought that current legislation was simple (Table 6.1.7, Figure 6.1.7).

In view of the opinions expressed regarding the number and complexity of laws and regulations it would seem that the industry as a whole would welcome some revision and rationalization of existing legislation.

6.1.8 Perceived Opportunity For Industry Contribution To The Formulation Of Regulations

Twenty-two respondents (81.5%) believed that the opportunity afforded to industry to have a say in the compilation of regulations that affected them to be inadequate. Only two respondents (7.4%) appeared to be satisfied with the existing situation (Table 6.1.8, Figure 6.1.8).

6.1.9 Reasons As To Why The Industry Feels It Should Be Consulted About Pollution Control Regulations

In view of the finding that the majority of respondents were of the opinion that there was inadequate opportunity for them to make a contribution to the formulation of regulations, a question was constructed to establish the nature of the contribution they wished to make. This question was in the form of a statement in which the researcher hypothesized that the fish processing industry managers believed that they should be consulted in the drafting of regulations because they have more information than the government concerning the costs and benefits of different approaches to pollution control (Questionnaire II, Appendix III A). Respondents were required to indicate to what extent they were in agreement with the researcher's hypothesis (Table 6.1.9).

Creating greater opportunities for the industry to make a contribution to new regulations at the formulation stage, could lead to the promulgation of economically efficient pollution control instruments. Industry input could result in the elimination of unforseen and unintended negative financial impacts that can occur with poorly drafted regulations. Such regulations could impede legitimate business activities.

6.2 FISH PROCESSING INDUSTRY OPINION ABOUT THE ADMINISTRATION AND ENFORCEMENT OF EXISTING POLLUTION CONTROL LEGISLATION

The effectiveness of a pollution control policy is highly dependent on the way in which the policy is administered. Although legislation may comprise satisfactory legal instruments, it may fail to achieve its objectives due to inadequate enforcement. Legislation could also fail if people believe that the law is unfair or perceive its objectives to be unreasonable.

TABLE 6.1.6
Perceived number of regulations

	Number of respondents	
	Demersal Sector	Pelagic Sector
Far Too Many	3	2
Too Many	2	7
Enough	4	5
Too Few	0	1
Far Too Few	0	0
Non-respondents	1	2

n = 27

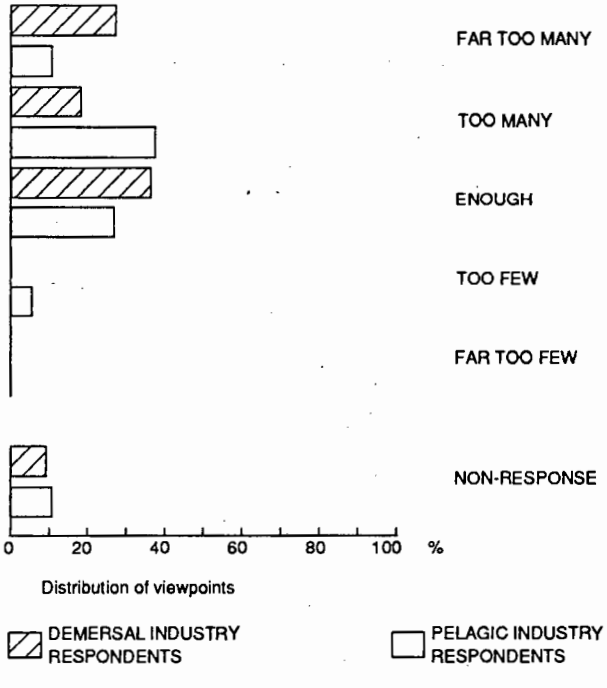

FIGURE 6.1.6
Perceived number of regulations

TABLE 6.1.7
Perceived complexity of laws and regulations

	Number of respondents	
	Demersal Sector	Pelagic Sector
Very Complex	3	1
Complex	3	7
Adequate	2	7
Simple	0	0
Very simple	0	0
Non-respondents	2	2
n = 27		

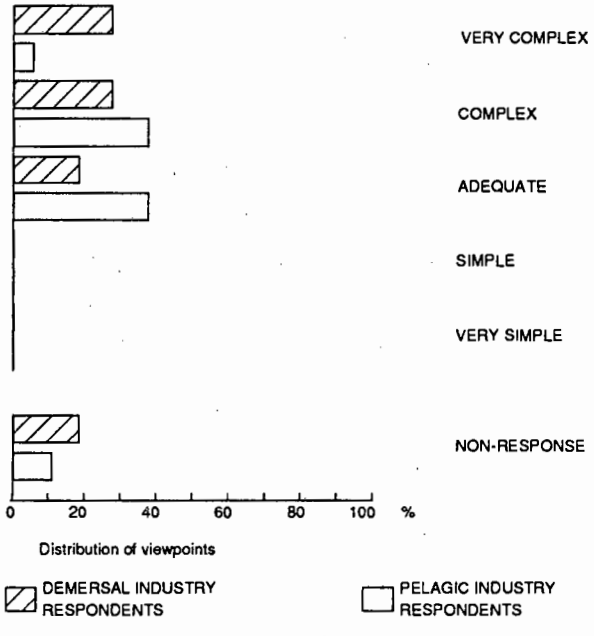

FIGURE 6.1.7
Perceived complexity of laws and regulations

TABLE 6.1.8
Perceived opportunity for industry contribution to the formulation of regulations

	Number of respondents	
	Demersal Sector	Pelagic Sector
Very Limited	4	6
Limited	4	8
Adequate	1	1
Excessive	0	0
Non-respondents	1	2

n = 27

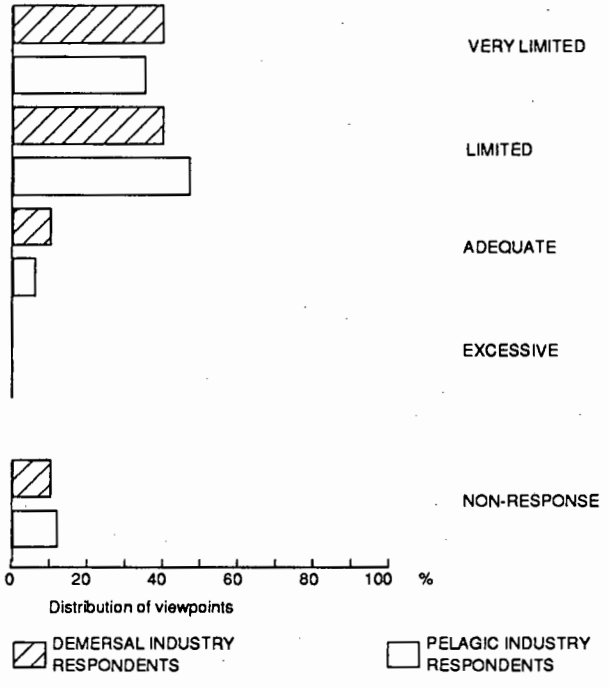

FIGURE 6.1.8
Perceived opportunity for industry contribution to the formulation of regulations

TABLE 6.1.9
Reasons as to why the industry feels it should be consulted about pollution control regulations

Respondents' evaluation of the statement that as the industry has more information than the government concerning the costs and benefits of various pollution control systems, they should be consulted in the search for optimum and efficient solutions

	Number of respondents	
	Demersal Sector	Pelagic Sector
Strongly Agreeing	1	9
Agreeing	8	4
Uncertain	0	0
Disagreeing	0	0
Strongly Disagreeing	0	0
Non-respondents	1	4

n = 27

Non-respondents were assumed to be in full agreement with the above statement (see Appendix III B).

6.2.1 The Law And Its Implementation

There was no clear indication as to whether the industry perceived the law or the way in which it was implemented to be a problem (Table 6.2.1, Figure 6.2.1). The finding that the industry does not appear to have formed a well defined opinion on this issue may be an indication that existing laws and regulations have a limited impact on the decisions of the managers of the fish processing industry.

Enforcement is the crucial test of any law. In South Africa adequate enforcement of environmental policy is problematical for the following reasons. Firstly, the wide variety of legislation and the many authorities involved in its implementation has resulted in overlapping and confusion of jurisdictional responsibilities in some cases, and the omission of control in others (Malan *et al.*, 1983; Rabie and Lusher, 1986). The plethora of laws has resulted also in excessive administrative costs (McGregor, 1985). It may be better to have a small number of laws that are properly enforced than a large number that are completely ignored. Secondly, enforcement is made difficult by the fragmented nature of environmental legislation itself. Thirdly, many state bodies are entrusted with dualistic assignments. On the one hand they are charged with protecting natural resources, while on the other they are expected to promote the exploitation of the same resources (Rabie and Erasmus, 1983). Finally there is a severe shortage of adequately trained technicians and inspectors to monitor the industry for compliance with regulations (Fuggle and Rabie, 1983; Tucker pers. comm., 1987).

TABLE 6.2.1
The law and its implementation

Respondents' evaluation of the statement that it is the way the law is applied rather than the law itself that creates problems.

	Number of respondents	
	Demersal Sector	Pelagic Sector
Strongly Agreeing	0	0
Agreeing	3	6
Uncertain	4	4
Disagreeing	2	6
Strongly Disagreeing	0	0
Non-respondents	1	1

n = 27

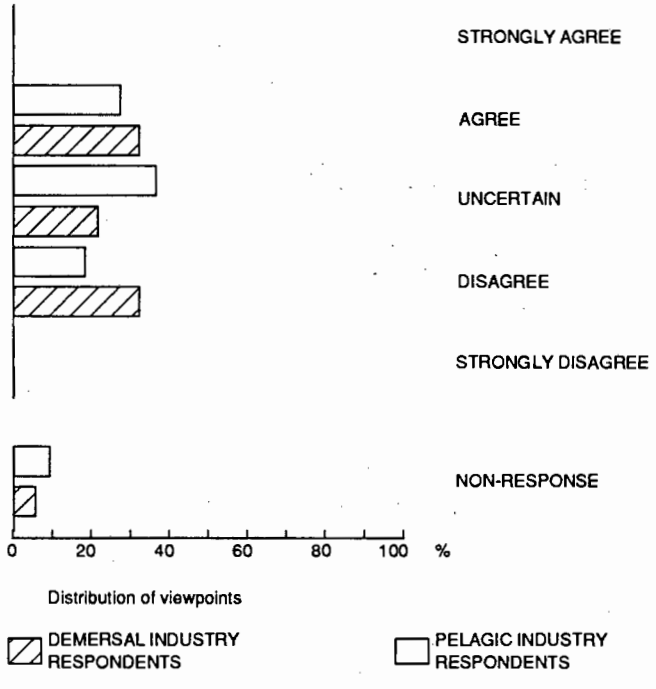

FIGURE 6.2.1
The law and its implementation

6.2.2 Dispute Settlement: Prosecution Or Negotiation

The problem with the sole reliance on the criminal sanction in regulations aimed at preventing pollution is that the role of the administration is reduced to the collection of information about suspected offenders. Ultimate control is left to the police, the prosecution and the courts which have little expertise in environmental issues (Willard, 1981). Furthermore the task of administrators is complicated by the fact that the provisions of laws dealing with general pollution often attempt to reconcile two irreconcilable views; to provide safeguards against pollution and to preserve the maximum amount of civil liberty for persons discharging effluents and emissions. Another serious deficiency of such laws that deal with general pollution, such as the Water Act, is that 'pollution' is not defined. The criterion that is used to decide whether pollution has occurred is whether the water has been rendered 'less fit' for the purposes for which it was or could be ordinarily used (Rabie and Lusher, 1986).

The end result of these deficiencies in prohibitory legislation is that the authorities avoid taking action under the provisions of the Water Act that deal with water being rendered 'less fit', and take action instead under the provisions dealing with compliance with legal requirements, which may result in less stringent penalties. In terms of the provisions relating to compliance with legal requirements, the state simply has to prove that the effluent did not comply with the conditions set out in the exemption. The effect of inconvenient legislation has been to dilute the application of the Water Act.

Although it is easier for the authorities to prosecute polluters in terms of the industrial pollution provisions, during the entire history of the fish processing industry only three legal actions have been brought against the fish processing industry for pollution. All three actions were brought in 1973, and although the state was successful in prosecuting two of these actions, the courts handed down very lenient fines (Van Langelaar pers. comm., 1987). This may have created the impression amongst the members of the fish processing industry that the government would rather negotiate than prosecute polluters.

Twenty-two respondents (81.5%) believed that only persistent offenders would be prosecuted and that the government would prefer to settle most disputes by negotiation. Only one respondent believed the opposite to be true (Table 6.2.2, Figure 6.2.2).

6.2.3 Opinion Regarding The Decriminalization Of Discharging Wastes To The Environment

The moral sense of the South African community may not regard pollution as wrong or to be a criminal offence (Pentreath, 1978). Experience has shown that for a law to be effective, it should follow the dictates of prevailing values and moral convictions, rather than attempt to impose them. Thirteen respondents (48.1%) felt that the discharge of wastes into the environment should remain a criminal offence. In contrast only six (22.2%) believed that it should not be a criminal offence to discharge fish factory wastes into the environment. A further six respondents were undecided on this issue (Table 6.2.3, Figure 6.2.3).

6.3 APPROACHES TO POLLUTION CONTROL POLICY

Regulations generally serve to limit the acceptable courses of behaviour that may be legitimately pursued. Certain regulatory approaches tend to be less efficient and equitable than others and

TABLE 6.2.2
Dispute settlement: prosecution or negotiation

Respondents' evaluation of the statement that the government will only take persistent offenders to court, preferring to settle most disputes by negotiation.

	Number of respondents	
	Demersal Sector	Pelagic Sector
Strongly Agreeing	1	8
Agreeing	7	6
Uncertain	1	1
Disagreeing	0	1
Strongly Disagreeing	0	0
Non-respondents	1	1

n = 27

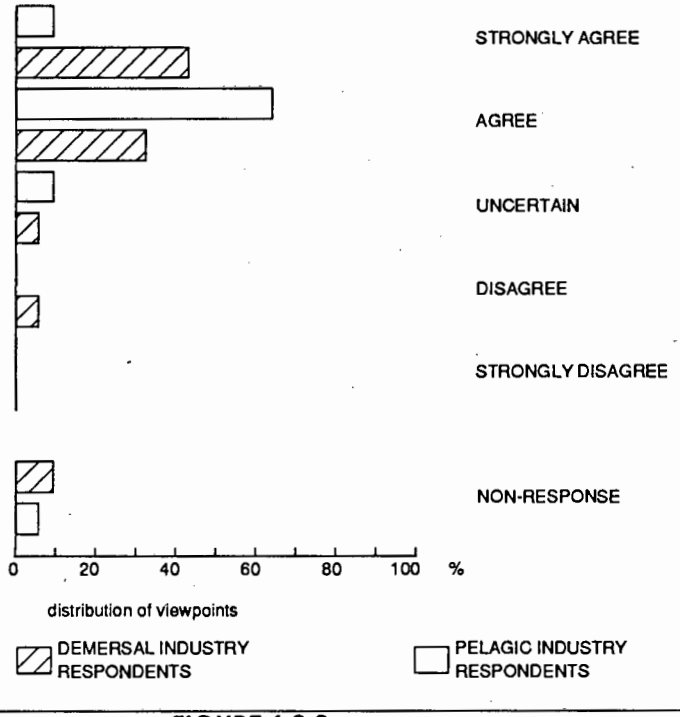

FIGURE 6.2.2
Dispute settlement: prosecution or negotiation

TABLE 6.2.3
Opinion regarding the decriminalization of discharging wastes to the environment

Respondents' evaluation of the statement that the discharge of untreated wastes from fish factories should remain a criminal offence.

	Number of respondents	
	Demersal Sector	Pelagic Sector
Strongly Agreeing	0	1
Agreeing	5	7
Uncertain	3	3
Disagreeing	0	4
Strongly Disagreeing	1	1
Non-respondents	1	1

n = 27

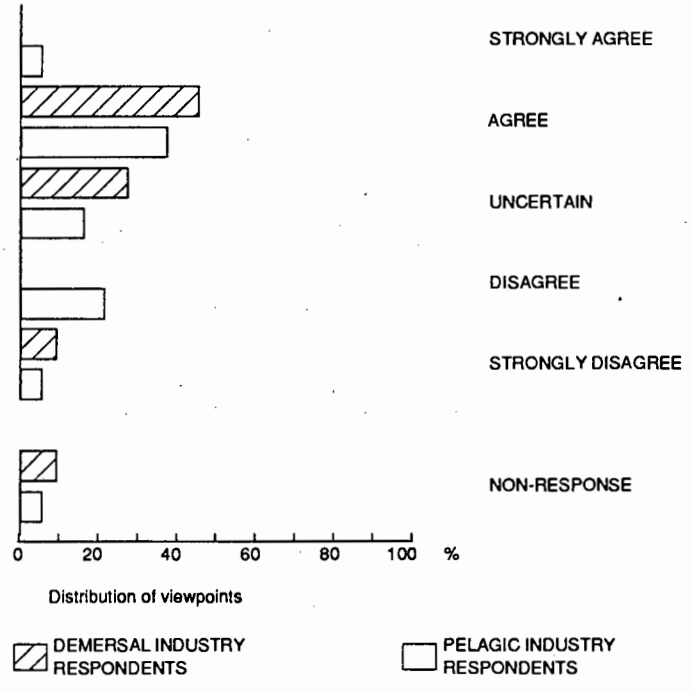

FIGURE 6.2.3
Opinion regarding the decriminalization of discharging wastes to the environment

may even be totally ignored if perceived to be unreasonable. It is therefore important to identify those policy instruments which have the ability to achieve their intended objectives and which are also perceived to be reasonable by the fish processing industry.

6.3.1 Pollution Control Policy Options Preferred By The Fish Processing Industry

Pollution control policy usually results in enterprises having to make investments in pollution control equipment. The choice of a policy instrument is of importance because some instruments can have a greater impact on the financial resources of a business than others.

The results of question B 1 indicate that respondents favour those policy instruments that could result in a decrease in the cost of acquiring pollution control systems. Such policy options include subsidies and income tax allowances (Table 6.3.1 (*a*), Figure 6.3.1 (*a*)).

Sixteen pelagic sector respondents attached the most value to subsidies as a means of promoting pollution control. No distinction was made between subsidies for in-plant modifications and subsidies for dedicated pollution control equipment. The pelagic sector rated income tax allowances, which are usually granted for specific types of investment, as their third choice. According to Hagevik (1970) and Rosencranz (1981), subsidies have only one substantial argument in their favour. There is less resistance to a system of subsidies than to one of direct regulation.

Subsidies violate the 'polluter pays' principle (Senecca and Taussig, 1979; Shapiro, 1977). Subsidies are regarded as costly and inefficient ways to protect the environment from pollution (Grima, 1976; Hagevik, 1970; Passer, 1971; Prude'homme, 1977). Specifically, it is difficult to establish how much to pay whom for any level of abatement. More important however, is the fact that it is difficult to predict the level of abatement *a priori* with both subsidies and tax incentives (Hahn, 1982). Furthermore, because such financial incentives are usually granted for specific investments, subsidies could discourage the development of innovative and efficient alternative abatement methods.

Some authors are however in favour of some short term financial assistance for the fish processing industry when required to upgrade their pollution abatement equipment (Koppernaes, 1975; Passer, 1971; Nelson, 1973). They feel that financial assistance should be given in cases where production facilities were built under a set of regulations which are no longer deemed adequate by the authorities. This assistance could however take the form of extra time for compliance with the new regulations or technical assistance from government.

In contrast to the pelagic sector respondents, the demersal sector respondents favour indirect subsidies in the form of income tax allowances over direct subsidies. This finding could reflect differences among the attitudes of respondents of the two industry sectors regarding the social desirability of receiving direct subsidies as compared with indirect subsidies (in the form of income tax allowances) for cleaning up the pollution that they generate.

Subsidies and allowances need to be applied in conjunction with direct controls. This is because it does not seem rational for companies to make use of such incentives to help purchase pollution abatement equipment unless all companies in the same industry are compelled by law to do so. Unilateral action by a few companies could severely impact the competitive advantage of these companies in comparison with those companies which have not incurred similar expenditure on abatement technology.

TABLE 6.3.1 (*a*)
Pollution control policy options preferred by the fish processing industry

Policy option	Number of times option favoured	
	Demersal Sector	Pelagic Sector
Equipment Specification Permits	0	2
Discharge Quality Criteria Permits	7	13
Private Law Remedies	0	2
Income Tax Allowance Incentives	7	14
Laws Based On Pollution Effects	3	9
Compulsory Insurance	0	3
Input Surcharges	0	0
Effluent/Emission Charges	3	2
Non-compliance Penalties	4	5
Pollution Control Equipment Subsidies	5	16
General Plant Modification Subsidies	6	16
Expropriation Of Obsolete Equipment	1	4
Output Taxes	0	0
Marketable Pollution Rights	2	0
Non-respondents	1	1
n = 27		

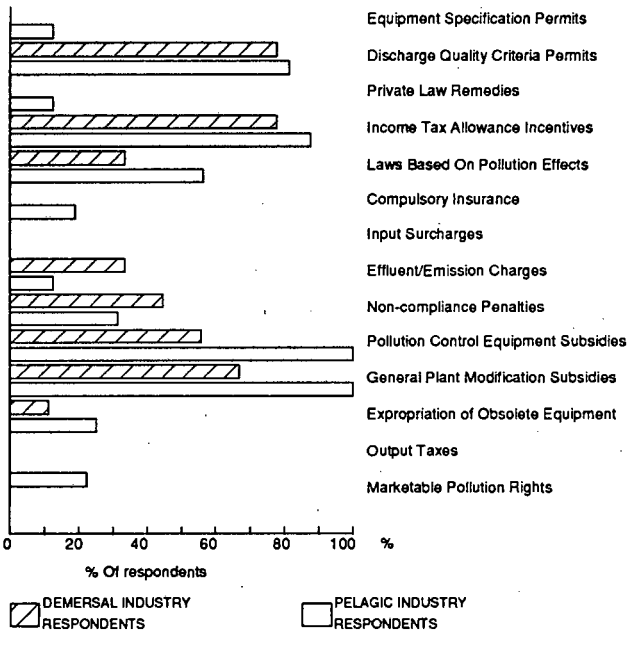

FIGURE 6.3.1 (*a*)
Pollution control policy options preferred by the fish processing industry

Demersal sector respondents did however assign an equal priority to both tax incentives and permit systems which specify the quality of the discharge into the environment, but not the method of achieving that quality. Such permit systems were regarded by the pelagic sector respondents as the next most preferred pollution control policy option after subsidies and income tax incentives.

Permits which specify the type of equipment that must be used to control pollution were favoured by only two respondents. In practice the specification standard used in the Atmospheric Pollution Prevention Act 45 of 1965 is not inflexible. The standard governing equipment that may be used in scheduled process, namely that of the best practicable technology (BPT) is derived in consultations between the Chief Air Pollution Officer and the industry concerned.

Negative financial incentives such as input surcharges and output taxes which are designed to decrease pollution by artificially lowering production levels were not liked by any of the respondents. Auld (1985), analyzing the principle of equity in situations where polluting companies face different demand elasticities with respect to the output of goods, argues that compensation may be required to ensure fairness. The introduction of a product tax, for example, in a monopolistic market, could be suboptimal from society's point of view. This is because product taxes could lead to an artificial shortage of certain products (Tisdell, 1982/3).

The major advantage of a product tax is that it can be implemented quickly with only rough measures of effluents and emissions being required. However, due to the inefficiency inherent in this system, Tisdell (1982/3) believes that it would be better to tax the discharge directly. According to Hahn (1982), industry generally regards taxes as a greater threat to doing business than the current cost of standards. Restricting the quantity of goods produced in order to reduce pollution is subject to similar criticisms as those applicable to product taxes. Methods such as rationing, quotas and the allocation of the means of production in terms of physical units, are methods of a planned economy (Haberler, 1977). Such methods do not work, because without economic growth, no funds will be available for controlling pollution (Drucker, 1977).

Similarly, the use of private law remedies (such as the interdict and compensation), compulsory insurance and the expropriation of obsolete pollution producing equipment, were not popular possibly because all of these options may have potentially serious financial implications. The interdict has been used in a number of South African cases to restrain activities that cause pollution. The establishment of a compulsory insurance fund, may not be favoured because it could create the impression that the fish processing industry is engaged in a 'harmful activity'. Furthermore the establishment of such a fund could lead to an increased amount of litigation for the industry.

Charges levied per unit of discharge, designed to discourage the release of large volumes of effluents and emissions were acceptable to five members of the industry. According to O'Riordan (1981), emission charges are a political extension of the price system. Changes in the prices of inputs are normal in business. Prices can be expected to rise as commodities become scarcer, and fall with innovative changes in production processes. The imposition of a charge merely changes the conditions under which the firm must operate (Baumol, 1974).

The effluent or emission charge will induce each firm to reduce their discharges as long as the marginal cost of compliance, including the diversion of management resources, is less than the levied charge (Bidwell, 1982; Brady and Cunningham, 1981; Forster, 1976). If the charge

is set too low, the danger exists that the environment may come to be regarded as a resource that can be bought at a price. This could also result in the level of pollution being raised up to the margin of assimilative capacity (Pearce, 1974). Concern has been expressed about the allocation of resources solely on the basis of 'ability to pay'. Ashby (1972) and O'Riordan (1981) therefore point out the necessity for taking social and political factors into account when determining such charges.

Laws specifying the relationship between the effluent and emission discharges of the industry in terms of the permissible effects that such discharges could have on the receiving environment were seen by twelve of the twenty-seven respondents as an option that could be used to control pollution. Nine respondents were in favour of the use of penalties that could be invoked for not complying with legislation pertaining to pollution control. Such penalties remove the economic advantage of non-compliance (Blackman and Baumol, 1980). Only two respondents were of the opinion that the creation of a market in transferable pollution rights was a viable option.

A perceptual map displaying the preferences of the fish processing industry managers for the various pollution control policy options has been generated by unfolding analysis (Figure 6.3.1 (*b*)). A field enclosing the most preferred options (given in Table 6.3.1 (*a*)), and the industry sector to which the (numbered) respondents were affiliated, are superimposed onto the map. This is done in order to highlight the spatial arrangement of the respondents to each other and to the most preferred policy options.

Since psychological distance (preference) is inversely related to geometric distance on these perceptual maps (see 2.4.2), the closer an individual is located to an option on the perceptual map, the higher the order of preference that individual will have for that option. The original rank ordered preference of the respondents (given in Appendix V D, Question B 2), were reproduced with an accuracy of 86.7%. That is the departure from perfect monotonicity (original rank ordering) was 0.133 or 13,3%.

Pollution control policy options that are currently available in South Africa have been indicated on the perceptual map. Of the options currently used in South Africa, only the permit system based on discharge quality criteria was highly favoured. Although income tax allowances are available for investments in production equipment, such allowances do not extend to dedicated pollution control equipment in terms of the South African Income Tax Act. Furthermore, it must be pointed out, that although three factories in the Cape Town metropolitan area pay effluent charges to the municipality (Appendix I), such charges are in reality treatment fees since their primary objective is not to discourage use of public resources (see 4.2.2).

From the unfolding analysis and the ratings of policy preferences, the fish processing industry would welcome a system of positive financial incentives to be introduced to help off-set the cost of pollution control systems. A question was constructed to confirm or refute this conclusion and presented to respondents in the second questionnaire (Appendix III A). It was also decided to test the hypothesis that should such incentives not be provided by government that the existing permit system based on the effluent quality standard would be acceptable to the industry. This is because this type of permit system allows each firm to find its own least cost solution in achieving the prescribed environmental quality criteria (Table 6.3.1 (*b*)).

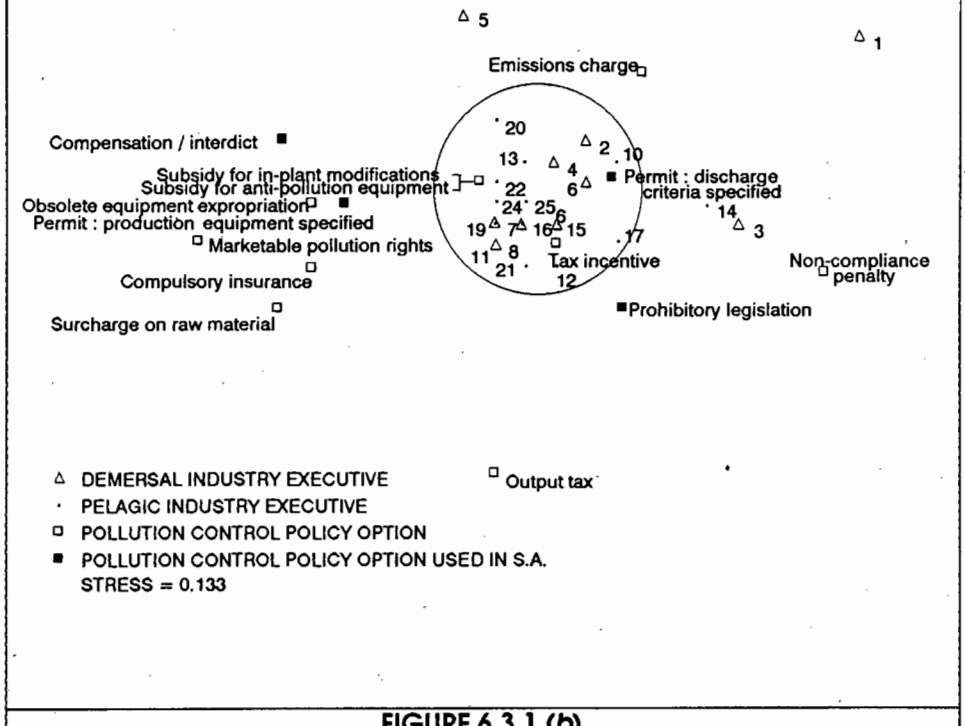

FIGURE 6.3.1 (*b*)

A PERCEPTUAL MAP DISPLAYING THE PREFERENCES OF FISH PROCESSING INDUSTRY MANAGEMENT FOR POLLUTION CONTROL POLICY OPTIONS

Psychological distance is represented by geometric distance on the perceptual map. The closer a respondent (represented by a number) is located to a pollution control policy option the higher his preference for that option. Respondents that are located close together are interpreted as having similar preferences. Policy options located close together are perceived by respondents as being similar with regard to some attributes. The policy options most favoured by respondents (Table 6.3.1 (*a*)) have been enclosed in a field. Pollution control policy options that are currently used in Southern Africa have been differentiated from policy options used elsewhere. There appears to be no difference in the distribution of preferences among the demersal and pelagic sector respondents. The stress level of 0.133 indicates that the original rank ordered preferences of respondents have been reproduced with an accuracy of 86.7%.

6.3.2 Administrative Considerations Of Industry Policy Preferences

The policy options preferred by the fish processing industry have very different implications from the points of view of industry and society in general, with regard to equity. Equity relates to the issue of how individuals will pay for pollution control. Demersal sector respondents believe that company customers and not the general tax payer should pay for environmental protection measures that the industry is required to install (Table 6.3.2 (*a*), Figure 6.3.2 (*a*)). The situation is not as clear among the pelagic sector respondents in that only eight respondents were of the opinion that the general tax payer should not pay for measures to protect the environment, as opposed to six respondents who were of the opposite opinion. This may be due to some

TABLE 6.3.1 (*b*)
Pollution control policy options most preferred by fish processing industry management

Respondents' evaluation of the statement that should financial assistance not be available for pollution control it would appear that the industry would be satisfied with the existing permit system which allows the discharge of effluents of a prescribed quality, while leaving the means of achieving this quality standard to the individual company so that a least cost solution can be found

	Number of respondents	
	Demersal Sector	Pelagic Sector
Strongly Agreeing	1	5
Agreeing	8	8
Uncertain	0	0
Disagreeing	0	0
Strongly Disagreeing	0	0
Non-respondents	1	4

n = 27

Non-respondents were assumed to be in full agreement with the above statement (see Appendix IIIB).

members in the pelagic sector believing that further expenditure on pollution control is uncalled for and if demanded should be met from public funds. Considering the responses of both sectors of the industry together, sixteen members (59.2%) of the research population believed that customers of a company rather than taxpayers should pay for environmental protection.

Fourteen respondents (51.9%) were in favour of the each discharge being evaluated on a case-by-case basis, whereas nine respondents (33.3%) were of the opinion that the same discharge conditions should be applicable throughout the fish processing industry (Table 6.3.2 (*b*), Figure 6.3.2 (*b*)).

Although variable standards may appear to serve the interests of the discharger, Industry has often stated a preference for uniform standards, for two reasons. Firstly, the feeling may exist that variable standards may make some members of the industry less competitive than others. Secondly, Industry may not be in favour of the control authority being allowed too much discretion (Bidwell, 1982). The administration of a permit system of pollution control which is based on variable standards could be susceptible to political pressures and the pleading of special cases (Ferrar and Horst, 1975; Grima, 1976).

Evidence does however exist in contradiction of the belief that a uniform standard may be preferred to treating each pollution source on a case-by-case basis. Specified technological solutions proposed for the treatment of fish factory wastes in both South Africa and Canada were generally not favoured (Koppernaes, 1975; Water Research Commission, 1983). This was

TABLE 6.3.2 (*a*)
Management opinion as to who should pay for environmental protection measures that the industry is required to install

Respondents' evaluation of the statement that tax payers rather than company customers should pay for protection of the environment.

	Number of respondents	
	Demersal Sector	Pelagic Sector
Strongly Agreeing	0	1
Agreeing	0	5
Uncertain	1	2
Disagreeing	7	4
Strongly Disagreeing	1	4
Non-respondents	1	1

n = 27

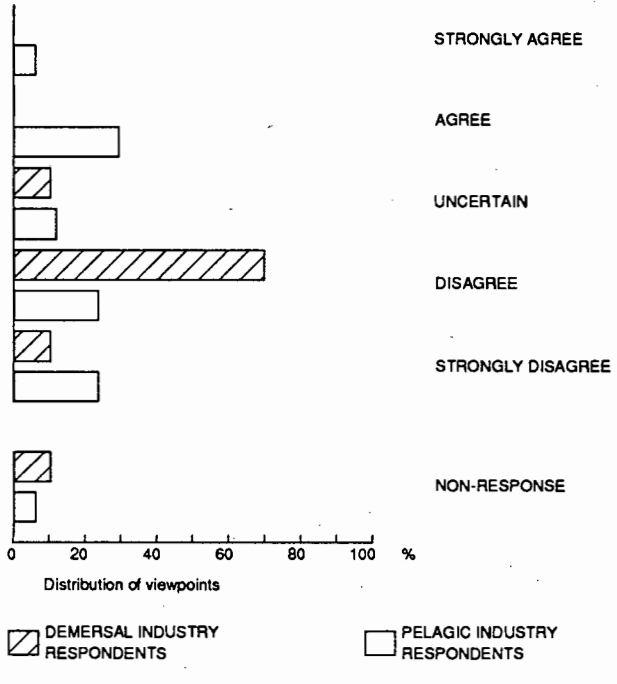

FIGURE 6.3.2 (*a*)
Management opinion as to who should pay for environmental protection measures that the industry is required to install

TABLE 6.3.2 (*b*)
Industry opinion as to whether pollution control regulations should be applied on a case-by-case or uniform basis

Respondents' evaluation of the statement that pollution control should be applied on a case-by-case basis rather than by means of uniform standards.

	Number of respondents	
	Demersal Sector	Pelagic Sector
Strongly Agreeing	1	7
Agreeing	3	3
Uncertain	2	0
Disagreeing	1	5
Strongly Disagreeing	2	1
Non-respondents	1	1

n = 27

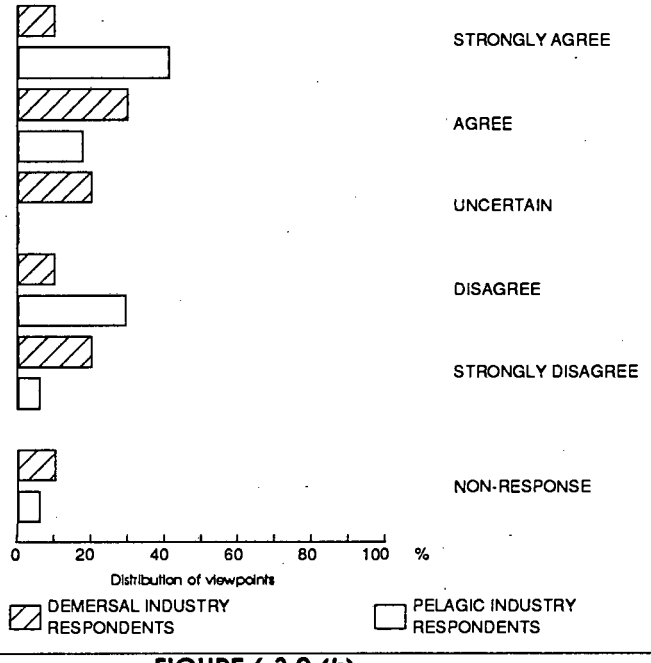

FIGURE 6.3.2 (*b*)
Industry opinion as to whether pollution control regulations should be applied on a case-by-case or uniform basis

primarily because of the wide variation in production technologies used and the variety of environmental conditions associated with each factory. The general view was expressed in both these studies that there should be room for flexibility to develop innovative solutions. The fish processing industry presently has to ensure that their effluents conform to environmental quality criteria. These criteria specify the limits that must not be exceeded in order to maintain the characteristics of a selected portion of the environment. This allows each factory to use the natural dispersing capabilities of the receiving environment and to adjust its level of pollution control so as to optimize pollution control expenditure.

6.4 SUMMARY

Current pollution control policy has not proved to be effective in promoting the required level of investment in environmental protection measures among all the factories of the fish processing industry (Appendix I). The required level of investment being the amount that the industry needs to spend in order to achieve a satisfactory abatement performance for the industry as a whole. Existing policy was therefore examined to highlight possible problem areas and with a view to improving future pollution control policy.

Most respondents perceived current pollution control legislation to be realistic, timely and fair. Penalties were perceived to be adequate tending towards lenient. Regulations were seen to be flexible in terms of how effluent and emission quality improvements are to be achieved. However, it was felt that there are too many laws, which are complex and afford very limited opportunity for industry input into their formulation. There was no agreement as to whether the law itself or the manner in which it is applied is problematic. Both sectors believe that the government would rather negotiate than take polluters to court. There is agreement that the discharge of untreated wastes from the fish processing industry should remain a criminal offence.

Pollution control can be promoted by a variety of policy instruments, some of which have a greater financial impact on a business than others. The fish processing industry displayed a preference for pollution control policy instruments which incorporate positive financial incentives such as subsidies and allowances. These incentives can offset the cost of acquiring pollution control equipment. However, should this not be possible, the industry would be satisfied with the existing permit system, which allows for a discharge of a prescribed quality, while leaving the means of achieving this to individual concerns, so that a least cost solution can be found.

Disincentives such as output taxes and input surcharges, aimed at controlling pollution levels indirectly by limiting production, were not favoured. Nor were private law remedies (such as compensation and the interdict), compulsory insurance or expropriation of obsolete pollution producing equipment, all of which could have potentially serious financial implications for the industry. Some members of the industry were in favour of legislation which specified the relationship between discharges and their permissible environmental effects. The use of penalties, which remove the economic advantage from those companies not complying with pollution control regulations were also favoured by some respondents.

The general opinion of the industry is that their customers rather than the taxpayers should fund any environmental protection measures that the industry is required to install. There was general agreement that discharges from factories should be treated on a case-by-case rather than

on a uniform basis probably because the costs of achieving a uniform discharge quality are sensitive to factory location.

The next chapter presents an integrated discussion of all the results presented in this and the previous chapter. The comments made by respondents, that suggest possible explanations for their responses to the various questions, and their actions with regard to pollution control are also discussed.

CHAPTER 7

Discussion and Conclusions regarding Factors that Influence Waste and Pollution Control Investment Decisions of the Management of the Fish Processing Industry and their Preferences for Pollution Control Policies

The *ex post facto* research design used in this study is best suited to suggesting possible explanations for the reported behaviour as well as the viewpoints and opinions expressed by the managers of the fish processing industry with regard to pollution control. This research design does not permit the testing of hypotheses, but is of use in exploratory and descriptive studies (Bailey, 1982; Churchill, 1983). The discussion presented below is based on the findings drawn from the two questionnaires presented in chapters five and six. Comments made by respondents regarding various issues in the two questionnaires have been included in the discussions. These comments provide valuable insights into management thinking and behaviour with regard to controlling pollution from land-based fish processing factories.

7.1 THE RELATIVE IMPORTANCE OF INVESTMENTS IN WASTE AND POLLUTION CONTROL COMPARED TO OTHER STRATEGIC INVESTMENTS

The first research objective of this study was to establish the relative importance of investments in waste and pollution control systems, compared with other strategic investment priorities, to managers of the fish processing industry. This was done because investment in waste and pollution control equipment may result in the diversion of large amounts of capital from other projects in which the business may wish to invest. In order to place investment in waste and pollution control in perspective it was necessary to first examine the business environment of the fish processing industry.

The business environment is composed of a dynamic set of interacting factors which influence the selection of goals, objectives and strategies. Managers need to be aware of these factors so that they can make timely and appropriate allocations of the finite resources at their disposal in order to ensure the survival of their companies. They must therefore continually gather information about threats and opportunities in the business environment and relate these to the capabilities of their companies.

Profitability is essential for the survival of a commercial enterprise. Without it no firm can maintain investments in assets which are needed if a company is to compete effectively, both locally and abroad. Investments in new assets are needed to cater for changing consumer demands. It is therefore not surprising to find that modernization programmes are viewed as the major investment priority of the fish processing industry (Figure 5.4.1).

Modernization usually results in improved efficiency both in terms of handling and processing material. Technological innovations contribute to profits either by improving yields or lowering operating costs, both of which lower the price of products and thus make products more competitive. This is an important factor when the threat of substitute products such as soya meal is considered. The price of substitute products place a limit on the prices that the fish processing industry can charge for their products if they wish to remain competitive (Bell and Kinoshita, 1973).

The major threat to profitability and modernization within the fish processing industry was perceived to be cost escalations (Figure 5.3.). Many factors can contribute to cost escalations. Declining catches per unit effort (CPUE) due to over fishing both by local and foreign vessels (Respondent 024, Appendix IV B; Respondent 021, Appendix VI B). Rising prices of key inputs such as fuel, due to unfavourable foreign exchange rates, result in higher production costs (Friedland, 1986; Stuttaford, 1985a). Costs can also be increased by high interest rates on loans taken out by the fish processing industry to finance asset replacement (Baumol and Blinder, 1979; Miller *et al.*, 1978). Trade sanctions have negative cost implications both from the point of view of acquiring new technology as well as from the point of view of access to markets upon which the industry can sell its products (Penrith, 1986). Excessive demands by workers for wage increases and lost income as a result of strikes serve to fuel inflation and result also in higher production costs (Miller *et al.*, 1985). Excessive government intervention and inappropriate regulations can also force an industry to adopt economically inefficient practices (Fox, 1981; Harris, 1974).

According to Firth (1985) the industry needs to maintain high production levels if it is to remain profitable. This is because the fish processing industry is heavily capitalized, that is, the emphasis in production has been on the use of capital assets rather than upon labour. This would explain the sensitivity of the industry to decreases in the quota allocation (Figure 5.3.). Potgieter (1985) and Stuttaford (1985b), both agree that modernization programmes can be justified only with high sustained catches with which to supplement the retained earnings needed to fund such programmes.

Fishing companies may either attempt to modify the constraints set by the business environment, or accept them and attempt to achieve their objectives within them. A number of strategies can be used to improve profitability (Cunningham *et al.*, 1985; Miller *et al.*, 1985). One such option is product benefication, that is the development of new and unique products from existing raw materials. Some respondents (001, 008, 009, 013, 015, 016, 017, 018 and 021, Appendix IV B) view this as a likely option. Four of these respondents (008, 013, 017 and 021, Appendix IV B) are of the opinion that more products will be developed for direct human consumption rather than for animal feeds. This is presently not the case in the pelagic sector of the industry where the bulk of the catch is processed into fish meal (Du Plessis, 1988).

Product diversification, especially into products for direct human consumption, will generate more income and create more employment than is currently the case with fish meal production in the pelagic sector of the industry (Potgieter, 1985). Nonetheless as the industry has a shortage of skilled labour (Prosch, 1985), it will need to upgrade the skills of its workers if it is to make the transition from mechanical to micro-electronic production control (Anon, 1982b; Anon, 1985a). The fish processing industry managers perceived the need for both job

creation and training, without which successful modernization or product diversification objectives cannot be achieved (Figure 5.4.1).

The managers of the fish processing industry perceived an opportunity in developing fisheries for species such as squid (*Loligo reynaudi*), tuna (*Thunnus* sp.) and mesopelagic fish which are currently not subject to quota restrictions (Figure 5.3.). Such ventures could involve high financial risks due to a relative lack of expertise in catching and processing such species. This would explain the perceived need for greater investments in research and development (Figure 5.4.1). Such investments would also be needed if the fish processing industry intends developing new products, or becoming involved in aquaculture.

Specialization (that is, focusing more narrowly on existing products and markets), employee benefit programmes, waste recovery and pollution control systems all have a relatively low investment priority when compared to the other strategic investments that the fish processing industry could make (Figure 5.4.1). This suggests that investment priorities are determined on the basis of perceived contribution of such investments to the survival of the industry.

As far as investments in waste and pollution control are concerned, one respondent (013, Appendix VI A) stated that all usable waste is currently recovered by the pelagic sector of the industry. Another respondent (022, Appendix VI A) pointed out that the industry had already spent hundreds of thousands of rands on improvements to environmental quality. This money was initially spent on those systems which provided an economic return such as dry-offloading systems and stickwater treatment plants. The industry had according to this respondent also invested in non-economic scrubbing towers to remove air pollution and more recently, in scum tanks which remove free oil and fine proteinaceous material from offloading water. He was of the opinion that any further improved measures to control pollution could be justified only by higher prices being obtained for products such as low temperature fish meals.

Nonetheless, it was of interest to note that investments in waste recovery, as opposed to pollution control were perceived to be very different by the respondents, as indicated by the locations of these parameters in the joint space on the perceptual map of industry investment priorities (Figure 5.4.2). The distinction between waste recovery and pollution control investments appears to be based on the financial returns that could be expected from waste recovery and pollution control equipment. This interpretation is supported by the fact that fish processing industry executives perceived investments in employee benefits to be similar to investments in pollution control as indicated by their close proximity in the joint space. The perceived dissimilarities between pollution control and waste control investments as indicated by the geometric distance between them in the joint space, may become less distinct as the costs of recovering the remaining material approach or fall below the value of the recovered product.

There also appears to be agreement among respondents that should the industry be able to modernize its operations, the need for additional expenditure on waste and pollution control can be expected to decrease accordingly (Table 5.4.3). Modern technologies tend to be more efficient and hence less likely to produce as much pollution as older designs (Royston, 1980). It therefore seems unlikely that the fish processing industry will divert significant amounts of capital to waste control and pollution control programmes, unless compelled by public pressure or more stringent regulations to do so. This can be inferred from the finding that the industry respondents do not

believe that they will be prosecuted for polluting (Figure 6.2.2) but appear nonetheless to be sensitive to their public image (Figure 5.5.1 (*a*)).

However, should the pelagic sector become geared to manufacturing a greater proportion of products for direct human consumption, as opposed to animal feeds, then the situation with regard to waste and pollution control investments could be expected to change. In the manufacture of products for human consumption catches are wet-offloaded so as to reduce physical damage to the fish during dry-offloading. Therefore, a shift to products for human consumption, could be expected to increase pollution levels due to a greater reliance on wet-offloading (see 1.1.2). This situation could lead to increased expenditure on waste control and pollution control by the pelagic sector.

Similarly, the demersal sector could be expected to make investments in environmental protection if it was to be prevented by law from disposing of its offal at sea or if a decision was taken by the demersal sector companies to process more offal on land than it currently does. The processing of more offal by the demersal sector does not appear to be likely on economic grounds, since offal cannot compete with edible fish for hold space on fishing vessels (Anon, 1974; Anon, 1975b).

CONCLUSION 1

Investments in environmental protection were not perceived to have a high priority in relation to other strategic investments that the industry may make in the medium and short term. Strategic investments aimed at ensuring the survival and profitability of the industry, such as modernization and diversification programmes, appear to be the most likely investments that the fish processing industry will make. This suggests that the reason for waste and pollution control investments not being viewed as important has to do with their low contribution to corporate profitability or short-term economic survival when compared to other strategic investments.

It appears unlikely on financial grounds that the fish processing industry will make any further significant investments in waste and pollution control equipment unless there is a significant increase in the value of the recovered product (fish meal) or an increase in public pressure on the industry to improve its abatement performance. This is because it would not be economically rational for the industry to invest in equipment from which returns may be marginal. Nor would it be rational for individual firms to invest in such equipment, on competitive grounds, unless there is certainty that firms are likely to incur financial losses due to having to pay fines for polluting.

7.2 FACTORS INFLUENCING WASTE AND POLLUTION CONTROL INVESTMENT DECISIONS OF FISH PROCESSING INDUSTRY MANAGEMENT

The second objective of this study was to identify the factors which influence senior managers of the fish processing industry when investments in waste and pollution control systems are required. Nadler and Lawler (1977) suggest that people have mental maps of what they believe the world to be like. They suggest that people then behave according to those ways in which their mental maps indicate will lead to outcomes that will satisfy their needs. Simon (1957) and

Lindblom (1959) believe that cognitive limitations of decision-makers may weigh against detailed consideration of many factors when making decisions. This could account for Downer's (1976) finding that business acumen is frequently substituted for formal computations in the investment decisions of businessmen. This implies that businessmen simplify the decision-making process by considering only the factors which they perceive to be the most important. A knowledge of the relative importance of factors considered by management when making investments in waste and pollution control could lead to an understanding of why measures taken by the fish processing industry to control pollution are generally inadequate (Appendix I).

Waste control investment decisions appear to be approached differently by the managers of the demersal and those of the pelagic sectors of the industry. This is demonstrated by the relative importance that executives of these two sectors attach to various factors when making such investments (Figure 5.5.1 (*a*)). It seems that the size of the financial return that can be expected from investments in waste control will determine how such investments will be approached.

The recovery of waste material from the relatively low volume effluent streams of the demersal sector may not be perceived to be conomically viable. Hence an investment in waste recovery equipment may be viewed by the demersal sector respondent primarily as a means of controlling pollution. In contrast, pelagic sector investments in waste control systems, directed primarily at the recovery of suspended solids (see 1.1.2), have generated sufficient income to offset the operating and capital costs of such systems (Anon, 1975a).

The inference that the size of the financial return from investments in waste control will determine how such investments will be approached is supported by the perceptual map produced by unfolding analysis showing that investments in waste and pollution control appear to be differentiated on the basis of their ability to generate income as discussed above in section 7.1. (Figure 5.4.2). One respondent (009, Appendix VI A), explicitly agreed with this assumption made by the researcher. This respondent stated that if investments in waste control did not have a financial return, then factors such as company image, pollution control regulations and prevention of pollution would be the most important factors in making such investments. On the other hand, when a financial return could be expected, then the following factors, namely, return on investment, profitability of the company and quota size would dominate the decision-making process.

Pelagic sector respondents appear to base their decisions to invest in pollution control equipment primarily on financial considerations (Figure 5.5.1 (*a*) and Figure 5.5.1 (*b*)). Of all the financial factors profitability of the company is regarded as the most important. This factor determines whether waste control equipment is affordable in the first place. Quota size is also of importance to most pelagic sector respondents because it sets a limit on the amount of fish and consequently the total income that may be made in any fishing season (Figure 5.5.1 (*a*) and Figure 5.5.1 (*c*)). If the quota is too small then it may not be possible for a company to maintain profitability. This could result in a decrease in the level of spending on new assets. However, even if companies are able to invest in waste control equipment, small quotas may make the recovery of material from the effluents generated during production uneconomical. This viewpoint was also expressed by a respondent (014 Appendix VI A).

Demersal sector respondents perceived the legal and social aspects associated with waste control investments to be of greater importance than the financial factors (Figure 5.5.1 (*a*) and Figure 5.5.1 (*b*)). The apparent concern of these respondents with the pollution control aspects of waste control equipment suggests that demersal sector respondents do not view waste recovery as an economically viable option. This does not however imply that the financial aspects of such investments are unimportant to the demersal sector. Ferrar (1974) believes that pollution control investment decisions are very sensitive to financial calculations. This belief is supported by the views of two respondents (001, and 014, Appendix VI B), who stated that returns from investments in waste control were usually considered in the negative sense, that is, in terms of fines avoided.

Prior to this study it was assumed by the researcher that companies in the pelagic sector which recovered waste material (in order to improve the fish meal yield), would have a financial advantage over companies that did not recover their wastes. This assumption does not appear to be justified. Competitive advantage does not appear to be an important factor in such investment decisions (Figure 5.5.1 (*a*)) for the following reason. All the fish meal produced by the pelagic sector of the industry is sold through a single organization, namely the South African Fish Meal Marketing Co. (Pty) Ltd. (Stuttaford, 1987). Since the price paid to all fish meal producers is the same, certain producers may find no financial advantage in installing waste recovery plants which may only recover small amounts of additional material to sell at a price that may not be high enough to provide a marked economic advantage. Potgieter (1985) is of the opinion that some fish meal producers may withdraw from this fish meal marketing association because it may be more profitable for them to sell their product themselves. Should companies be able to negotiate better prices for their fish meal then the perceived financial advantage of acquiring waste control systems may become an important factor in the investment decision process.

Company image was perceived to be an important factor in influencing decisions to invest in waste control equipment (Figure 5.5.1 (*a*)). This may be a reflection of the increasing pressure exerted on the industry by residents and other groups who make use of the amenities in the vicinity of fish factories (Appendix I). One respondent (001, Appendix VI B) believed that the fish processing industry as a whole tends to take the blame for pollution instead of individual factories. If this is indeed the case then it would be in the best interests of all factories to have a positive public image. To achieve this fishing companies would have to make investments in waste and pollution control ahead of public demands. Companies failing to make such investments in response to public pressure run the risk of costly government intervention in the form of stringent pollution control regulations.

It was of interest to note that neither tax investment incentives nor the ability to pass the costs of acquiring waste control equipment onto customers were regarded as important factors when making investments in such equipment. Both these options reduce the direct cost to companies of making such investments. Kefalas and Carrol (1976/7) found that more than 50% of North American businessmen surveyed were in favour of passing the costs of environmental protection onto customers. The reason that passing on costs does not appear to be a popular alternative, as far as the Southern African fish processing industry is concerned, may be that this could lead to consumer resistance. This is an important fact to consider when substitute products produced by other sectors of the economy are available at competitive prices.

Tax incentives on the other hand, provide a means of reducing costs without the need to increase the price of goods. In order to qualify for a tax allowance a company must first make an investment. Presumably, the value of the allowance received by firms that invest in waste control equipment is not an attractive enough incentive to encourage the management of the fish processing industry to make such investments. In any event all investments in equipment which form part of the process of manufacture, such as waste recovery equipment, would qualify in terms of the South African Income Tax Act for such an allowance. Therefore it seems unlikely that such incentives would be more likely to encourage investments in waste control equipment over those investments in other areas of production that promise a greater financial return. Hence such incentives because of their general applicability to all production equipment may not be perceived as important factors in the investment decision process.

The finding that the interests of company shareholders were not regarded as an important factor in waste control investment decisions may be a reflection of the size of such investments (Figure 5.5.1 (*a*)). If expenditure on such systems is relatively low in relation to other expenses that a company may incurr, then they are unlikely to have a significant effect on dividends paid to shareholders. On the other hand if such investments were to result in lower dividends being paid to shareholders, then shareholders could be expected to sell their shares and withdraw their financial support from the industry (Kling, 1985).

Pelagic sector respondents were of the opinion that pollution control regulations had significantly increased production costs (Figure 5.5.3). However the majority of respondents from both sectors reported capital and operating expenditure to be between zero and four percent of annual budgeted expenditure. Kefalas and Carrol (1976/7) point out the question of pollution control expenditure is complex, because, in addition to being able to justify the costs in terms of perceived benefits, most firms do not want to publicly disclose how much they spend on protecting the environment. Furthermore capital investments in waste and pollution equipment tend to be irregular so that in some years such costs could represent a higher percentage of budgeted costs than others. Thus the question as to whether the acquisition of such equipment had significantly increased production costs is difficult to confirm independently of industry claims.

It appears that only the demersal sector respondents believed that expenditure on pollution control had been economically justifiable (Figure 5.5.2 (*b*)). The majority of the research population were undecided on this point. This uncertainty can, in part, be attributed to the value of the perceived savings or benefits of pollution control, which may be difficult to quantify. These include the value of fines avoided and the extent to which pre-emptive investment by the industry had reduced the potential costs of future legislation. Considering these benefits from the point of view of material recovery alone, it is not easy to estimate the value of such investments. This is because the yields can vary widely among different fish species and even within the same species due to seasonal and other factors such as the condition of the fish arriving at the factories.

Thus it would appear that the relative importance of various factors in making investments in waste and pollution control will be dependant on whether such investments are capable of generating a financial return. If such investments are expected to generate a financial return as may be the case with waste control equipment, then financial factors will dominate the

decision-making process. However, if returns are marginal or nonexistent then managers of the fish processing industry may not make a distinction between investments in waste control equipment and pollution control equipment. In the event of waste control investments being viewed as exercises in pollution control, legal and social considerations can be expected to be of greater importance than financial factors in the investment decision process.

CONCLUSION 2

Legal and social considerations tend to dominate waste control investment decisions in the demersal sector. Whereas the pelagic sector management appear to regard the financial aspects of waste control investment decisions to be of greater importance than the social and legal considerations. As the effluents of the demersal sector comprise mainly wash waters, managers in this sector may not perceive the recovery of waste material from such effluents as being economically viable. Consequently waste recovery in this sector may be viewed primarily as an investment in pollution control.

In contrast to the demersal sector of the industry, the pelagic sector has made significant investments in waste control equipment. Although waste control investments were initially motivated by laws aimed at decreasing pollution, such equipment has generated sufficient income to offset the costs of acquiring these systems and made a contribution to profits. This could account for the relative importance of the economic considerations of waste control investment decisions to the managers of the pelagic sector. It therefore seems that the relative importance of factors that influence managers of the fish processing industry to invest in waste control equipment appears to be determined by the perceived financial returns that can be expected from such investments.

7.3 VIEWPOINTS AND OPINIONS REGARDING EXISTING POLLUTION CONTROL POLICY

The third objective of this study was to establish the viewpoints of senior managers of the fish processing industry regarding current government pollution control policy. This was done in order to highlight possible problems with existing legislation. Pollution control policy will not achieve its objectives if it is perceived by the industry to be unnecessary or unreasonable. This is especially true in cases where companies are compelled by law to make investments in environmental protection as such investments could result in diversion of capital from more productive activities. Fishing industry perceptions about the necessity for such investments will, in part, be influenced by the nature of the pollution problem. As has been pointed out (see 1.1.2), discharges from the fish processing industry comprise non-toxic organic material which, when not adequately dispersed, create localised problems which can result in mortalities of marine organisms. Other problems tend to be more of an aesthetic nature and do not present any direct danger to human physical health, but do result in mounting pressure on the industry to take adequate steps to prevent them from occurring.

It was therefore interesting to note that only the demersal sector believed that the discharge of untreated wastes could cause significant harm to the environment (Figure 5.5.2 (*a*)). By implication it would seem that pelagic sector respondents were of the opinion that discharges of

fish processing wastes did not constitute pollution. This could also explain why investments in waste control equipment are approached differently by the two industry sectors and account for the divergent viewpoints held about current pollution control legislation.

Most respondents perceived pollution control legislation to be realistic (Figure 6.1.1), timely (Figure 6.1.2), and fair (Figure 6.1.3). A study by Kefalas and Carrol (1976/7) found that north American business executives believed that environmental protection regulations were premature and that the target dates set for compliance were too optimistic. In the Southern African fish processing industry this does not appear to be the case, probably because target dates for the implementation of such regulations are usually decided in consultation with the involved parties (Tucker pers. comm., 1987). There was general agreement among respondents that regulations for controlling pollution were flexible in terms of the abatement methods that individual companies could use to achieve the required level of pollution control (Figure 6.1.5).

Penalties for polluting were perceived to be adequate. However, some respondents were of the opinion that penalties were generally lenient (Figure 6.1.4). The danger of lenient penalties is that they may come to be regarded as part of the cost of doing business. According to Drucker (1977), punitive laws succeed only when transgressors are few and the unlawful act is comparatively rare, but not when everyone is transgressing. Fines and penalties provide a more concrete indication of the importance that governments attach to the environment. The opinions expressed by fish processing industry management about the adequacy of existing regulations, coupled with the unsatisfactory abatement performance of the fish processing industry in general, could indicate that existing policy has little or no impact on management decision-making.

Many reasons have been put forward to account for the inadequacy of current legislative approaches to protect the environment. The most often cited reasons point to problems with the administration and enforcement of the law. Environmental protection laws in South Africa are generally believed to be adequate legal instruments, but sporadic and selective enforcement can result in a situation in which the efforts of government are ignored with relative impunity (Pentreath, 1978; Rabie and Erasmus, 1983). It appears that government pollution control policy is not taken seriously by members of the fish processing industry. This is manifested by the belief held by most respondents that the government would rather negotiate than prosecute polluters (Figure 6.2.2). This impression may have been created because throughout the entire history of the fish processing industry only three cases of pollution, all in 1973, have been brought to court by the South African government.

Nonetheless there was general agreement among the respondents that the discharge of untreated wastes from fish factories should remain a criminal offence (Figure 6.2.3). This belief was, however, qualified by four respondents (001, 014, 021, and 022, Appendix VI B), who felt that the criminal sanction should be invoked only for intentional discharges and then for selected wastes only. This qualification was made on the grounds that many of the factors that contributed to fishing industry pollution, such as the condition of the fish arriving at the factories, were beyond the control of the industry. Generally the further the fleet has to travel from the fishing grounds to the factories the higher the level of decomposition of the fish in the holds and the greater the potential for organic pollution. Furthermore a respondent (013, Appendix VI B) pointed out that although effluents were not allowed to discolour the sea, natural discolouration, which is difficult to distinguish from pollution, also occurred. Two respondents (001 and 021,

Appendix VI B) expressed the opinion that the government should consult the industry before recourse to courts of law. In addition these respondents believed that when penalties were imposed, that it should be done on a case-by-case basis and that there should be provision for graded penalties.

There was, however, no certainty among respondents as to whether the problem with current legislation was due to the law itself or the way in which the law was administered (Figure 6.2.1). Possibly a lack of familiarity of some of the respondents with the relevant pollution control laws accounted for this uncertainty. The lack of familiarity with pollution control regulations was suggested by the fact that three respondents displayed a lack of knowledge about certain key provisions contained in the regulations that were pertinent to the control of pollution and the acquisition of pollution control equipment. One respondent (013, Appendix VI A) was not aware of a key provision in the Sea Fisheries Act of 1973 that reversed the presumption of 'innocence until proven guilty' in the case of pollution occurring within an eight kilometer radius of a fish factory. Two other respondents (011 and 014, Appendix VI B) were under the erroneous impression that dedicated pollution control equipment qualified for income tax allowances. A more plausible explanation for the uncertainty of most respondents as to whether there was a problem with the law itself or the way in which it was administered, may be that current pollution control policy has little impact on the decision making of the fish processing industry. Consequently respondents had not formed definite opinions on this issue.

The research population did however hold definite viewpoints about certain aspects of current legislation. Most respondents felt that there were too many laws (Figure 6.1.6) and that existing laws were complex (Figure 6.1.7). Furthermore, respondents were of the opinion that the fish processing industry had been provided with very limited opportunities to contribute to the formulation of existing pollution control legislation (Figure 6.1.8). One respondent (010, Appendix VI A) stated that the plethora of different government departments involved had created a considerable amount of unproductive work for senior industry personnel. Thus it would seem that rationalization of current pollution control policy would be welcomed by the fish processing industry. Another respondent (024, Appendix IV B) created the impression that the industry would welcome more legislation only if it was aimed at protecting the interests of the fishing industry, for example, regulations restricting the activities of foreign fishing vessels operating in South African waters.

Alter (1984) points out that pollution control strategies that are too complex or too strict result in conflict between industry and the government. Such strategies do not serve to protect human health or the environment. Regulations should be designed to facilitate the achievement of goals, and, according to respondents, drawn up after consultation with the industry about the practical implications of various policy options. This has been done successfully in Japan where extensive negotiations between government and industry have taken place (McKinney, 1984). Incorporation of the views and opinions of the fish processing industry at the legislation formulation stage could result in the identification and elimination of unforseen problems (Fox, 1981). This consultation, could, according to Rabie and Erasmus (1983), decrease the need for later judicial review of promulgated regulations, as well as enhance the acceptance of such new regulations by the industry concerned.

CONCLUSION 3

The managers of the fish processing industry believe that existing pollution control laws pertaining to the fish processing industry need to be reduced in number and simplified in order to facilitate compliance by the industry. In addition these managers would like also to have more opportunities to make a contribution to the formulation of future pollution control regulations on the grounds of their technical expertise and relevant experience regarding the impact of such legislation on the industry. Nonetheless, existing pollution control regulations are perceived by the management of the fish processing industry to be adequate legal instruments. However, the laws and regulations aimed at controlling pollution do not appear to be achieving their objectives. This suggests that the problem is primarily due to inadequate enforcement of existing laws.

7.4 POLLUTION CONTROL POLICY APPROACHES FAVOURED BY THE FISH PROCESSING INDUSTRY

The forth objective of this study was to discover which policy options senior managers of the fish processing industry would prefer to see the South African Government adopt for the control of pollution from land-based fish factories. Pollution control policy formulation presents administrators with two basic problems. First, there is the need to decide upon an appropriate level for environmental quality. Second, an appropriate policy instrument must be selected to ensure that the desired level of environmental quality is achieved (Baumol and Oats, 1975; Kneese and Bower, 1968).

The choice of a particular pollution control policy instrument depends to a large degree on the level of scientific understanding about the relationship between materials that are discharged and resultant pollution (Hahn, 1982). In a world of complete certainty and perfect information the choice of a policy instrument would not make such a difference to the protection of the environment because the policy instrument could be designed to incorporate adequate safeguards to prevent environmental deterioration. However in the real world where such decisions are based on imperfect information and practical considerations, such as the feasibility of monitoring pollution sources for compliance, the choice of a policy instrument may be critical to the success of an environmental protection programme. According to Tisdell (1982/3) administrators have therefore to choose among imperfect policy instruments each with their own advantages and disadvantages. In most cases the authorities adopt a broad-based policy approach to control pollution. This consists of a number of policy instruments applied either singly or in combination.

Pollution control can be achieved either by limiting the acceptable courses of behaviour with a system of rewards and penalties, or by influencing the values and criteria employed by the decision-makers. In South Africa it appears that administrative deficiencies and inadequate enforcement adversely affect the success of pollution control policy (Malan *et al.*, 1983). It is therefore important to identify those policy instruments that are favoured by the industry since these policies are more likely to be complied with.

Policy instruments that are preferred by the fish processing industry are intuitively more likely to be complied with than options which are perceived by the industry to be unreasonable. It can also be assumed that such pollution control options will be preferred by the fish processing

industry management because these policy options are perceived to result in the least amount of unnecessary interference with the goals and objectives of the industry.

Of the wide range of policy instruments that could be used to control pollution the respondents displayed the highest preference for those instruments which incorporated positive financial incentives such as subsidies and tax allowances (Figure 6.3.1 (*a*)). Such instruments can be used to offset the costs of legally mandated investments in waste and pollution control equipment. These policy instruments do however violate the 'polluter pays principle' (Senecca and Taussig, 1979; Shapiro, 1977). The apparent reluctance of the industry managers to burden the taxpayer with the costs of environmental protection measures that their companies are required to install by law (Figure 6.3.2 (*a*)), seems to contradict their expressed preferences for subsidies and income tax allowances (Figure 6.3.1 (*a*)). Some respondents (001, 003, 011, 014 and 021, Appendix VI B) were emphatic that the tax payer should not have to pay for environmental protection measures that firms were required to install. However one of these respondents (021) qualified his views by stating that the taxpayer should pay if demands for environmental protection measures made by the public were excessive or unrealistic.

A possible explanation for the apparent contradiction between preferences of the respondents for income tax allowances and subsidies on the one hand and their view that tax payers should not have to fund environmental protection measures on the other is suggested by the findings of Kefalas and Carrol (1976/7). They found that given a choice, American businessmen preferred income tax allowances more than subsidies and cash grants as a means of paying for environmental protection. This distinction between these positive financial incentives may be explained in terms of the perceived social desirability of direct subsidies compared with that of income tax allowances.

A grant or a subsidy received by the industry to finance abatement equipment for which they should be paying may not be acceptable to management from the point of view of company image. Tax allowances, which are also funded by the tax payer, are far easier to conceal as they represent hidden government expenditure as opposed to the direct appropriation of public funds as is the case with government subsidies. In the present study no significant distinction appears to exist between the desirability of subsidies and tax incentives as a means of financing pollution control (Figure 6.3.1 (*a*)). This suggests that the majority of respondents did not consider the social implications associated with subsidies and income tax allowances. The social implications were deliberately highlighted later in the first questionnaire (Question E1) in order avoid socially desirable replies as in the case of the Kefalas and Carrol (1976/7) study. The researcher felt that had the social implications been explicitly stated together with or prior to establishing the policy preferences of respondents (Question B2, Questionnaire I), a socially acceptable response may have been obtained rather than the true position of the respondents on these issues.

It appears that should financial incentive policies not be feasible, that the industry would be satisfied with the existing permit system which specifies the quality criteria to which discharges of fish processing wastes should conform (Table 6.3.1 (*b*)). Such permit systems allow each enterprise to find the most innovative and least expensive solutions to their pollution problems. In contrast permits which specify the technology that must be used to control pollution (Figure 6.3.1 (*a*)) or that require all pollution sources to reduce pollution emissions by the same amount were not generally favoured (Figure 6.3.2 (*b*)). This appears to be because costs vary

from source to source (Respondent 019, Appendix VI A; Respondent 022, Appendix VI B), and because many treatment technologies are available for the treatment of each type of pollution problem (Alexander, 1984; Donnan, 1979; Hagevik, 1970).

Quite apart from the fact that uniform standards and specified technology may not bear any relationship to the quality of the receiving environment, such standards may be too stringent in some cases and inadequate in others. Some respondents were not in favour of variable standards (Figure 6.3.2 (*b*)). This may have been because such standards allow the government more discretion than is the case with uniform standards (Bidwell, 1982). This could make the regulatory system susceptible to political pressures (Grima, 1976). A more likely explanation for the finding that some respondents were not in favour of variable standards is that such standards could also result in some members of the industry becoming less competitive because of the higher abatement costs that they may have to incur. This idea appears to be supported by those respondents who displayed a preference for non-compliance penalties (Figure 6.3.1 (*a*)). Non-compliance penalties remove the economic incentive from companies that are able to produce goods more cheaply than their competitors because they have not had to incur the expenses for pollution control.

Control of fish factory pollution presents no insurmountable technological problems, but it must be remembered that the costs of abatement increase more than proportionally with each amount of pollution abated (Williams, 1979). Three respondents (014, 016 and 021, Appendix VI B) expressed the view that the level of pollution control required of the industry should not be extreme or academic as some abatement systems can be capital wasteful (Respondent 021, Appendix VI B). Smith (1975) feels that no firm should be forced to spend on pollution control technology just because it is available. According to Koppernaes (1975) the objective of policy should be to prevent pollution rather than to adhere strictly to a procedure which may not be appropriate in all cases.

The fish processing industry has seen a number of changes to pollution control regulations. When such regulations prescribe standards which generate unacceptable costs, from the industry's point of view, the industry may be reluctant to comply. The real issue raised is one of credibility. Even experts frequently disagree about the relationship between discharges and their negative environmental impacts (Brewer, 1981; Lave and Seskin, 1979; Mendelson and Orcutt, 1979; Platt, 1984). Hence it is not surprising to find that some respondents expressed a preference for regulations that specify a relationship between discharges and observable effects in the environment (Figure 6.3.1 (*a*)), Such regulations make it far easier for managers to justify expenditure on pollution control than those regulations which specify a particular type of technology. Nonetheless it appears that until better empirical information is available policy instruments and acceptable environmental quality will be determined in a predominantly political decision-making process (Basson, 1984; Brewer, 1981; Story and Walker, 1978). Consequently companies may be prepared to consider larger and longer term investments in pollution control systems only when scientific information about the effects of pollution can create an atmosphere of greater certainty.

It seems likely that because fishing is a high risk endeavour that the fishing industry will take steps to minimize all sources of controllable risk. This probably accounts for the finding that marketable pollution rights, private law remedies (compensation and interdict) and the

expropriation of obsolete pollution producing equipment were not considered to be popular options for controlling pollution (Figure 6.3.1 (*a*)). All these have uncertain and potentially serious financial implications. Private law remedies such as compensation, especially if linked to a compulsory insurance scheme, could result in an increase in the number of claims from people who have incurred losses as a result of the industry's operations. The consequences of invoking the interdict to prevent the fish processing factory from operating in a certain way could have very serious financial implications for the industry. Today the industry has to interact with a better informed public which is not prepared to have its property rights infringed. A precedent already exists involving an interdict and subsequent closure of a pet-food factory in the western Cape, which was considered to be creating an odour nuisance (Anon, 1987c).

Disincentives such as output taxes, input surcharges and quota restrictions aimed at controlling pollution indirectly by decreasing production levels were not liked by any of the respondents (Figure 6.3.1 (*a*)). Pollution control policy options that decrease production levels in capital intensive industries retard growth (Friedland, 1986; Potgieter, 1985; Stuttaford, 1985b). Without growth there may also be insufficient capital available for pollution control. However an interesting recommendation was made by the Diemont Commission (1986) that quotas should be granted subject to certain clear obligations recorded in the quota document. Such obligations could specifically include measures that must be taken to control pollution. Thus it would appear that quotas could be used as a powerful coercive tool to encourage the industry to install the necessary abatement equipment.

Effluent charge systems which are also intended to provide a disincentive to firms wishing to make use of the environment to dispose of their wastes, were favoured by some respondents as a suitable means to control pollution (Figure 6.3.1 (*a*)). This may have been due to the fact that the respondents who were in favour of these charges may have equated effluent charges with treatment fees. Treatment fees are currently paid by three fish processing factories to the Cape Town municipality (Appendix I). The idea behind effluent and emissions charges is to keep the marginal cost of installing the necessary abatement equipment less than the charge levied per unit of discharge and thereby providing a continuing incentive for companies to treat their wastes (Bidwell, 1982; Brady and Cunningham, 1981; Forster, 1976).

Thus, in conclusion, it would seem that the industry is not in favour of pollution control policy instruments which could result in the wasteful diversion of large amounts of capital that cannot be justified, or complex strategies that could result in planning uncertainties or unfairness to some members of the industry. It would also appear that of the existing pollution control policy instruments the permit system which specifies the environmental quality criteria that must be met by firms discharging effluents, has the lowest impact on the cost of doing business.

CONCLUSION 4

In view of apparent government deficiencies with regard to the enforcement of the law and the finding that only the demersal sector respondents are of the opinion that untreated wastes can cause environmental damage, careful consideration needs to be given to the selection of appropriate policy instruments. Pollution control policy may result in industry incurring expenditure which it would not normally have incurred in the absence of regulations. Consequently

policy instruments which force firms to adopt economically inefficient practices or that make excessive demands on the limited financial resources of fishing companies are less likely to be favoured than policy options which are perceived to be reasonable. Thus it is important to identify and incorporate policy instruments that are favoured by the fish processing industry, since such legislation is more likely to be complied with.

The pollution control policy instruments most favoured by the fish processing industry management were those which lowered the costs of legally mandated expenditure on abatement equipment. These options included subsidies and income tax allowances. Industry management were also in favour of the permit system for controlling pollution in which the environmental quality criteria that the effluent or emission had to comply with were specified, but the means of achieving compliance being left up to the individual manufacturing concerns. Such permit systems are favoured because they allow each factory to find the cheapest means of meeting environmental requirements and hence provide firms with a way of mitigating the financial impact of legislation.

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APPENDIX I

POLLUTION CONTROL EFFECTIVENESS IN THE SOUTHERN AFRICAN FISH PROCESSING INDUSTRY

INTRODUCTION

Although technological innovations have resulted in a reduction in pollution generated by the fish processing industry, a pollution problem, albeit of a localized and intermittent nature, still exists. The major causes of this problem appear to be related to inadequated abatement facilities and poor management control (Lusher pers. comm., 1986; Moldan pers. comm., 1986).

There appear to be no major technological obstacles to controlling fish factory pollution (Water Research Commission, 1983; 1988). Therefore, it seems reasonable to assume that the pollution problem in this case, is of a socio-economic nature. Hence the pollution problem could be a reflection of the effectiveness of government pollution control policy and the cost of abatement measures. It was therefore decided to investigate the adequacy of the pollution control measures taken by the 21 factories of the fish processing industry in order to gain some idea of the magnitude of this pollution problem.

Research Objective

To develop and apply a convenient instrument for assessing pollution control effectiveness of fish processing factories.

Development And Application Of The Research Instrument

Two major problems needed to be solved in the development of the research instrument. Firstly, the varied nature of operations that exist in the industry makes the direct comparison of factories problematical. Factories process varying amounts of different fish species, employ a diversity of production technologies and produce a variety of products. Secondly, the pollution and waste generated during production varies both in quality and quantity throughout the course of the fishing season. This makes it difficult to establish a "typical" pollution profile for each factory.

In order to assess the pollution control effectiveness of each factory, it was decided to make use of a panel of pollution control experts. The panel comprised three experts, two from the Department of Water Affairs and one from the Department of Health (air pollution control). The panel members were chosen on the basis of their duties. These duties included the inspection of the fish processing factories of interest, for compliance with legal requirements.

QUESTIONNAIRE A 1.

QUALITATIVE ASSESSMENT OF POLLUTION CONTROL EFFECTIVENESS FOR FISH PROCESSING FACTORIES.

1. FISH FACTORY NUMBER:_____

2. COMPANY NAME:_____

3. LOCATION OF FACTORY:_____

4. SECTOR: PELAGIC_____/DEMERSAL_____

5. LANDED CATCH (1986):_____t.*

6. YIELD FACTOR (1986):_____#

* To be completed by Sea Fisheries Research Institute.

Landed catch : Total product; Pelagic factories only.

PLEASE TICK ✓ THE CATEGORY THAT BEST DESCRIBES THE POLLUTION CONTROL EFFECTIVENESS FOR EACH OF THE FOLLOWING ISSUES:

	VERY POOR	POOR	ADEQUATE	GOOD	VERY GOOD
A. OFF-LOADING OPERATIONS:	( )	( )	( )	( )	( )
B. EFFLUENT QUALITY:	( )	( )	( )	( )	( )
C. NOISE ABATEMENT:	( )	( )	( )	( )	( )
D. ODOUR ABATEMENT:	( )	( )	( )	( )	( )
E. PRODUCTION SUPERVISION:	( )	( )	( )	( )	( )
F. GENERAL CONDITION OF PRODUCTION FACILITIES:	( )	( )	( )	( )	( )
G. PUBLIC COMPLAINT RECORD:	( )	( )	( )	( )	( )
H. OVERALL IMPRESSION OF POLLUTION CONTROL EFFECTIVENESS:	( )	( )	( )	( )	( )

PLEASE COMMENT ON ANY ASPECT OF THE POLLUTION CONTROL RECORD OF THIS FACTORY:_____

_____

_____

_____

Panel members were asked to consider the pollution control effectiveness of the twenty-one factories of the fish processing industry. They were requested to rate a number of more visible factors which reflect the pollution control effectiveness, for each factory. The factors included offloading operations (a major source of pollution in the pelagic sector), effluent quality, noise abatement, odour abatement, production supervision (house-keeping practices), the general condition of production facilities (efficiency and maintenance) and complaints received from the public (see Questionnaire A1).

A Delphi technique approach was used to obtain a consensus of expert opinion regarding factory pollution control effectiveness (Dalkey and Helmer, 1963; Richey *et al.*, 1985a; 1985b). Each expert was first required to rate each of the twenty-one factories on the factors presented above. Each factor was evaluated on a five point scale. The scale was divided into very poor, poor, adequate, good and very good. This was done in order to create the same framework of reference for all the members of the panel. The panel members were then asked to rate the overall pollution control effectiveness for each factory. The ratings of all the panel members were presented to each panel member. They were given the opportunity to amend their ratings if they so wished. Consensus was achieved after one iteration of this procedure.

In addition to rating the various factors, that could have had a bearing on the pollution level, for each factory, the experts were asked to comment on any aspect of the pollution control record of each factory. This was done to gain an insight into possible factors that could underlie the rating assigned to each factory.

In the present study each factory has been identified only by means of a code number which indicates the sector to which it belongs. The factory location is also given. This was done for the following reasons. Firstly the purpose of this study was aimed at establishing whether or not the pollution abatement measures taken by the fish processing industry as a whole were considered adequate. Secondly, as these ratings were not directly based on empirical data, and only provide a relative assessment of abatement performance. It was therefore felt that further identification of individual factories could be prejudicial to the companies concerned.

Additional information was collected from the records of the Sea Fisheries Research Institute about the amount of fish processed by each company and factory as well as the total volume of goods produced (meal, oil, cans, frozen fish, pet food etc.). This information was collected for the purpose of discovering whether a convenient, independent quantitative index of efficiency or index of waste could be determined. A total yield factor for each factory was calculated by dividing the mass of fish processed by each factory, by the total mass of products produced from that fish.

TABLE A1: QUALITATIVE EXPERT PANEL ASSESSMENT OF ISSUES RELATED TO THE POLLUTION CONTROL EFFECTIVENESS OF THE SOUTHERN AFRICAN FISH INDUSTRY (1986).

	PELAGIC FISH FACTORIES														DEMERSAL FISH FACTORIES						
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	D1	D2	D3	D4	D5	D6	D7
OFFLOADING OPERATIONS	■	■	★★★	★★★	■	★★	★★★	★★★	★★★	★	★★★	★★	★★	★	NA	★★★	NA	NA	★★★	NA	NA
EFFLUENT QUALITY	■	■	★★★	★★a / ■	■	★★★ / ■a	★	★★a / ■	★	★★a / ■	★★a / ■	■	■	■	★★	★	★★	NA[c]	★	NA[c]	NA[c]
NOISE ABATEMENT	★★	★★	★★★	★★★	★★	★★★	★★	★★★	★★★	★★★	★★★	★★★	■	★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★
ODOUR ABATEMENT	★	★	★★★	★★	★	★★	■	★★	★	★★	★	★	★	★	★★★	★★	★★★	★★★	★★	★★	★★
PRODUCTION SUPERVISION	★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★	★★★
PRODUCTION FACILITIES	★★	★★	★★★	★★	★★	★★	★★★	★★★	★★★	★	★★★	★★	★★	★★★	★★	★★★	★★	★★	★★★	★★★	★★★
COMPLAINT RECORD	★★	★★	★★★	★★	★★	★★	★	★★	★★★	★★	★★★	■	★★	★★	★★★	★★★	★★★	★★★	★★	★★★	★★★
OVERALL IMPRESSION	■	■	★★★	★★a / ■	■	★★★a / ■	★	★★a / ■	★	★★a / ■	★★a / ■	■	■	★	★★	★	★★	★★	★	★★	★★
PERCENTAGE OF LANDINGS	8,6	2,6	8,1	3,8	10,2	7,9	7,3	4,6	3,3	5,6	9,7	13,7	6,3	8,3	bd	40,6	46,3 d		2,2	2,0	8,9
TOTAL YIELD FACTOR	2,2	3,5b	3,4b	2,4	2,6	3,2	3,5	2,9	3,5b	2,5	3,3	3,6	2,5	2,6	d	1,5	1,2 d		1,5	1,4	1,3
FACTORY LOCATION	WB	WB	HB	GB	WB	LP	LB	SB	SH	SB	SH	SH	WB	SH	CT	SB	CT	CT	MB	CT	CT

KEY:

★★★ Very good
★★ Good
★ Adequate
■ Poor
NA Not applicable

a: Top = Fish-meal production operations; Bottom = Fish canning operations.
b: Factory produces only fish meal and oil.
c: Effluent discharged to municipal sewer.
d: Factories D1, D3 and D4 process 46.3% of the total demersal landings.

Factory Location: CT = Cape Town; GB = Gansbaai; HB = Hout Bay; LB = Lambert's Bay; LP = Laaiplek; MB = Mossel Bay; SB = Saldanha Bay; SH = St. Helena Bay; WB = Walvis Bay.

The data presented above was extracted from Questionnaire A 1. Percentage of fish landings processed by each factory and the total yield factors were calculated from data supplied by the Sea Fisheries Research Institute.

The total demersal fish landings for Southern Africa during 1986 were 169 109 tons. The total pelagic fish landings for the same period were 538 105 tons. Total yield factors were calculated by dividing the fish landings (tons) by the sum of all products produced (fish for human consumption, pet food, fish-meal etc. calculated in tons), for each factory.

TABLE A 2: COMMENTS ON THE POLLUTION CONTROL RECORD OF THE SOUTHERN AFRICAN FISH PROCESSING FACTORIES (1986).

Pelagic Factories.

P1: Wet-offloading discolours harbour.
P2: Wet-offloading causes high pollution loads. Harbour very discoloured.
P3: The factory has improved radically over the past ten years, mainly due to pressure from government and local rate payers.
P4: Effluent quality varies with product, as does pollution control effectiveness. Wet-offloading for canning purposes produces much effluent.
P5: Harbour very discoloured.
P6: Effluent quality dependant on whether fish is canned or turned into meal. Effluent quality ranges from poor to very good. Installation of deodorizer improved odour.
P7: No deodorizer. Resident population dependant on the fishing industry. Complaints are therefore less than would be expected from this smelly factory.
P8: Effluent quality varies according to product. Public complaints have decreased regarding effluents and odours.
P9: Polisher effluent discharged outside harbour area. No public complaints to date. Overall impression is one of adequate because harbour is not discoloured.
P10: Effluent varies according to product. Production facilities have been operated on a "shoe-string".
P11: Effluent varies with product produced.
P12: Although dry-offloading reported, water is probably added. Settling capacity inadequate inspite of being increased. Equipment well maintained but overloaded. Pollution from this factory very visual.
P13: Dry-offloading reported but water is used. Dry-offloading equipment not silenced. Harbour very discoloured.
P14: Wastefull use of sea-water which overloads settling tanks and influences effluent quality.

Demersal Factories.

D1: Offloading considered a small operation. Only condensate and sea-water discharged. Wash-water to be diverted to a municipal sewer.
D2: This factory could do more to improve their effluent quality. This type of operation should be virtually pollution-free.
D3: Discharges to river. No visual pollution or odour. Treatment prior to discharge effective.
D4: All effluent to municipal sewer after coarse screening to decrease solids (COD). Salinity of effluent main problem. Factory pays treatment fees to municipality. Effluent tested every six weeks.
D5: Offal was deposited on rocks in front of factory. After authorities intervened, due to public pressure, no further complaints received.
D6: Effluent discharged to municipal sewer after screening (see D4).
D7: Effluent discharged to municipal sewer after screening (see D4).

Results

The expert ratings of pollution control effectiveness and the supplementary information supplied by the Sea Fisheries Research Institute are presented in Table A1 and A2. A number of points need however to be borne in mind. Firstly, although most of the categories used in rating were applicable to most of the factories, there were a few exceptions. Five of the demersal factories were located a significant distance from the off-loading point and required road transport to deliver the raw material to the factories. Three of the factories, in the Cape Town metropolitan area, discharge their effluents to municipal sewers and pay treatment fees to the municipality. Secondly the pollution produced by the land-based factories of the demersal sector of the industry is significantly less than that produced by the pelagic sector. This is primarily due to the fact that demersal fish are "cleaned" at sea. These fish are tailed, headed and gutted and most of the offal disposed of at sea. On arrival at the factories, only the off-shore demersal catch is processed. The in-shore catch is sold as is (Payne, pers. comm., 1986).

Table A 1 displays the assessment of various aspects related to the overall pollution control effectiveness, by the panel of experts. Comments pertaining to specific factories are given in Table A 2. The information in Table A 1 has been displayed in graphic form in such a way as to highlight unsatisfactory aspects related to pollution control effectiveness.

Ten of the 21 fish processing factories, all in the pelagic sector, were considered unsatisfactory with regard to their overall abatement performance for all or part of the time. Five factories, namely P1, P2, P5, P12 and P13 were rated as poor for the entire 1986 fishing season. A further five factories, namely P4, P6, P8, P10 and P11 were judged unsatisfactory with regard to abatement performance related specifically to fish canning operations.

The major factor contributing to the pollution problem in the pelagic sector appears to be poor effluent quality. Eleven of the 14 factories were judged to produce poor quality effluents in terms of what was considered, in the opinion of the experts, to be reasonably achievable. Six of the factories, in particular, P1, P2, P5, P12, P13 and P14, were regarded to have sub-optimal effluents for the whole of the fishing season.

Wet-offloading practices, which involve the addition of water to the holds to facilitate the pumping of fish to the factory, exacerbate effluent problems, especially in Walvis Bay (P1, P2 and P5). This practice produces large volumes of organically enriched bloodwaters which are often released into harbours due to the inadequate settling tank capacities at the factories (see Table A2; P1, P2, P5, P12, P13 and P14).

As far as noise and odour abatement were concerned, only two factories, namely P13

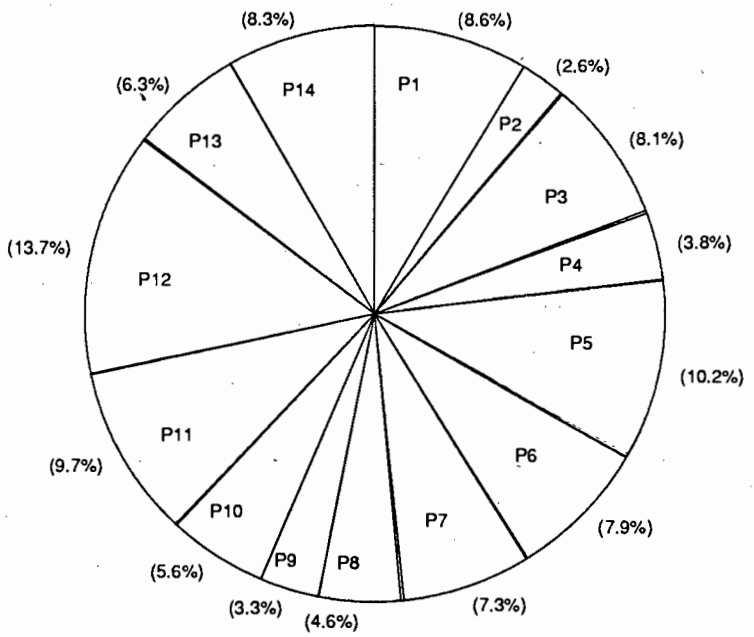

FIGURE A1

Percentage of 1986 catch processed by each factory of the Southern African pelagic fishing industry

Source: Sea Fisheries Research Institute

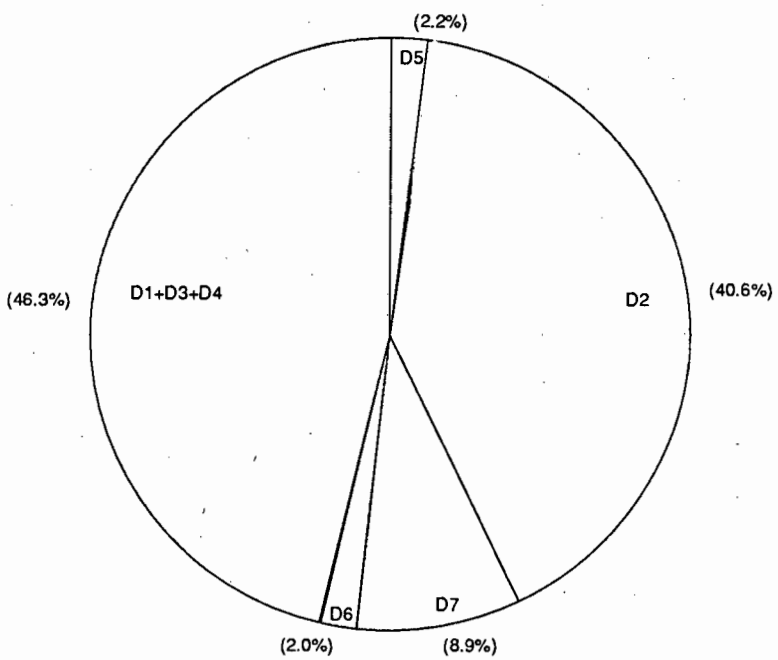

FIGURE A2

Percentage of the 1986 catch processed by the factories of the Southern African demersal fishing industry

Source: Sea Fisheries Research Institute

OPMERKINGS

WAT IS DIE VERNAAMSTE STERK EN SWAK PUNTE, BEDREIGINGS EN GELEENTHEDE VAN DIE VISVERWERKINGSBEDRYF?

Die vernaamste sterk punte van die visverwerkingsbedryf word beskou as tegniese kundigheid, 'n goed bestuurde vissery en 'n gedugte finansiële grondslag. Swak punte sluit in verslete en verouderde bates, seisoensgebonde wisselings in opbrengs en 'n tekort aan geskoolde arbeid. Die vernaamste bedreiging waarvoor die bedryf te staan kom, is kostestyging van die vervanging van bates en bedryfskoste.

Ander bedreigings is "arbitrêre" regeringsoptrede, in verband met kwotatoewysings, algemene inmenging deur die regering in die daaglikse bestuur van die bedryf, sanksies, en druk deur vakbonde. Die bedryf ervaar egter 'n behoefte aan meer regeringstoetrede op sekere gebiede bv. beheer oor die deelname van buitelandse vaartuie wat uit die bedryf se tradisionele bronne oes.

Maatskappybeeld blyk nie 'n vername rol te speel in die besluite om in afval- of besoedelingbeheertoerusting te belê nie. Dit mag egter in sekere gevalle verander soos waar die bedryf in stryd raak met ander groepe wat gevestigde belange in dieselfde geografiese gebied het, byvoorbeeld waar toeriste- of residensiële behuising in gebiede, wat tradisioneel deur die bedryf beset is, gevestig geraak het. Sou 'n konflik van belange voorkom, voel die bedryf dat konflikoplossing daarop gerig moet wees om die beste belang van die land, eerder as in die behoeftes van die minderheid, te dien.

IN WATTER GEBIEDE SAL DIE BEDRYF GEREDELIK BEDUIDENDE KAPITAALBELEGGINGS MAAK?

Die ontwikkeling van die vissery vir nie-kwota spesies, beter benutting van die bestaande kwota en die herwinning van stokvis- en sardynbronne, word deur altwee die sektore van die bedryf as die vernaamste geleenthede beskou.

Gegrond op waargenome toekomstige toestande blyk dit dat die bedryf se vernaamste beleggingsprioriteite tot die jaar 2 000 gerig is op die vervanging van

OPMERKINGS

uitgespreek. Toeslae kan gebruik word om beleggings in nuwe (en gewoonlik ook skoner) produksietegnologie te stimuleer, aangesien die huidige toerusting verouderd en baie in waarde verminder is.

Die bedryf sal graag wil sien dat beleidinstrumente vir besoedelingsbeheer op positiewe finansiële dryfvere, soos subsidies en toeslae, gegrond word. Van die instrumente tans beskikbaar in die RSA, is die bestaande permitstelsel vir die uitstorting van afvalwater die gewildste.

GEVOLGTREKKING

Sou finansiële bystand nie vir besoedelingsbeheeruitgawes beskikbaar wees nie, blyk dit asof die bedryf met die bestaande permitstelsel, wat die uitstorting van afvalwater van 'n voorgeskrewe kwaliteit toelaat, tevrede sal wees, terwyl die metode van die bereiking van die kwaliteitstandaard aan die individuele maatskappy oorgelaat word, sodat die goedkoopste oplossing gevind kan word.

Omkring die kategorie wat u standpunt die beste beskryf:

STEM BESLIS SAAM; STEM ONSEKER; STEM NIE SAAM NIE; STEM BESLIS NIE SAAM NIE;

<u>Besoedelingsbeheer en toekomstige prioriteite</u>

'n Poging is aangewend om die relatiewe belangrikheid van besoedeling en afvalbeheerbelegging in verhouding met die ander waargenome beleggingsprioriteite van die visverwerkingsbedryf te bring.

Visvang, weens die (onreëlmatig) wisselings in opbrengs en prys, is 'n riskante bedryf. 'n Maatskappy se sukses hang af van sy vermoë om tydige en toepaslike aanpassings by 'n ingewikkelde en veranderende omgewing te maak. Belegging sal daarvolgens in die lig van die waargenome sterk en swak punte, bedreigings en geleenthede waarvoor elke maatskappy te staan kom, gemaak word.

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besoedelingswetgewing as realisties, tydig en regverdig, en strafbepalings as toereikend, met 'n neiging tot toeskietlikheid. Regulasies word ook beskou as buigsaam sover dit die kwaliteitbepaling van uitloop en uitstorting aangaan. Die gevoel is dat daar te veel ingewikkelde wette bestaan en dat daar beperkte geleentheid vir insette in die formulering daarvan aan die bedryf gegee word.

GEVOLGTREKKING

Aangesien die bedryf oor meer inligting rakende die koste en voordele van die verskeie besoedelingsbeheerstelsels beskik, behoort met hulle oorleg gepleeg te word in die soeke na optimale en doeltreffende oplossings.

Omkring die kategorie wat u standpunt die beste beskryf:

STEM BESLIS SAAM	STEM SAAM	ONSEKER	STEM NIE SAAM NIE	STEM BESLIS NIE SAAM NIE

Beleidsvoorkeur van Besoedelingsbeheer

Besoedelingsbeheer kan deur 'n verskeidenheid van instrumente, vanaf direkte regulering en beheer enersyds, tot markverwante meganismes andersyds, bevorder word.

WATTER REGULERINGSINSTRUMENTE SAL DIE BEDRYF IN WERKING WIL SIEN OM BESOEDELINGSBEHEER TE BEVORDER?

Negatiewe dryfvere soos uitsetbelasting, produkbelasting en kwotaverminderings gemik daarop om besoedeling indirek deur die beperking van produksie te laat afneem, word in 'n ongunstige lig beskou. Synde hoogs kapitaalintensief, vereis vismaatskappye 'n groot volume deurset om winsvlakke vol te hou. Die bedyf werk tans onder sy volle vermoë.

Geen finansiële dryfvere vir belegging in besoedelingsbeheertoerusting, wat nie deel van die vervaardigingsproses is nie, bestaan tans nie. Die standpunt dat die toeslagstelsel uitgebrei moet word om besoedelingsbeheertoerusting in te sluit, is

OPMERKINGS

WATTER STANDPUNTE WORD OOR DIE INVLOED VAN BESOEDELINGSBEHEERBELEID OP DIE VISVERWERKINGSBELEID GEHULDIG?

Algemene eenstemmigheid bestaan dat die verbruiker, eerder as die algemene belastingbetaler, die koste van omgewingsbeskermingsmaatreëls wat deur 'n maatskappy aangegaan word, behoort te betaal. Daar is egter 'n plafon waarbo koste nie meer op verbruikers afgewentel kan word nie.

Daar bestaan nie eenstemmigheid daaroor of dit die wet, of die manier waarop die wet toegepas word, wat problematies is nie. Die pelagiese bedryf meen dat uitstortings van visfabrieke van geval tot geval beskou moet word, omdat die koste verbonde aan die bereiking van 'n algemeen toegepaste "standaard", verband hou met waar die fabriek geleë is. Die demersale sektor kon nie uitsluitsel oor die punt bereik nie.

Die pelagiese sektor stem saam dat uitgawe op besoedelingsbeheer ekonomies verrekenbaar was, terwyl die demersale sektor weer eens onseker hieroor was.

Slegs die pelagiese sektor het verslag gedoen oor koste en meen dat produksiekoste van besoedelingsbeheer beduidend verhoog het. Die sektor het die stelling gemaak dat die kwotagrootte 'n invloed op belegging in afvalherwinning gehad het.

Altwee die sektore stem saam dat die uitstorting van onbehandelde afval van visverwerkingsfabrieke 'n kriminele oortreding behoort te bly, maar slegs die demersale sektor voel dat die uitstorting van onbehandelde afval beduidende omgewingskade kan aanrig.

Altwee die sektore meen dat die regering sal onderhandel eerder as om "besoedelaars" voor die hof te daag.

HOE VOEL DIE BEDRYF OOR BESTAANDE BESOEDELINGSBEHEERWETGEWING?

Die meeste van die respondente beskou huidige

DIE INVLOED VAN BESOEDELINGBEHEERREGULASIES OP DIE LANDGEBASEERDE OPERASIES VAN DIE VISVERWERKINGSBEDRYF: SENIOR BESTUURSMENING EN - STANDPUNT

OPMERKINGS

Beleggingsbesluite oor Afvalbeheertoerusting

Inleiding

Gedwonge beleggings in afval- en besoedelingsbeheer, te wyte aan veranderinge in "omgewingsbeskermings-standaarde", kan finansiële probleme vir sekere maatskappye in die visverwerkingsbedryf skep, deurdat bronne weg van produktiewe aktiwiteite herlei en ontwikkelingsplanne omvergegooi word.

Groot kapitale beleggingsbesluite rakende afvalbeheertoerusting is gewoonlik van 'n eenmalige, nie-geroetineerde aard en word gekenmerk deur 'n hoë mate van onsekerheid. Weens tyds- en geldelike beperkings moet sulke besluite dikwels op grond van onvolledige en soms teenstrydige inligting geneem word. 'n Benadering wat dikwels in sulke gevalle gevolg word, is om die elemente van die besluit te vereenvoudig en rasioneel binne grense van hierdie beperkings op te tree.

HOE BELANGRIK IS DIE ONDERSKEIE FAKTORE WAT BELEGGINGSBESLUITE OOR AFVALBEHEER BEÏNVLOED?

Dit kom voor asof besluite om in afvalbeheertoerusting te belê, op finansiële kriteria soos die koste van die stelsel en wins op die belegging, gegrond word. Lede van die demersale sektor beskou besoedelingsbeheer as die primêre rede vir sulke beleggings.

Besoedelingsbeheerbeleid

Vandag se bespreking word nie gewy daaraan of die omgewing teen besoedeling beskerm moet word nie, maar eerder aan hoeveel gedoen moet word, en die beste manier om dit te doen.

APPENDIX III A

DEPARTEMENT VAN OMGEWINGSAKE

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Privaatsak X2, Roggebaai, Kaapstad.
Republiek van Suid-Afrika 8012

DEPARTMENT OF ENVIRONMENT AFFAIRS

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• 1142M8 (K) • | Navrae / Inquiries S.R. Lipschitz

Geagte Heer

DIE INVLOED VAN BESOEDELINGSBEHEERREGULASIES OP DIE VISVERWERKINGSBEDRYF

Die inligting wat hieronder voorgehou word, is verkry uit die vraelyste wat u en ander senior bedryfsleiers in die visverwerkingsbedryf onlangs ingevul het. Bestudeer asseblief hierdie opsomming van die bevindings en dui aan in watter mate u met die vernaamste gevolgtrekkings saamstem deur die toepaslike kategorie te omkring. Ruimte is voorsien indien u verdere opmerkings sou wou maak.

U samewerking is van groot belang aangesien die bevindings van hierdie navorsingsprojek tot die bevaartlyning van administratiewe prosedure van die regering rakende die beheer oor besoedeling, sowel as 'n aanduiding van watter beleidsrigtings verder ondersoek moet word, sal bydra.

Stuur asseblief die pamflet en u kommentaar voor terug na mnr. S.R. Lipschitz, by bostaande adres, in die koevert wat aan u voorsien word.

Alle response is naamloos en daar is geen manier waarop enige persoon of maatskappy uit hierdie finale vraelys geïdentifiseer kan word nie.

Die uwe

DIREKTEUR: NAVORSINGSINSTITUUT VIR SEEVISSERYE

IN WHICH SECTOR OF THE INDUSTRY ARE YOU CURRENTLY INVOLVED?

DEMERSAL PELAGIC

IF YOU WISH TO MAKE ANY FURTHER COMMENTS ABOUT THE FINDINGS AND CONCLUSIONS PRESENTED ABOVE OR ABOUT ANY ASPECT OF POLLUTION CONTROL POLICY THAT IS RELEVANT TO THE FISH PROCESSING INDUSTRY, PLEASE DO SO BELOW.

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Thank you for your valuable time and cooperation in completing this important questionnaire.

COMMENTS

the operation of foreign vessels harvesting the industry's traditional resource.

Company image does not appear to be a major factor in the decision to invest in waste or pollution control equipment. This may change however in cases where the industry comes into conflict with other groups with vested interests in the same geographical localities for example where tourism or residential housing has moved into areas traditionally occupied by the industry. In the event of a conflict of interests arising, the industry feels that conflict resolution should be directed at serving the best interests of the country rather than on the needs of a few.

IN WHICH AREAS WOULD THE INDUSTRY BE LIKELY TO MAKE SIGNIFICANT CAPITAL INVESTMENTS ?

The development of non-quota species fisheries, the better utilization of the existing quota and the recovery of the hake and pilchard stocks were seen as the major opportunities by both sectors of the industry.

Based on perceptions of the future conditions it appears that the industry's major investment priorities up to the year 2000, will be asset replacement, the development of new products for new markets and job creation and training. Pollution and waste control investments are not viewed as major priorities

CONCLUSION:

If the fish processing industry is able to replace its aging assets, and further improve its utilization of raw material, the need for major additional expenditure on waste recovery and pollution control equipment can be expected to decrease accordingly.

Circle the category that best describes your viewpoint

STRONGLY AGREE	AGREE	UNCERTAIN	DISAGREE	STRONGLY DISAGREE

COMMENTS

CONCLUSION:

Should financial assistance not be available for pollution control expenditures, it would appear that the industry would be satisfied with the existing permit system which allows the discharge of effluents of a prescribed quality, while leaving the means of achieving the quality standard upto the the individual company, so that a least cost solution can be found.

Circle the category that best describes your viewpoint

STRONGLY AGREE UNCERTAIN DISAGREE STRONGLY AGREE DISAGREE

Pollution Control and Future Priorities.

An attempt was made to establish the relative importance of pollution and waste control investments in relation to the other perceived investment priorities of the fish processing industry.

Fishing is a risky business because of random fluctuations in yield and price. A company's success is dependant on its ability to make timely and appropriate adaptations to a complex and changing environment. Investments will accordingly be made in the light of the perceived strengths, weaknesses, threats and opportunities facing each company.

WHAT ARE THE MAJOR STRENGTHS, WEAKNESSES, THREATS AND OPPORTUNITIES OF THE FISH PROCESSING INDUSTRY ?

The major strengths of the fish processing industry were seen to be technical expertise, a well managed fishery and a sound financial base. Weaknesses included worn and outdated assets, seasonal yield fluctuations and a shortage of skilled labour. The major threat facing the industry is cost escalation in regard to the replacement of assets and operating costs.

Other threats were seen to be 'arbitrary' governement action in regard to quota allocations, general government intervention in the day to day running of the industry, sanctions and trade union pressure. The industry however feels the need for more government intervention in certain areas for example to control

COMMENTS

CONCLUSION:

As the industry has more information than the government about the costs and benefits of various pollution control systems, they should be consulted in the search for optimal and efficient solutions.

Circle the category that best describes your viewpoint

STRONGLY AGREE	AGREE	UNCERTAIN	DISAGREE	STRONGLY DISAGREE

Pollution Control Policy Preference.

Pollution control can be promoted by a variety of instruments, from direct regulation and control on the one hand to market related mechanisms on the other.

WHICH REGULATORY INSTRUMENTS WOULD THE INDUSTRY LIKE TO SEE USED TO PROMOTE POLLUTION CONTROL ?

Disincentives such as output taxes, product taxes and quota cut-backs, aimed at decreasing pollution indirectly by restricting production are not favoured. Being highly capital intensive, fishing companies require a high volume of throughput to maintain profit levels. The industry is at present operating below its full capacity.

At present there are no financial incentives for pollution control equipment investments which do not form part of the process of manufacture.The view has been expressed that the allowance system should be extended to include pollution control equipment. Allowances could be used to stimulate investment in new (and usually cleaner) production technology as the current equipment is outdated and heavily depreciated.

The industry would like to see pollution control policy instruments based on positive financial incentives such as subsidies and allowances. Of the current instruments available in the R.S.A., the existing permit system for the discharge of effluents was the most prefered.

COMMENTS

There is no agreement as to whether it is the law or the manner in which it is implemented that is problematic. The pelagic industry feels that discharges from fish factories should be treated on a case-by-case basis as the cost of achieving a generally applied 'standard' is very sensitive to factory location. The demersal sector were indecisive on this point.

The pelagic sector also agree that expenditure on pollution control had been economically justifiable whereas the demersal sector were again uncertain.

As far as costs were concerned only the pelagic sector reported that pollution control had significantly increased production costs. This sector stated that the size of the quota had an influence on waste recovery investments.

Both sectors agree that the discharge of untreated wastes from fish processing factories should remain a criminal offence, but only the demersal sector feels that the discharge of untreated wastes could cause significant environmental harm.

Both sectors believe that the government would negotiate rather than take 'polluters' to court.

HOW DOES THE INDUSTRY FEEL ABOUT EXISTING POLLUTION CONTROL LEGISLATION?

Most respondents perceive current pollution laws and regulations to be realistic, timely, fair and penalties to be adequate, tending towards lenient. Regulations are also seen to be flexible in terms of how effluent and emission quality is to be achieved. However it is felt that that there are too many laws, which are complex and which afford very limited opportunity for industry input into their formulation.

THE IMPACT OF POLLUTION CONTROL REGULATIONS ON THE LAND-BASED OPERATIONS OF THE FISH PROCESSING INDUSTRY: SENIOR MANAGEMENT OPINION AND VIEWPOINT.

COMMENTS

Waste Control Equipment Investment Decisions.

Introduction.

Forced investments in waste and pollution control due to changes in environmental protection 'standards' could create financial difficulties for some companies in the fish processing industry by diverting resources away from productive activities and disrupting development plans.

Large capital investment decisions concerning waste control equipment are usually of a "once-off", non-routine nature characterised by a high degree of uncertainty. Due to time and money contraints, such decisions often have to be made on the basis of incomplete and sometimes conflicting information. An approach that is often adopted in such cases is to simplify the elements of the decision and then to behave rationally within these constraints.

HOW IMPORTANT ARE VARIOUS FACTORS IN INFLUENCING WASTE CONTROL INVESTMENT DECISIONS ?

It appears that decisions to invest in waste control equipment are based on financial criteria such as the cost of the system and return on investment. Members of the demersal sector, however, perceive pollution control to be the primary reason for making such investments.

Pollution Control Policy.

Today the discussion is not centered on whether the environment should be protected from pollution but rather on how much to do and how best to do it.

WHAT VIEWS ARE HELD ABOUT THE IMPACT OF POLLUTION CONTROL POLICY ON THE FISH PROCESSING INDUSTRY ?

There is general agreement that the consumer rather than the general tax payer should absorb the cost of environmental protection measures adopted by the company. However, there is a ceiling beyond which costs cannot be passed on to consumers.

APPENDIX III A

DEPARTEMENT VAN OMGEWINGSAKE

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DEPARTMENT OF ENVIRONMENT AFFAIRS

Chief Directorate: Marine Development
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1142M1K

Verwysing / Reference V1/1/3/4/1

Navrae / Inquiries S.R. Lipschitz

Dear Sir

THE IMPACT OF POLLUTION CONTROL REGULATIONS ON THE FISH PROCESSING INDUSTRY.

The information presented below was extracted from the questionnaires which you and other senior executives of the fish processing industry recently completed. Please study this summary of the findings and indicate to what extent you are in agreement with the major conclusions by circling the appropriate 'agreement' category. Space has been provided for you to make additional comments should you wish to do so.

Your cooperation is of great importance as the findings of this study will contribute to the streamlining of government administrative procedures concerned with the control of pollution, as well as suggesting which policy options should be investigated further.

Please return this booklet and your comments by the ..... to Mr S.R. Lipschitz at the above address in the envelope provided.

All the responses are anonymous and there is no way of identifying any person or company from this final questionnaire.

Yours faithfully

DIRECTOR: SEA FISHERIES RESEARCH INSTITUTE

APPENDIX III

APPENDIX II C

DEPARTEMENT VAN OMGEWINGSAKE

Hoofdirektoraat: Seevisserye
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*1059M2

Geagte

DIE INVLOED VAN VERSKILLENDE REGULATORIESE BENADERINGS TOT BESOEDELINGSBEHEER

U is 'n paar weke gelede versoek om 'n vraelys rakende "Die invloed van verskillende regulatoriese benaderings teenoor besoedelingsbeheer op die visverwerkingsbedryf" te voltooi.

Indien u reeds u voltooide vraelys afgestuur het, ignoreer asseblief hierdie kennisgewing. Omdat al die antwoorde anoniem is, is daar geen manier om vas te stel of u antwoord reeds ontvang is nie.

As u nog nie u vraelys voltooi het nie, kan u dit asseblief so gou as moontlik doen. Sodra die uitstaande vraelyste ontleed is, sal 'n opsomming van hierdie belangrike ondersoek vir kommentaar aan u gestuur word.

Dankie vir u samewerking

DIREKTEUR: NAVORSINGSINSTITUUT VIR SEEVISSERYE

APPENDIX II C

DEPARTEMENT VAN OMGEWINGSAKE

Hoofdirektoraat: Mariene Ontwikkeling
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Verwysing / Reference V1/1/3/4/1

Navrae / Inquiries S.R. Lipschitz

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Dear

THE IMPACT OF DIFFERENT REGULATORY APPROACHES TO POLLUTION CONTROL

A few weeks ago you were asked to complete a questionnaire concerning "The impact of different regulatory approaches to pollution control on the fish processing industry".

If you have already mailed your completed questionnaire, please disregard this notice. As all the returns are anonymous, there is no way of knowing whether or not you have responded already.

Should you have not returned your completed questionnaire, please could you do so as soon as possible. As soon as the outstanding questionnaires have been analysed, you will be sent a summary of the findings of this important study for your comment.

Thank you for your cooperation.

DIRECTOR: SEA FISHERIES RESEARCH INSTITUTE

F.1 WATTER PERSENTASIE VAN U MAATSKAPPY SE JAARLIKSE BEGROTE UITGAWE WORD NA U SKATTING OP BESOEDELINGSBEHEER GESPANDEER (Gemiddeld oor 'n tydperk van vyf jaar)?

Merk asseblief die gepaste spasie:

KAPITALE UITGAWE		BEDRYFSUITGAWE	
0 - 4%	( )	0 - 4%	( )
5 - 9%	( )	5 - 9%	( )
10 - 14%	( )	10 - 14%	( )
15 - 19%	( )	15 - 19%	( )
MEER AS 20%	( )	MEER AS 20%	( )
KAN NIE GESKAT WORD NIE	( )	KAN NIE GESKAT WORD NIE	( )
KAN NIE VERSTREK	( )	KAN NIE VERSTREK	( )

F.2 HET U 'N DIREKTE FINANSIëLE BELANG (AANDELE) IN DIE VISBEDRYF?

JA	( )	NEE	( )

F.3 WIL U ENIGE VERDERE AANMERKINGS MAAK OOR DIE INVLOED VAN BESOEDELINGSBEHEERWETGEWING OP DIE VISBEDRYF?

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.....

MAAK ASSEBLIEF SEKER DAT U AL DIE VRAE BEANTWOORD HET

BAIE DANKIE WEER EENS VIR U SAMEWERKING EN VIR U WAARDEVOLLE TYD OM HIERDIE BELANGRIKE VRAELYS TE VOLTOOI.

DUI ASSEBLIEF AAN IN WATTER MATE U MET DIE VOLGENDE STELLINGS SAAMSTEM

STEM VOLKOME SAAM/STEM SAAM/ONSEKER/STEM NIE SAAM NIE/STEM GLAD NIE SAAM NIE
(1) (2) (3) (4) (5)

Omkring asseblief die gepaste nommer (1) (2) (3) (4) (5)

E.1 BELASTINGBETALERS, EERDER AS MAATSKAPPYKLIëNTE, MOET VIR DIE BESKERMING VAN DIE OMGEWING BETAAL..... (1) (2) (3) (4) (5)

E.2 DIT IS DIE MANIER WAAROP DIE WET TOEGEPAS WORD, EERDER AS DIE WET SELF WAT PROBLEME VEROORSAAK..... (1) (2) (3) (4) (5)

E.3 BESOEDELINGSBEHEER MOET OP 'N GEVALLEGRONDSLAG TOEGEPAS WORD, EERDER AS OP UNIFORME STANDAARDE..... (1) (2) (3) (4) (5)

E.4 ONS MAATSKAPPY SE UITGAWE OP BESOEDELINGSBEHEER IS EKONOMIES REGVERDIGBAAR..... (1) (2) (3) (4) (5)

E.5 DIE REGERING SAL NET HERHAALDE OORTREDERS VOOR DIE HOF DAAG EN VERKIES OM DIE MEESTE DISPUTE DEUR ONDERHANDELING TE BESLEG..... (1) (2) (3) (4) (5)

E.6 BESOEDELINGSBEHEERREGULASIES MAAK 'N BETEKENISVOLLE BYDRAE TOT VERHOOGDE PRODUKSIEKOSTE..... (1) (2) (3) (4) (5)

E.7 KWOTABEPERKINGS HET BELEGGINGS IN AFVALHERWINNING-STELSELS BETEKENISVOL BEINVLOED..... (1) (2) (3) (4) (5)

E.8 DIE UITLAAT VAN ONBEHANDELDE AFVAL VAN VISFABRIEKE MOET 'N KRIMINELE OORTREDING BLY..... (1) (2) (3) (4) (5)

E.9 ONBEHANDELDE AFLOOPWATER VAN VISFABRIEKE KAN BYDRA TOT BETEKENISVOLLE SKADE AAN DIE MARIENE OMGEWING..... (1) (2) (3) (4) (5)

D.1 HOE VOEL U OOR BESTAANDE BESOEDELINGSBEHEERWETGEWING MET BETREKKING TOT DIE VOLGENDE AANGELEENTHEDE?

Omkring asseblief die kategorie wat die aangeleentheid die beste beskryf.

A. REALISME

baie realisties	onrealisties	realisties	baie realisties

B. TYDSBEREKENING VAN IMPLEMENTERING VAN REGULERING

baie ontydig	ontydig	betyds	te laat

C . REGVERDIGHEID VAN IMPLEMENTERING

baie onregverdig	onregverdig	regverdig	baie regverdig

D. STRAWWE

baie swaar	swaar	voldoende	toegeeflik	baie toegeeflik

E. BUIGSAAMHEID

baie onbuigsaam	onbuigsaam	voldoende buigsaam	buigsaam	baie buigsaam

F. GETAL REGULASIES

veels te veel	te veel	genoeg	te min	veels te min

G. INGEWIKKELDHEID VAN WETTE EN REGULASIES

baie ingewikkeld	ingewikkeld	voldoende	eenvoudig	baie eenvoudig

H. GELEENTHEID VIR INSETTE DEUR DIE BEDRYF IN DIE OPSTEL VAN REGULASIES

baie beperk	beperk	voldoende	te veel

C.2 GEGROND OP U OPVATTINGS VAN DIE TOEKOMS, OP WATTER VAN DIE VOLGENDE TERREINE SAL U NA ALLE WAARSKYNLIKHEID BETEKENISVOLLE KAPITALE BELEGGINGS MAAK?

ONWAARSKYNLIK O — WAARSKYNLIK W — BAIE WAARSKYNLIK B

Merk asseblief die gepaste spasie	(O)	(W)	(B)
A. DIVERSIFIKASIE (nuwe produkte vir nuwe markte).....	( )	( )	( )
B. SPESIALISASIE (fokus meer spesifiek op bestaande produkte en markte).....	( )	( )	( )
C. WERKNEMERVOORDELE (bv. behuisingskemas).....	( )	( )	( )
D. WERKSKEPPING EN OPLEIDING.....	( )	( )	( )
E. BESOEDELINGSBEHEER.....	( )	( )	( )
F. MODERNISERINGSPROGRAMME (bootvervanging en/of verbetering van produksiegeriewe).....	( )	( )	( )
G. AFVAL/MATERIAALHERWINNINGSTELSELS.....	( )	( )	( )
H. BELEGGINGS IN ONDERNEMINGS NIE VERWANT AAN DIE VISBEDRYF.....	( )	( )	( )
I. NAVORSING EN ONTWIKKELING.....	( )	( )	( )
J. ANDER: SPESIFISEER ASSEBLIEF.....			

C.3 GEGROND OP U SIENING VAN DIE TOEKOMS (TOT DIE JAAR 2000), RANGSKIK ASSEBLIEF AL NEGE DIE OPSIES (A - I) HIERBO GELYS VOLGENS U VOORSIENE BELEGGINGSVOORKEURE.

1 = hoogste voorkeur; 9 = laagste voorkeur

1.... 2.... 3.... 4.... 5.... 6.... 7.... 8.... 9....

C.1 IN DIE TYDPERK TUSSEN DIE HEDE EN DIE JAAR 2000, WAT GLO U IS DIE VERNAAMSTE MAGTE, SWAKHEDE, GELEENTHEDE EN BEDREIGINGS VAN U SEKTOR VAN DIE BEDRYF?

(bv. 'n geleentheid kan die ontwikkeling wees van 'n vissery van 'n nie-kwotaspesie en 'n bedreiging kan die styging in koste van sleutelinsette soos bv. brandstof, wees).

MAGTE.....

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SWAKHEDE.....

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BEDREIGINGS.....

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GELEENTHEDE.....

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.....

H. HEFFING OP UITVLOEISEL/UITLATING (belasting op oorblyfsels)..... ( ) ( ) ( )

I. BOETES VIR WEIERING OM DIE WET TE GEHOORSAAM (om die ekonomiese voordeel te verwyder van weiering aan voorafbepaalde afvalvereistes)..... ( ) ( ) ( )

J. SUBSIDIES EN SKENKINGS VIR GOEDGEKEURDE TEEN-BESOEDELINGSTOERUSTING..... ( ) ( ) ( )

K. SUBSIDIES VIR GOEDGEKEURDE FABRIEKSMODIFIKASIES OM DOELTREFFENDHEID TE VERBETER (waardeur die gehalte van die uitvloeisel verbeter word; tans bestaan daar geen sulke aansporings nie) ..... ( ) ( ) ( )

L. ONTEIENING DEUR DIE REGERING VAN ONBRUIKBARE TOERUSTING WAT BESOEDELING VEROORSAAK (vergoeding ontvang moet bydra tot die onkoste aan nuwe, doeltreffender toerusting)..... ( ) ( ) ( )

M. BELASTING OP PRODUKSIE-UITSET OF BEPERKING VAN DIE HOEVEELHEID GOEDERE GEPRODUSEER (vermindering van besoedeling deur verminderde produksie)..... ( ) ( ) ( )

N. BEMARKBARE STELSEL VIR BESOEDELINGSPERMITTE ('n Vasgestelde aantal regte om besoedeling tot op 'n sekere vlak binne 'n bepaalde gebied toe te laat, word van die regering aan die hoogste bod verkoop. Maatskappye wat hul besoedelingsvlak kan verlaag tot benede die vlak van die reg wat hulle het, kan die orskot besoedelingskapasiteit aan ander maatskappye verkoop wat die streek wil binnekom of kan dit vir hul eie uitbreiding gebruik)..... ( ) ( ) ( )

O. ANDER: SPESIFISEER ASSEBLIEF.....

B.2 RANGSKIK ASSEBLIEF AL VEERTIEN DIE BESOEDELINGSBEHEEROPSIES (A - N) IN VOLGORDE VAN VOORKEUR WAT U AS DIE VERNAAMSTE WYSE VIR DIE BEVORDERING VAN BESOEDELINGSBEHEER SIEN. 1 = verkieslikste; 14 = minste verkieslik.

1... 2... 3... 4... 5... 6... 7... 8... 9... 10... 11... 12... 13... 14...

B.1 WATTER VAN DIE VOLGENDE BELEIDSOPSIES SAL U GRAAG WIL SIEN AS DIE VERNAAMSTE WYSE OM BESOEDELINGSBEHEER AAN TE MOEDIG?

Beleggings in besoedelingsbeheertoerusting dra nie direk by tot die wins nie en vorm nie deel van die vervaardigingsproses nie, bv. waterskroptorings
om lugbesoedeling te voorkom.

JA	ONSEKER	NEE			
J	O	N	(J)	(O)	(N)

Merk asseblief die gepaste spasie

A. PERMITSTELSEL GEGROND OP DIE SPESIFIKASIE VAN (GOEDGEKEURDE) PRODUKSIETOERUSTING MET 'N BOETE VIR PERMITOORTREDING (bv. Wet op die Voorkoming van Besoedeling van die Atmosfeer; keuse van toerusting beperk)..... ( ) ( ) ( )

B. PERMITSTELSEL GEGROND OP DIE MAKSIMUMVLAK VAN AFVAL WAT GESTORT MAG WORD MET 'N BOETE VIR PERMITOORTREDING (bv. Waterwet; die metode word oorgelaat aan die individuele maatskappy)..... ( ) ( ) ( )

C. PRIVAATREGTELIKE OPLOSSINGS (wat individuele slagoffers van besoedeling toelaat om die besoedelaar te dagvaar vir vergoeding, of om vir 'n interdik aansoek te doen).... ( ) ( ) ( )

D. FINASIëLE AANSPORING IN DIE WET OP INKOMSTEBELASTING (bv. belastingkrediet, aanvanklike toelaes en deprisiasie vir goedgekeurde beleggings in teen-besoedelings= toerusting. Tans is die Wet slegs van toepassing op toerusting wat in die vervaardigingsproses gebruik word).. ( ) ( ) ( )

E. WETGEWING GEGROND OP DIE GEVOLGE VAN BESOEDELING (bv. die Wet op Seevisserye wat dit 'n oortreding maak vir enigiemand om enigiets ter see te stort wat 'n nadelige invloed op die mariene omgewing kan hê; skuld word veronderstel totdat die teendeel bewys is)..... ( ) ( ) ( )

F. VERPLIGTE VERSEKERING (vir vergoeding vir slagoffers van besoedeling)..... ( ) ( ) ( )

G.HEFFING OP ROUMATERIAAL (heffing op roumateriaal wat in produksie gebruik word)..... ( ) ( ) ( )

Vervolg op die volgende bladsy

A.1 HOE BELANGRIK IS ELK VAN DIE VOLGENDE FAKTORE IN DIE BEÏNVLOEDING VAN U BESLUIT OM IN AFVALBEHEERTOERUSTING TE BELÊ?

Beleggings in afvalbeheertoerusting kan koste óf gedeeltelik óf algeheel verminder in terme van die materiaal wat herwin word.

ONBELANGRIK	MATIG BELANGRIK	BAIE BELANGRIK
O	M	B

Merk asseblief die gepaste spasie

	(O)	(M)	(B)
A. SPESIFIEKE TEEN-BESOEDELINGSREGULASIES (in terme van die waarde van boetes vermy).....	( )	( )	( )
B. KWOTAGROOTTE (afvalbeheertoerusting kan die opbrengs van die vasgestelde hoeveelheid roumateriaal wat die maatskappy moet verwerk, verhoog).....	( )	( )	( )
C. OPBRENGS OP BELEGGING (waarde van produk herwin).....	( )	( )	( )
D. VOORKOMING VAN BESOEDELING (beskerming van die plaaslike omgewing).....	( )	( )	( )
E. WINSGEWENDHEID VAN DIE MAATSKAPPY.....	( )	( )	( )
F. DIE KOSTE VAN DIE AVFALBEHEERSTELSEL (kapitaal, installering en bedryf).....	( )	( )	( )
G. MAATSKAPPYBEELD (klagtes van die publiek).....	( )	( )	( )
H. MEDEDINGINGSVOORDEEL (om ' n afvalherwinningstelsel te installeer).....	( )	( )	( )
I. BESTAANDE FINANSIëLE AANSPORING (aanvanklike toelaes, deprisiasie ens).....	( )	( )	( )
J. VERMOë OM KOSTE AAN KLIëNTE OOR TE DRA.....	( )	( )	( )
K. BELANGE VAN MAATSKAPPY SE AANDEELHOUERS.....	( )	( )	( )
L. ANDER: SPESIFISEER ASSEBLIEF.....			

A. 2 NA OORWEGING VAN DIE FAKTORE (A - K) HIERBO GELYS, RANGSKIK ASSEBLIEF AL ELF DIE FAKTORE IN VOLGORDE VAN HUL BELANGRIKHEID VIR U WANNEER U BESLUITE OOR KAPITAALBELEGGINGS IN AFVALBEHEERTEGNOLOGIE MOET MAAK.
1 = belangrikste; 11 = minste belangrik, m.a.w. as u voel dat G die belangrikste faktor is, skryf dit in die spasie na 1 ens.

1.....2.....3.....4.....5.....6.....7.....8.....9.....10.....11.....

OMKRING ASSEBLIEF DIE NOMMER OF NOMMERS WAT U ANTWOORD DIE BESTE BESKRYF

WATTER POSISIE BEKLEE U TANS?

1. BESTURENDE DIREKTEUR
2. DIREKTEUR
3. ALGEMENE GROEPBESTUURDER
4. ALGEMENE BESTUURDER
5. FABRIEKSBESTUURDER
6. SENIOR AMPTENAAR

1. 2. 3. 4. 5. 6.

HOEVEEL JAAR ONDERVINDING HET U IN DIE VISBEDRYF?

1. 0 - 4 jaar
2. 5 - 9 jaar
3. 10 - 14 jaar
4. 15 - 19 jaar
5. 20 - 24 jaar
6. 25 en meer jaar

1. 2. 3. 4. 5. 6.

IN WATTER SEKTOR(-E) VAN DIE BEDRYF IS U MAATSKAPPY TANS BETROKKE?

1. Demersale
2. Pelagies
3. Kreef
4. Lynvis
5. Ander

1. 2. 3. 4. 5.

WAAR IS DIE PELAGIESE EN/OF DEMERSALE VISVERWERKINGSFABRIEK(-E) VAN U MAATSKAPPY GELEë?

1. Walvisbaai
2. Lambertsbaai
3. Laaiplek
4. St Helenabaai
5. Saldanhabaai
6. Kaapstad
7. Houtbaai
8. Gansbaai
9. Mosselbaai
10. Ander

1. 2. 3. 4. 5. 6. 7. 8. 9. 10.

APPENDIX II B

OM/EN 6/1/1

DEPARTEMENT VAN OMGEWINGSAKE

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Navrae / Inquiries S.R. Lipschitz

DIE INVLOED VAN VERSKILLENDE REGULATORIESE BENADERINGS TOT BESOEDELINGSBEHEER OP DIE VISVERWERKINGSBEDRYF

Wetgewing oor omgewingsbewaring wat onduidelik saamgestel is kan lei tot onopsetlike en onbedoelde gevolge op die ekonomiese aktiwiteite van individuele maatskappye. Hierdie studie ondersoek die potensiële uitwerking van verskillende besoedelingsbeheerbeleide op die demersale en pelagiese visverwerkingsbedrywe. Beter begrip oor beperkinge waaronder die visverwerkingsaanlegte werk, kan lei tot die ontwikkeling van beter regulasies gesien in die lig van omgewingsbeskerming, en die beperking van onnodige regeringsinmenging in die werksaamhede van die visbedryf.

Daar is geen "regte" of "verkeerde" antwoorde nie; ons stel belang in u menings en beskouinge tot besoedelingsbeheer in verband met die invloed van verskillende regulatoriese benaderings op die visverwerkingsbedryf.

Alle antwoorde sal as vertroulik beskou word. Sodra die data saamgestel is, sal dit nie moontlik wees om enige persoon of maatskappy uit te ken nie. 'n Opsomming van die bevindinge van hierdie belangrike studie, in die vorm van 'n statistiese verslag, sal aan u en al die ander respondente van hierdie vraelys vir kommentaar voorgelê word voordat die finale verslag saamgestel word.

BEANTWOORD ASSEBLIEF ALLE VRAE

STUUR ASB. VOOR..../..../19... TERUG AAN:

Die Direkteur:
Navorsingsinstituut vir Seevisserye
Privaatsak X2
Roggebaai
8012

AANDAG: Mnr. S.R.LIPSCHITZ

F.1 WHAT PERCENTAGE OF YOUR COMPANY'S ANNUAL BUDGETED EXPENDITURE DO YOU ESTIMATE IS SPENT ON POLLUTION CONTROL (Averaged over a five year period)?

Please tick the appropriate space:

CAPITAL EXPENDITURE	OPERATING EXPENDITURE
0 - 4%.....( )	0 - 4%.....( )
5 - 9%.....( )	5 - 9%.....( )
10 - 14%.....( )	10 - 14%.....( )
15 - 19%.....( )	15 - 19%.....( )
OVER 20%.....( )	OVER 20%.....( )
CANNOT BE ESTIMATED....( )	CANNOT BE ESTIMATED....( )
CANNOT BE DIVULGED.....( )	CANNOT BE DIVULGED.....( )

F.2 DO YOU HAVE A DIRECT FINANCIAL INTEREST (SHARES) IN THE FISHING INDUSTRY?

YES.....( ) NO.....( )

F.3 DO YOU WISH TO MAKE ANY ADDITIONAL COMMENTS ABOUT THE IMPACT THAT POLLUTION CONTROL LEGISLATION HAS ON THE FISHING INDUSTRY?

.....

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.....

PLEASE MAKE SURE THAT YOU HAVE ANSWERED ALL THE QUESTIONS

THANK YOU AGAIN FOR YOUR CO-OPERATION AND YOUR VALUABLE TIME IN COMPLETING THIS IMPORTANT QUESTIONNAIRE.

PLEASE INDICATE TO WHAT EXTENT YOU ARE IN AGREEMENT WITH EACH OF THE FOLLOWING STATEMENTS

STRONGLY AGREE/AGREE/UNCERTAIN/DISAGREE/STRONGLY DISAGREE
(1) (2) (3) (4) (5)

Please circle in the appropriate number	(1)	(2)	(3)	(4)	(5)
E.1 TAX PAYERS, RATHER THAN COMPANY CUSTOMERS SHOULD PAY FOR THE PROTECTION OF THE ENVIRONMENT.....	(1)	(2)	(3)	(4)	(5)
E.2 IT IS THE WAY THAT THE LAW IS APPLIED RATHER THAN THE LAW ITSELF THAT CREATES PROBLEMS.....	(1)	(2)	(3)	(4)	(5)
E.3 POLLUTION CONTROL SHOULD BE APPLIED ON A CASE BY CASE BASIS RATHER THAN BY MEANS OF UNIFORM STANDARDS.....	(1)	(2)	(3)	(4)	(5)
E.4 OUR COMPANY'S EXPENDITURE ON POLLUTION CONTROL HAS BEEN ECONOMICALLY JUSTIFIABLE.....	(1)	(2)	(3)	(4)	(5)
E.5 THE GOVERNMENT WILL ONLY TAKE PERSISTENT OFFENDERS TO COURT PREFERING TO SETTLE MOST DISPUTES BY NEGOTIATION.....	(1)	(2)	(3)	(4)	(5)
E.6 POLLUTION CONTROL REGULATIONS CONTRIBUTE SIGNIFICANTLY TO INCREASED PRODUCTION COSTS.....	(1)	(2)	(3)	(4)	(5)
E.7 QUOTA RESTRICTIONS HAVE SIGNIFICANTLY INFLUENCED INVESTMENT IN WASTE RECOVERY SYSTEMS.....	(1)	(2)	(3)	(4)	(5)
E.8 THE DISCHARGE OF UNTREATED WASTES FROM FISH FACTORIES SHOULD REMAIN A CRIMINAL OFFENCE.....	(1)	(2)	(3)	(4)	(5)
E.9 UNTREATED FISH FACTORY EFFLUENT CAN RESULT IN SIGNIFICANT HARM TO THE MARINE ENVIRONMENT.....	(1)	(2)	(3)	(4)	(5)

D.1 HOW DO YOU FEEL ABOUT EXISTING POLLUTION CONTROL LEGISLATION WITH REGARD TO THE FOLLOWING ISSUES?

Please circle the category which best describes each issue.

A. REALISM

very unrealistic | unrealistic | realistic | very realistic

B. TIMING OF REGULATION IMPLEMENTATION

very premature | premature | timely | overdue

C. FAIRNESS IN IMPLEMENTATION

very unfair | unfair | fair | very fair

D. PENALTIES

very severe | severe | adequate | lenient | very lenient

E. FLEXIBILITY (as to method of controlling pollution)

very inflexible | inflexible | adequate | flexible | very flexible

F. NUMBER OF REGULATIONS

far too many | too many | enough | too few | far too few

G. COMPLEXITY OF LAWS AND REGULATIONS

very complex | complex | adequate | simple | very simple

H. OPPORTUNITY FOR INDUSTRY INPUT INTO COMPILATION OF REGULATIONS

very limited | limited | adequate | excessive

C.2 BASED ON YOUR PERCEPTIONS OF THE FUTURE, IN WHICH OF THE FOLLOWING AREAS WOULD YOU BE LIKELY TO MAKE SIGNIFICANT CAPITAL INVESTMENTS?

UNLIKELY	LIKELY	VERY LIKELY
U	L	V

Please tick in the appropriate space (U) (L) (V)

A. DIVERSIFICATION (new products for new markets).....( ) ( ) ( )

B. SPECIALIZATION (focus more narrowly on existing products and markets).....( ) ( ) ( )

C. EMPLOYEE BENEFITS (e.g. housing schemes).....( ) ( ) ( )

D. JOB CREATION AND TRAINING.....( ) ( ) ( )

E. POLLUTION CONTROL.....( ) ( ) ( )

F. MODERNIZATION PROGRAMMES (ship replacement and / or upgrading production facilities).....( ) ( ) ( )

G. WASTE/MATERIALS RECOVERY SYSTEMS.....( ) ( ) ( )

H. INVESTMENTS IN ENTERPRISES UNRELATED TO FISHING.....( ) ( ) ( )

I. RESEARCH AND DEVELOPMENT.....( ) ( ) ( )

J. OTHER: PLEASE SPECIFY .....

C.3 BASED ON YOUR VIEW OF THE FUTURE (TO THE YEAR 2000), PLEASE RANK ALL NINE OPTIONS LISTED ABOVE (A - I) ACCORDING TO YOUR PERCEIVED INVESTMENT PRIORITIES.

1 = Highest priority; 9 = Lowest priority.

1.... 2.... 3.... 4.... 5.... 6.... 7.... 8.... 9....

C.1 IN THE PERIOD BETWEEN NOW AND THE YEAR 2000, WHAT DO YOU BELIEVE TO BE THE MAJOR STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS OF YOUR SECTOR OF THE INDUSTRY?

(e.g. an opportunity could be the development of a non-quota species fishery and a threat could be a rise in the cost of key inputs e.g. fuel)

STRENGTHS .....

.....

.....

.....

.....

.....

WEAKNESSES .....

.....

.....

.....

.....

.....

THREATS .....

.....

.....

.....

.....

.....

OPPORTUNITIES .....

.....

.....

.....

.....

.....

		(Y)	(U)	(N)
H.	EFFLUENT/EMISSION CHARGES (residuals tax).....	( )	( )	( )
I.	NON-COMPLIANCE PENALTIES (to remove the economic advantage of not complying with pre-set discharge conditions).....	( )	( )	( )
J.	SUBSIDIES AND GRANTS FOR APPROVED ANTI-POLLUTION EQUIPMENT.....	( )	( )	( )
K.	SUBSIDIES FOR APPROVED IN-PLANT MODIFICATIONS TO IMPROVE EFFICIENCY (and thereby improving effluent quality; at present no such incentive exists).....	( )	( )	( )
L.	GOVERNMENT EXPROPRIATION OF OBSOLETE POLLUTION PRODUCING EQUIPMENT (compensation received to be used to off-set the cost of new more efficient equipment).....	( )	( )	( )
M.	TAX ON PRODUCTION OUTPUT OR RESTRICTING THE QUANTITY OF GOODS PRODUCED (reducing pollution by decreasing production).....	( )	( )	( )
N.	MARKETABLE POLLUTION PERMIT SYSTEM (A fixed number of rights to pollute up to a specified level in a region are obtained from the government by bidding. Companies that manage to decrease their pollution to below the level for which they hold a right, may sell the surplus pollution capacity to other companies wishing to enter the region or use it for their own expansion).....	( )	( )	( )
O.	OTHER: PLEASE SPECIFY			

B.2 PLEASE RANK ALL FOURTEEN OF THE POLLUTION CONTROL POLICY OPTIONS (A - N) IN ORDER OF PREFERENCE, THAT YOU WOULD LIKE TO SEE USED AS THE PRICIPAL MEANS OF PROMOTING POLLUTION CONTROL. 1 = most prefered; 14 = least prefered.

1... 2... 3... 4... 5... 6... 7... 8... 9... 10... 11... 12... 13... 14...

B.1 WHICH OF THE FOLLOWING POLICY OPTIONS WOULD YOU LIKE TO SEE USED AS THE PRICIPAL MEANS OF PROMOTING POLLUTION CONTROL IN THE FUTURE?

Investments in pollution control equipment do not contribute directly to profit and do not form part of the process of manufacture e.g. scrubbing towers to prevent air pollution.

YES	UNCERTAIN	NO
Y	U	N

Please tick the appropriate space	(Y)	(U)	(N)
A. PERMIT SYSTEM BASED ON THE SPECIFICATION OF (APPROVED) PRODUCTION EQUIPMENT WITH A PENALTY FOR PERMIT CONTRAVENTION (e.g. Atmospheric Pollution Prevention Act; choice of equipment limited).....	( )	( )	( )
B. PERMIT SYSTEM BASED ON MAXIMUM LEVEL OF WASTE THAT MAY BE DISCHARGED WITH A PENALTY FOR PERMIT CONTRAVENTION (e.g. Water Act; the method of achievement left to the individual company).....	( )	( )	( )
C. PRIVATE-LAW REMEDIES (which allow for individual victims of pollution to sue the polluter for compensation or to apply for an interdict).....	( )	( )	( )
D. FINANCIAL INCENTIVES IN THE INCOME TAX ACT (e.g. tax credits, initial allowances and depreciation for approved investments in anti-pollution equipment. At present the Act only applies to equipment used in the process of manufacture).....	( )	( )	( )
E. LEGISLATION BASED ON THE EFFECTS OF POLLUTION (e.g. the Sea Fisheries Act which makes it an offence for any one to discharge anything to sea that may have adverse effects on the marine environment; guilt is presumed until the contrary is proved).....	( )	( )	( )
F. COMPULSORY INSURANCE (for compensating victims of pollution).....	( )	( )	( )
G. INPUT SURCHARGES ON RAW MATERIALS (levy on the raw materials used in production).....	( )	( )	( )

Continued on the next page.../H.

A.1 HOW IMPORTANT ARE EACH OF THE FOLLOWING FACTORS IN INFLUENCING YOUR DECISION TO INVEST IN WASTE CONTROL EQUIPMENT?

Investments in waste control equipment can off-set costs either partially or wholly in terms of materials recovered.

UNIMPORTANT U	MODERATELY IMPORTANT M	VERY IMPORTANT V

Place tick in the appropriate space

		(U)	(M)	(V)
A.	SPECIFIC ANTI-POLLUTION REGULATIONS (in terms of the value of fines avoided).....	( )	( )	( )
B.	QUOTA SIZE (waste control equipment can improve yield of the fixed amount of raw material that the company has to process).....	( )	( )	( )
C.	RETURN ON INVESTMENT (value of product recovered).....	( )	( )	( )
D.	PREVENTION OF POLLUTION (protection of the local environment).....	( )	( )	( )
E.	PROFITABILITY OF THE COMPANY.....	( )	( )	( )
F.	THE COST OF THE WASTE CONTROL SYSTEM (capital, installation and operating).....	( )	( )	( )
G.	COMPANY IMAGE (complaints from the public).....	( )	( )	( )
H.	COMPETITIVE ADVANTAGE (of installing a waste recovery system).....	( )	( )	( )
I.	EXISTING FINANCIAL INCENTIVES (initial allowances, depreciation etc.).....	( )	( )	( )
J.	THE ABILITY TO PASS COSTS ON TO CUSTOMERS.....	( )	( )	( )
K.	INTERESTS OF COMPANY SHARE HOLDERS.....	( )	( )	( )
L.	OTHER: PLEASE SPECIFY			

A.2 AFTER CONSIDERATION OF THE FACTORS (A - K) LISTED ABOVE, PLEASE RANK ALL ELEVEN OF THE FACTORS IN ORDER OF THEIR IMPORTANCE TO YOU WHEN MAKING CAPITAL INVESTMENT DECISIONS IN WASTE CONTROL TECHNOLOGY.

1 = most important; 11 = least important, e.g. if you feel that G is the most important factor, write it in the space next to 1 and so on.

1.... 2.... 3.... 4.... 5.... 6.... 7.... 8.... 9.... 10.... 11....

PLEASE CIRCLE THE NUMBER OR NUMBERS THAT BEST DESCRIBES YOUR ANSWER.

WHAT POSITION DO YOU CURRENTLY HOLD?

1. Managing Director
2. Director
3. Group General Manager
4. General Manager
5. Factory Manager
6. Senior Executive.

1. 2. 3. 4. 5. 6.

HOW MANY YEARS OF EXPERIENCE DO YOU HAVE IN THE FISH PROCESSING INDUSTRY?

1. 0 - 4 years
2. 5 - 9 years
3. 10 - 14 years
4. 15 - 19 years
5. 20 - 24 years
6. 25 and more years

1. 2. 3. 4. 5. 6.

IN WHICH FISHING INDUSTRY SECTOR(S) IS YOUR COMPANY CURRENTLY INVOLVED?

1. Demersal
2. Pelagic
3. Rock Lobster
4. Line Fish
5. Other

1. 2. 3. 4. 5.

WHERE IS/ARE THE PELAGIC AND OR DEMERSAL FISH PROCESSING FACTORY(S) OF YOUR COMPANY LOCATED?

1. Walvis Bay
2. Lamberts Bay
3. Laaiplek
4. St Helena Bay
5. Saldanha Bay
6. Cape Town
7. Hout Bay
8. Gansbaai
9. Mossel Bay
10. Other

1. 2. 3. 4. 5. 6. 7. 8. 9. 10.

APPENDIX II B

DEPARTEMENT VAN OMGEWINGSAKE

Hoofdirektoraat: Mariene Ontwikkeling
Privaatsak X2, Roggebaai, Kaapstad.
Republiek van Suid-Afrika 8012

OM/EN 6/1/1

DEPARTMENT OF ENVIRONMENT AFFAIRS

Chief Directorate: Marine Development
Private Bag X2, Rogge Bay, Cape Town.
Republic of South Africa 8012

Telefoon Telephone 49-6160 Telegramme Telegrams PLANKTON Teleks Telex 5-20796

1055M

Verwysing Reference V1/1/3/4/1

Navrae Inquiries S.R. Lipschitz

THE IMPACT OF DIFFERENT REGULATORY APPROACHES TO POLLUTION CONTROL ON THE FISH PROCESSING INDUSTRY

Poorly drafted environmental protection legislation can lead to unforeseen and unintended effects on the economic activities of individual companies. This study investigates the potential impact of various pollution control policies on the demersal and pelagic fish processing industries. An understanding of the constraints under which the fish processing industries operate will lead to the development of better regulations both from the point of view of environmental protection and of preventing unnecessary government interference in the operations of the fishing industry.

There are no "right" or "wrong" answers; we are interested in your opinions and viewpoints regarding the impact of different regulatory approaches to pollution control on the fish processing industry.

All responses will be treated confidentially. — Once the data has been compiled it will not be possible to identify any person or company. A summary of the findings of this important study, in the form of a statistical report, will be sent to you and all the other respondents to this survey for comment before the final report is compiled.

PLEASE ANSWER ALL QUESTIONS.

PLEASE RETURN BY ...../...../19... TO

Director: Sea Fisheries Research Institute
Private Bag X2
ROGGE BAY
8012

ATTENTION: MR S.R. LIPSCHITZ

APPENDIX II A

IMPACT OF POLLUTION CONTROL REGULATIONS ON THE FISHING INDUSTRY

DIE INVLOED VAN BESOEDELINGSBEHEERREGULASIES OP DIE VISBEDRYF.

To ensure the widest possible coverage of opinions and beliefs, please supply the names of all the senior executives who would be involved in making investment decisions in pollution control programmes.

Verskaf asseblief die name van al die senior bestuurslede wat 'n bydrae tot beleggingsbesluite in besoedelingsbeheerprogramme kan maak om die breedste moontlike dekking van menings en beskouinge te verseker.

Please print/Drukskrif asseblief.

NAME OF COMPANY/NAAM VAN MAATSKAPPY:_____

NAME/NAAM: TELEPHONE No./TELEFOON No.:

1._____

2._____

3._____

4._____

5._____

6._____

7._____

8._____

9._____

10._____

Inquiries/Navrae:Mr S Lipschitz. Telephone/Telefoon:(021)49-6160.

'n Vraelys is saamgestel om die standpunt van die bedryfsbestuur rakende die bogenoemde aspekte te toets. Mnr. Lipschitz sal persoonlik die vraelys, wat binne 35 minute voltooi kan word, administreer. Daar word beplan om hierdie vraelysonderhoude gedurende die tydperk middel November 1987 tot einde Januarie 1988 af te handel. Kan u asseblief so gou as moontlik 'n lys van al u senior bestuurslede van u maatskappy wat 'n bydrae tot belangrike beleggingsbesluite in u afval- en besoedelingsbeheerprogram kan maak, aan mnr. Lipschitz verskaf. Mnr. Lipschitz sal met u en diegene wat deur u genomineer is in verbinding tree om 'n geskikte tyd te reël vir voltooiing van die vraelys.

Al die inligting wat u verkaf sal as vertroulik beskou word. Sodra die data saamgestel is, sal dit nie moontlik wees om enige persoon of maatskappy uit te ken nie. 'n Opsomming van die bevindinge van die belangrike studie, in die vorm van 'n statistiese verslag, sal aan u en al die ander respondente van die vraelys vir kommentaar voorgelê word, voordat die finale verslag saamgestel word.

Ek dank u by voorbaat.

Die uwe

DIREKTEUR: NAVORSINGSINSTITUUT VIR SEEVISSERYE

The specialised expertise of you and your senior management will provide a valuable insight into the problems that could be experienced by the industry, should certain regulatory and administrative proceedures be adopted.

A questionnaire has been compiled to survey industry management viewpoint on the issues mentioned above. Mr Lipschitz will personally be administering the questionnaire which should take approximately 35 minutes to complete. It is envisaged that these questionnaire-interviews will be carried out between mid November 1987 and the end of January 1988. Please could you submit a list as soon as possible to Mr Lipschitz of all the senior executives in your company who would be involved in making important investment decisions in your waste and pollution control programmes. You and those that you nominate will be contacted by Mr Lipschitz to arrange a convenient time for the completion of the questionnaire.

All the information that you supply will be treated confidentially. Once the data has been compiled it will not be possible to identify any person or company. A summary of the findings of this important study, in the form of a statistical report, will be sent to you and all the other respondents to this questionnaire for comment before the final report is compiled.

Thanking you in anticipation of your co-operation.

Yours faithfully

DIRECTOR: SEA FISHERIES RESEARCH INSTITUTE

OM/EN 6/1/1

DEPARTEMENT VAN OMGEWINGSAKE

Hoofdirektoraat: Mariene Ontwikkeling
Privaatsak X2, Roggebaai, Kaapstad.
Republiek van Suid-Afrika 8012

DEPARTMENT OF ENVIRONMENT AFFAIRS

Chief Directorate: Marine Development
Private Bag X2, Rogge Bay, Cape Town.
Republic of South Africa 8012

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Verwysing / Reference V1/1/3/4/1

Navrae / Inquiries S.R. Lipschitz

Geagte

DIE INVLOED VAN BESOEDELINGSBEHEERREGULASIES OP DIE VISBEDRYF*

Wetgewing oor omgewingsbeskerming wat onduidelik saamgestel is, kan lei tot onvoorsiene en onopsetlike gevolge op die ekonomiese aktiwiteite van individuele maatskappye. Mnr. Steven Lipschitz, 'n wetenskaplike van die Navorsingsinstituut vir Seevisserye, is deur die Departement van Omgewingsake opdrag gegee om die potensiële uitwerking van die verskillende beleidstandpunte oor besoedelingsbeheer op die demersale en pelagiese visverwerkingsbedrywe te ondersoek. Beter begrip oor die beperkinge waaronder visverwerkingsaanlegte werk, kan lei tot die ontwikkeling van beter regulasies, gesien in die lig van omgewingsbeskerming, en die beperking van onnodige regeringsinmenging in die werksaamhede van die visbedryf.

'n Belangrike deel van die studie is die opname van die menings en beskouinge van senior uitvoerende amptenare van die bedryf ten opsigte van:
Die faktore wat deur die bedryf in ag geneem word wanneer beleggings in afval- en besoedelingsbeheerprogramme gemaak word;
Die gevolge van soedanige beleggings op die vermoë van maatskappye om hul doelwitte te bereik; en
Die identifikasie van moontlike alternatiewe regeringsbeleidstandpunte wat die bedryf in werking wil sien as 'n manier om belegging in omgewingsbeskerming aan te moedig.

Die gespesialiseerde kundigheid van u en u senior bestuur sal 'n waardevolle insig in die probleme wat deur die bedryf ondervind mag word, kan verskaf, sou sommige regulerende en administratiewe prosedures aanvaar word.

*English on the reverse side

APPENDIX II A

OM/EN 6/1/1

DEPARTEMENT VAN OMGEWINGSAKE

Hoofdirektoraat: Mariene Ontwikkeling
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Verwysing Reference V1/1/3/4/1

Navrae Inquiries S.R. LIPSCHITZ

Dear

THE IMPACT OF POLLUTION CONTROL REGULATIONS ON THE FISHING INDUSTRY*

Poorly drafted environmental protection legislation can lead to unforeseen and unintended effects on the economic activity of individual companies. Mr Steven Lipschitz, a scientist in the Pollution Division of the Sea Fisheries Research Institute, has been directed by the Department of Environment Affairs to study the potential impact of various pollution control policies on the demersal and pelagic fish processing industries. An understanding of the constraints under which the fish processing industries operate will lead to the development of better regulations both from the point of view of environmental protection and of preventing unnecessary government interference in the operations of the fishing industry.

An important part of this study is aimed at surveying opinions and beliefs of the senior executives of the industry regarding:
The factors that are taken into account by the industry when making investments in waste and pollution control programmes;
The effects of such investments on the ability of companies to meet their objectives; and
The identification of possible government policy options that the industry would prefer to see used as a means of promoting investment in environmental protection.

*Afrikaans op keersy

APPENDIX II

PAYNE A, (1986) Assistant Director, Sea Fisheries Research Institute. *Personal interview.* 12/3/1986.

RICHEY J S, HORNER R R, MAR B W, (1985a) The delphi technique in environmental assessment: II Consensus on critical issues in environmental monitoring program design. *Journal of Environmental Management.* 21: 147 - 159.

RICHEY J S, MAR B W, HORNER R R, (1985b) The delphi technique in environmental assessment: I Implementation and effectiveness. *Journal of Environmental Management.* 21: 135 - 146.

WATER RESEARCH COMMISSION, (1983) *A survey of water and effluent management in the fish processing industry of South Africa.* Pretoria. Report, prepared by Messers. Binnie and Partners, consulting engineers on behalf of the Water Research Commission.

WATER RESEARCH COMMISSION (1988) *Technology transfer : Effluent problems in the fish processing industry : Latest level of expertise in respect of effluent treatment.* A seminar, held at Laaiplek, South Africa. 20 October, 1988.

experts to be poor in terms of their pollution control effectiveness. As this assessment was based on the abatement performance that these experts believe could reasonably be expected from the industry, much room for improvement exists. This is supported by the fact that only one factory (P3) was considered to be "very good". The major pollution problem facing the fish processing industry still appears to be that of effluents generated primarily during wet-offloading operations (Water Research Commission, 1983). Wet-Offloading is used to remove fish from boats that are destined for canning. This method is considered less damaging to the fish than dry-offloading. The factories situated at Walvis Bay make almost exclusive use of wet-offloading practices even when the fish are to be converted into meal and oil. It would therefore seem that the most reliable indicator of potential pollution problems in the fish processing industry is the method used to offload pelagic catches.

Intuitively, one would expect complaints to be an indicator of abatement performance. This does not appear to be the case, probably due to the fragmented nature of the administration which could result in complaints being channeled to various government departments. This could create an inaccurate perception of the true state of the pollution problem for some or all of the controlling authorities. It is of note, however, that public complaints have been cited as the reason for major improvements in abatement performance at a number of factories. Nonetheless complaints regarding undesirable practices at other factories have been fewer than would normally have been expected. This appears to be directly related to the economic dependance of the local community on these factories. Factories located closer to metropolitan areas such as Cape Town or in areas with large resident populations which have no direct association with these factories, appear to be more vulnerable to public pressure.

No simple relationship appears to exist between catch size or "total yield factors", and pollution control effectiveness. Total yield factors represent an average raw material conversion factor which is not sensitive enough to allow discrimination between the different factory efficiencies. This applied also to factories which produced only fish meal and oil.

References

DALKEY N, HELMER O, (1963) An experimental application of the Delphi method to the use of experts. *Management Science*. 9: 458 - 467.

LUSHER J A, (1986) Deputy Director, Department of Water Affairs. *Personal interview*. 5/3/86.

MOLDAN A G S, (1986) Assistant Director, Sea Fisheries Research Institute. *Personal interview*. 4/3/86.

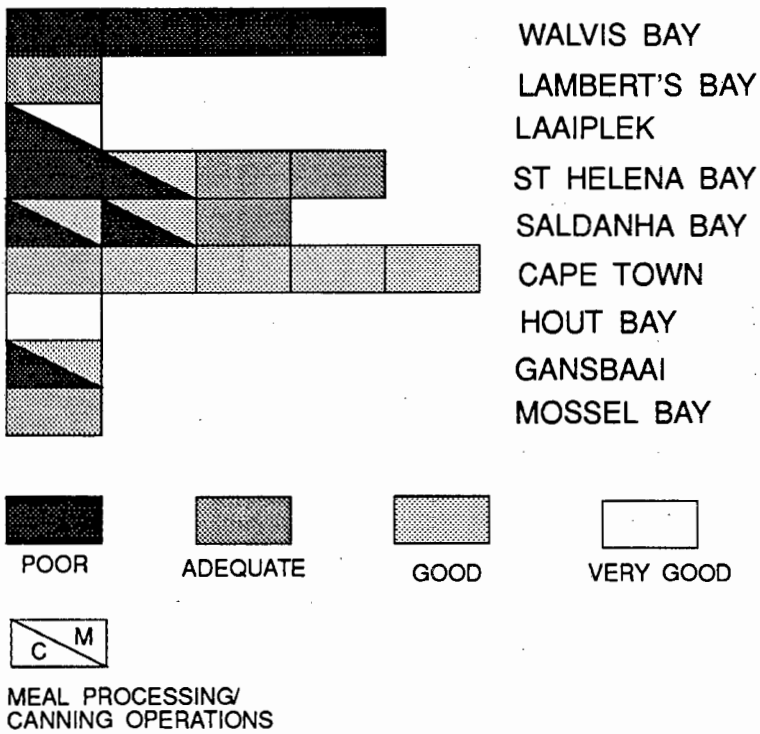

FIGURE A5

Qualitative assessment of the pollution control effectiveness of the fish processing factories situated at various locations on the Southern African coast (1986)

Scource: Table A1

and P7 respectively, were rated as poor. In the case of the former factory the problem could be attributed to the operation of un-silenced dry-offloading equipment. The odour problem was attributed to the absence of a deodorizer (see Table A 2).

Although visual and olfactory manifestations of pollution have been a cause for public complaint, only one factory, namely P12 was considered by the experts to have a significant complaint record (Table A1). It must be pointed out however that improved abatement performance at three factories, namely P3, P8 and D5, has been attributed to public pressure (see Table A 2). Whereas at other factories namely P7 and P9 complaints appear to be less than would normally be expected.

Finally it must be noted that only one factory in the fish processing industry was considered to be "very good" (P3; Table A1).

The information supplied by the Sea Fisheries Research Institute was examined to see if any correlations between certain quantitative parameters and expert assessment of pollution control effectiveness could be found. The percentages of the total catch processed by each factory (presented in Figures A1 and A2) for each sector of the industry do not appear to be related to pollution control effectiveness. Factory P2 which processed 2,6% of the pelagic catch, and factory P12 which processed 13,7%, the largest single proportion of the same catch, were both assessed as poor. "Total yield factors" a measure of the relationship between the amount of raw material used per averaged unit of total product produced (oil, meal and cans), did likewise not appear to be related to abatement performance or provide an index of waste.

Figures A3 and A4 give the percentage of the catch processed by each fishing group. These figures have been included to show that the control of the fishing industry is divided among relatively few companies. This could have implications regarding the financial and other resources of these companies.

A summary of the qualitative assessment of pollution control effectiveness for the factories of the southern African fish processing industry is presented in figure A 5. A relationship appears to exist between abatement performance and the local economy. Pollution control appears to be more effective in those areas in which the local community is less dependent on the fishing industry, as is the case in Cape Town, Hout Bay and Mossel Bay.

Discussion and Conclusions

Ten of the twenty-one factories of the fish processing industry were considered by a panel of

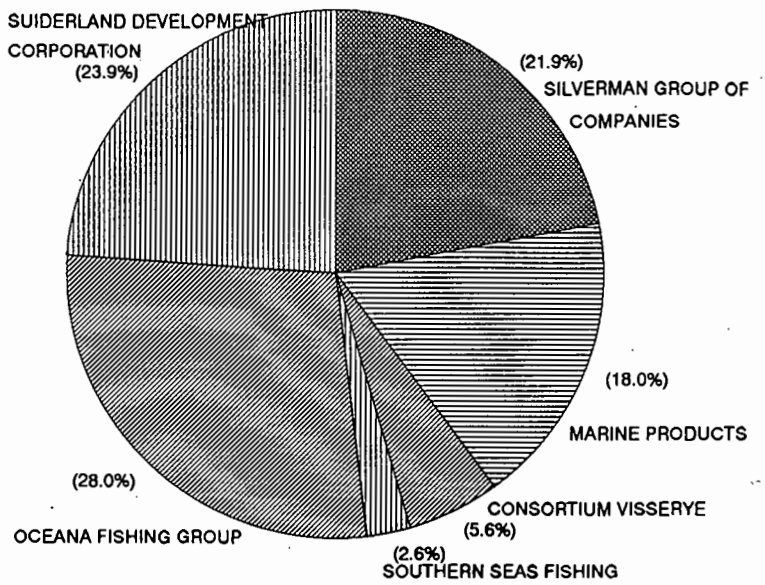

FIGURE A3

Percentage of the Southern African pelagic catch processed by each fishing group (1986)

Source: Sea Fisheries Research Institute

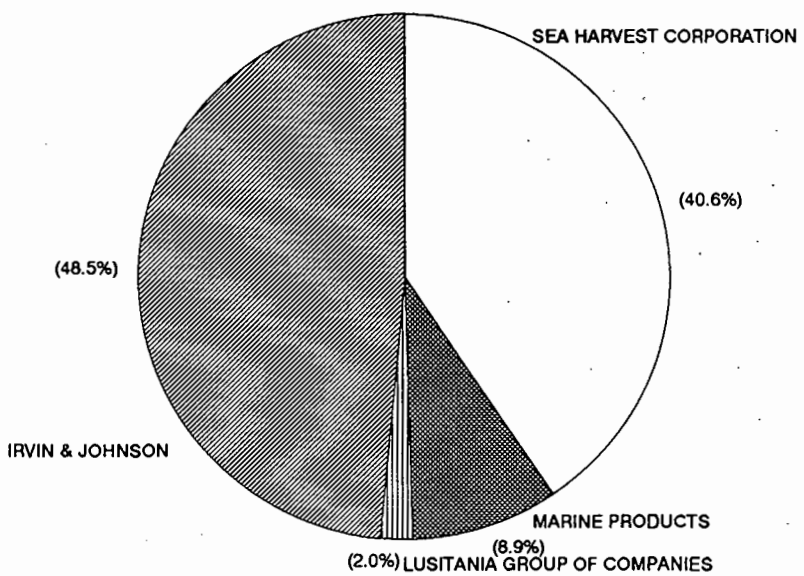

FIGURE A4

Percentage of the Southern African demersal catch processed by each fishing group (1986)

Source: Sea Fisheries Research Institute

OPMERKINGS

bates, die ontwikkeling van nuwe produkte vir nuwe markte en die skepping van werksgeleenthede en opleiding. Besoedeling en afvalbeheerbeleggings word nie as vername prioriteite beskou nie.

GEVOLGTREKKING

Sou die visverwerkingsbedryf in staat wees om verouderende bates te vervang, en sy benutting van roumateriaal verder te verbeter, kan verwag word dat die behoefte aan vername bykomstige uitgawe op afvalherwinning en besoedelingsbeheertoerusting ooreenstemmend sal afneem.

Omkring die kategorie wat u standpunt die beste beskryf:

STEM BESLIS SAAM; STEM SAAM; ONSEKER; STEM NIE SAAM NIE; STEM BESLIS NIE SAAM NIE

IN WATTER SEKTOR VAN DIE BEDRYF STAAN U HUIDIGLIK?

DEMERSAAL PELAGIES

SOU U VERDERE OPMERKINGS WOU MAAK OOR DIE BEVINDINGS EN GEVOLGTREKKINGS HIERBO VOORGEHOU, OF OOR ENIGE SY VAN BESOEDELINGSBEHEERBELEID VAN TOEPASSING OP DIE VISVERWERKINGSBEDRYF, GEBRUIK ASSEBLIEF DIE RUIMTE HIERONDER

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Dankie vir u waardevolle tyd en samewerking om hierdie belangrike vraelys in te vul.

APPENDIX III B

DEPARTEMENT VAN OMGEWINGSAKE

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Navrae Inquiries S.R. Lipschitz

OM/EN 6/1/1

Dear

THE IMPACT OF DIFFERENT REGULATORY APPROACHES TO POLLUTION CONTROL

A few weeks ago you were sent a summary of the findings of a study concerning "The impact of different regulatory approaches to pollution control on the fish processing industry", for comment.

If you have already returned your comments, please disregard this notice. As all the returns are anonymous, there is no way of knowing whether or not you have responded already.

Should you not have submitted your comments, please could you do so as soon as possible. The assumption will be made, that those respondents who have not replied by the 30th of June, 1988, are in full agreement with the findings and conclusions as set out in the summary report.

Thank you for your cooperation.

DIRECTOR: SEA FISHERIES RESEARCH INSTITUTE

APPENDIX IV

APPENDIX IV A

BIOGRAPHICAL DATA: QUESTIONNAIRE 1.

Respondents					Other Sectors					Factory Locations									
	R	Y	S	F	1	2	3	4	5	1	2	3	4	5	6	7	8	9	10
001	3	5	1	1	1	0	3	0	5	1	0	0	0	0	6	0	0	9	10
002	4	5	1	2	1	0	3	0	5	0	0	0	0	0	6	0	0	0	0
003	6	3	1	1	1	0	3	0	5	1	0	0	0	0	6	0	0	9	10
004	6	6	1	2	1	0	3	0	5	1	0	0	0	0	6	0	0	9	10
005	1	5	1	1	1	0	0	0	0	0	0	0	0	5	0	0	0	0	0
006	6	3	1	2	1	0	0	0	0	0	0	0	0	5	0	0	0	0	0
007	6	3	1	2	1	0	0	0	0	0	0	0	0	5	0	0	0	0	0
008	1	6	1	2	1	0	0	0	0	0	0	0	0	0	6	0	0	0	0
009	2	5	2	1	1	2	3	0	0	1	0	3	0	0	6	0	8	0	0
010	6	2	2	1	1	2	3	0	0	1	0	3	0	0	6	0	8	0	0
011	1	2	1	2	1	0	0	0	0	0	0	0	0	0	6	0	0	0	0
012	5	5	2	2	0	2	0	0	0	0	0	3	0	0	0	0	0	0	0
013	5	5	2	0	0	2	0	0	0	0	0	0	0	0	0	0	8	0	0
014	6	5	2	2	0	2	3	4	5	0	2	0	4	0	6	7	0	0	0
015	3	6	2	1	0	2	3	4	5	1	2	0	4	0	0	7	0	0	0
016	4	5	2	2	0	2	3	0	0	0	2	0	0	0	0	0	0	0	0
017	3	3	2	1	0	2	3	0	0	1	0	0	4	5	0	0	0	0	0
018	4	4	2	2	0	2	3	0	0	0	0	0	4	5	0	0	0	0	0
019	5	6	2	1	0	2	0	0	0	0	0	0	4	0	0	0	0	0	0
020	5	5	2	1	0	2	3	0	0	0	0	0	4	5	0	0	0	0	0
021	2	6	2	1	0	2	3	0	0	1	0	0	4	5	0	0	0	0	0
022	1	4	2	1	0	2	3	0	5	1	0	0	4	0	0	0	0	0	0
023	6	6	2	2	0	2	3	0	5	1	0	0	4	0	0	0	0	0	0
024	1	4	2	2	1	2	0	4	0	1	0	0	0	0	0	0	0	0	0
025	6	4	2	2	1	2	0	4	0	1	0	0	0	0	0	0	0	0	0

001 - 027 = Total population of decision-makers.
026 and 027 did not respond.

R (rank): 1 = managing director; 2 = director; 3 = group general manager; 4 = general manager; 5 = factory manager; 6 = senior executive.
Y (years of experience): 1 = 0 - 4; 2 = 5 - 9; 3 = 10 - 14; 4 = 15 - 19; 5 = 20 - 25; 6 = greater than 25.
S (industry sector): 1 = demersal; 2 = pelagic. F (direct financial interest / share holding in own company): 1 = yes; 2 = no.
Other sectors (of the industry in which respondent's company operates): 1 = demersal; 2 = pelagic; 3 = rock lobster; 4 = line fish; 5 = other.

Factory locations (in which respondent's company operates):
1 = Walvis Bay; 2 = Lambert's Bay; 3 = Laaiplek; 4 = St. Helena Bay; 5 = Saldanha Bay; 6 = Cape Town; 7 = Hout Bay; 8 = Gansbaai; 9 = Mossel Bay; 10 = other.

APPENDIX IV B

DATA : VULNERABILITY ANALYSIS : RESPONSES TO QUESTION C 1, QUESTIONNAIRE 1

Strengths:

RESPONDENTS' COMMENTS:

001: Well managed and controlled resource. Well established and reasonably stable domestic market.

002: Good management of the resources.

003: Good sound foundation: financially strong; considerable expertise in catching and processing fish; sound backing.

004: Well equiped (demersal) fleet. Strong marketing department. Well equiped and staffed product development department. Technical expertise in production.

008: Only factory in S.A. able to produce pure white fish meal.

009: Die voedsel mark, hoewel onderhewig aan wisselinge is redelik bestand teen totale insinking; goeie beheer oor visbronne verseker stabiliteit.

010: Diversity of operations in different sectors. Technical expertise. Multipurpose vessels.

011: Development of non-quota species for a growing white and black population.

012: Ons gesofistikeerde bedryf gemeet aan wêreld standaarde.

014: Continued quota rights. Fishing expertise. Production and marketing expertise. Well maintained fixed assets. Solid cash backing. Good management. Proven minimum pelagic and lobster resources.

015: Working within the framework of strict control and monitoring of the resources to avoid overexploitation. Growing demand for food for human consumption. The availability of capital. Resourcefulness in processing and marketing.

016: Lid van die grootste pelagiese visgroep. Die infrastruktering om vis en kreef te hanteer

is goed gevestig. Werknemers en vissermanne met ondervinding en kennis. Kundigheid is beskikbaar.

017: Ability of industry to cooperate on many aspects which affect all its members through the industry associations.

018: Financially sound. Improving quota size. Market availability for products.

019: Past and future research and our research potential. Vested knowledge and experience of South African and international fishing industry.

020: Stable and increasing anchovy resource. Personnel production expertise. Ready market for products. Industry on sound financial footing. Industry well situated geographically to exploit fish resource.

022: The industry has managed to survive an order of magnitude quota cut (Walvis Bay) by increasing efficiency of operation. It is therefore well set to benefit from future growth in quotas which (as a result of strict conservation measures) are a possibility. These benefits can be applied in replacing vessels, plants which are outdated and to prepare for the future.

023: The granting of long-term fishing rights. The existence of a scientifically based controlling system. Well establishing marketing channel.

024: Efficient conservation of stocks.

Weaknesses:

RESPONDENTS' COMMENTS:

001: Vulnerability to exchange rate fluctuations on the cost side; fuel, spares and fluctuations on the sales side for export earnings. Cost of vessel replacement or asset replacement in general. Lack of personnel skills in certain areas.

002: Cost to replace assets e.g. trawlers.

003: Shortages of skilled labour. Trade restrictions.

004: Calibre of trawler crews.

008: Aging equipment.

009: Invloed van onbeheerde kostes. Die bestaande vloot sal vervang moet word teen baie

hoë kostes.

010: Lack of sufficient risk capital.

011: Fuel price. Quotas.

012: Inflasie, ons weer op die uitvoermark moet begin meeding.

013: Sikliese vermindering in visbronne a.g.v. weers omstandighede oor kort of lang termyn.

014: Cost escalations within a fixed cost framework. Old and technologically outdated plant and machinery. Development of markets of fish for third world consumption.

015: Old plant, equipment, vessels which have been heavily written down and require replacement at great cost. Political interference.

016: Bedryf beperk deur kwotas; regeringsdepartemente kan kwotas wysig. visvang bedrywighede is seisonaal. Beperkte hawe diepte en fasiliteite - ook Doringbaai en Hondeklipbaai.

017: Cooperation is threatened by individuals putting their own interests before those of the industry and using political influence to bring about changes which take no account of historical factors.

018: Quota system. Seasonal nature of business. Development of other fish sectors (quota bound also).

019: High degree of interference of the state and too many government departments. Control should be centralised.

020: Severe fluctuations in yearly raw fish quotas. Difficult long-term planning due to delays and uncertainty regarding the fixing of quotas.

021: Quota system and its limitations restricts growth and expansion.

022: The industry is operating with plant and vessels which is technologically out of date. It is faced with increasing demands from labour and other participants in the industry. Costs of production are increasing faster than income, as selling prices of products are adjusted responsibly.

023: Unpredictability of the natural environment. The high cost of improved fishing and processing equipment.

024: Insufficient research. Expanding territorial waters to at least 200 miles and efficient protection against foreign fishing nations.

Threats:

RESPONDENTS' COMMENTS:

001: Sanctions - we are net exporters and a total embargo could precipitate a domestic market collapse. Cyclical price movements on export markets which are beyond our control or influence.

002: Small increases in quotas for bigger companies. Cost of catching the quota i.e. landed price of fish (fuel price / labour costs etc.)

003: Government legislation. Unsecured quotas and changes in procedure. creation of special interest groups. Political pressure.

004: Rapidly spiraling costs of fleet replacement. Arbitrary government action on quota allocations.

008: Declining white fish quotas. Ratio of value of fresh fish to offal. R/$ exchange rate; Export price R945/t, local price R915/t. In the 60s production was 12 000 t/month, now 390 - 250t/m or R90 000 p.a.

009: Politieke onsekerheid in Suidwes.

010: Political and social instability. Possible regulations framed under the draft bill on environmental conservation if promulgated. Fuel costs if sanctions bite deeper.

011: Entry of more participants into a limited fishery.

012: Robbe.

014: Variability of the fish resources. Demands by public sector for direct funds. Difficulty to plan for large changes in the resource (species change).

013: Politieke toestande soos vakbonde. Veranderinge regeringsbeleid. Biokotte van ingevoerde fabriekstoerusting. Te veel rompslomp vanaf owerheidsweë; onoordeelkundige besluitneming deur owerhede weens onkunde oor visbronne. Besoedeling van die see deur olie tenkskepe se stranding. Vervanging van treilers en toerusting se kostes wat steeds eskaleer. Die beskerming van robbe wat onbeheersd aanwas en visbronne uitput.

015: Trade union action. Rates of exchange. Sanctions. Political interference.

016: Verlaging van kwotas. Lugbesoedeling - moontlike beperkings. Die plaas van kwotas op nie-kwota spesies. Sanksies teen uitvoerprodukte. Inflasie en stygende kostes.

017: Interference by politicians and scientists in the day to day running of the industry.

018: Capital costs of fleet replacement. Insufficient fishermen being developed. Average of the fleet 20 years. Pollution.

019: Tonnage taken by birds and seals. The tremendous spiraling costs related to all facets of the industry.

020: Encroachment of residential housing and tourism onto industry locations, places restrictions on industry. Replacement cost of plant. Availability of "qualified" fishermen. Rising costs of processing materials, coal etc.

021: Reduction of quotas and also the reallocation to groups without a capital investment obligation.

022: Major threat could be the obsolescence of major products e.g. fish meal and fish oil (e.g. research into single cell protein manufacture.)

023: International boycots. Abnormal prce rise of production materials. Abnormal price of fuel.

024: Pollitical instability in S W A / Namibia.

Opportunities:

RESPONDENTS' COMMENTS:

001: Utilization of other species e.g. maasbanker: better utilization of catch then improvements in quality yields.

002: Increasing price of red meat and chicken. Awareness of health benefits of eating fish.

003: Expansion world-wide.

004: Recovery of the hake resource. Development of non-quota species fisheries. Aquaculture of high-priced species such as perlemoen, prawns, soles.

008: Enforcement of the Sea Fisheries act regarding offal retention at sea. Better utilization

of white fish for human consumption.

009: Beter benutting van bestaande vissoorte wat gevang word. Die ontginning van nie-kwota spesies soos maasbanker, makriel en rooi-oog.

010: Underutilised species on the west coast - lantern fish; unexploited resource on the south coast - redeye, canning and meal; maasbanker via mid-water trawl techniques.

011: Exploitation of other species.

012: Groter kwota indien die biomassa dit regverdig.

013: Om die huidige visbronne meer direk as eetbare voedselbron beskikbaar te stel.

014: Possibility of government subsidies. Large third world market for inexpensive protein.

015: Better utilization of existing resources. Development of non-quota species.

016: Uitbreiding na nie-kwota spesies (meer as reeds gedoen word). Ontwikkeling van alternatiewe produkte van bestaande vangste. Prosessering van alle afval produkte.

017: To protect the resource and expand product ranges. Improve the quality of products. Invest in new technology. Investment in growth of the aquaculture industry.

018: Value added products from existing raw materials: aqua/mariculture.

019: The greater utilization of non-quota species. All sections of the industry must strive for and take steps for the recovery and maximum utilization of the pilchard resource.

020: New approach to annual quota granting based on scientific and practical knowledge (1987 was an example). Better research into pilchard stocks - increased quota).

021: Greater degree of benefication and extention of product range.

022: Possibility of exploiting other resources e.g. redeye, lantern fish, tuna.

023: Development of a non-quota fishery. Possibility of exports to African countries.

024: Recovery of white fish resources if 200 mile limit is declared and enforced.

APPENDIX IV B

VULNERABILITY ANALYSIS:
Coded responses to question C 1, questionnaire 1.

	Respondents:																								
STRENGTHS:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	No
Good fisheries management	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	0	6
Well equiped and maintained assets	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3
Market for products	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	3
Sound financial base	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	0	5
Technical expertise	0	0	1	1	0	0	0	0	0	1	0	1	0	1	1	1	0	0	0	1	0	1	0	0	0	9
Management skills	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	3
Marketing skills	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	4
Diversification	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cooperative marketing associations	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Geographic location of the industry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Only white fish-meal plant in industry	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Research potential	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
WEAKNESSES																										
Outdated and worn assets	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	1	0	0	0	1	0	0	0	6
Seasonal fluctuations/birds/seals	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	1	1	0	0	0	0	0	0	6
Limited growth in fixed quota framework	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	4
Inadequate long-term planning	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	2
Shortage of skilled labour	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	5
Lack of venture capital	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Inadequate harbour facilities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
THREATS																										
Cost spirals: asset replacement & operating	1	1	0	1	0	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	17
Sanctions: import/export	1	0	1	0	0	0	0	0	0	1	0	0	1	0	1	1	0	0	0	0	0	0	1	0	0	7
Government intervention	0	0	1	0	0	0	0	0	0	1	0	0	1	1	1	0	1	0	1	0	0	0	0	0	0	7
Arbitrary government action re quotas	0	0	1	1	0	0	0	1	0	0	1	0	0	1	0	1	0	1	0	1	1	0	0	0	0	9
New entrants into limited fishery	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
Competition (selling assoc. dissolution)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Trade union action/political pressure	0	0	1	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	5
Political situation in Namibia	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
Foreign vessels	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Pollution	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	2
Obselescence of some products	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	3
Conflict with special interest groups	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	3
Shortage of offal	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
OPPORTUNITIES																										
Non-quota species fisheries	1	0	0	1	0	0	0	0	1	1	1	0	0	0	1	1	0	0	1	0	0	1	1	0	0	10
Better utilization of existing quota	1	0	0	0	0	0	0	1	1	0	0	0	1	0	1	1	1	1	0	0	1	0	0	0	0	9
Development of new markets	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	4
Increased share of food market	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Resource recovery (Pilchard & Hake)	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	1	0	1	0	6
Aqua/mariculture	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	3
Industry subsidy	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1

Code: 1 = issue explicitly mentioned by respondent; 0 = issue not mentioned. No. = total number of times issue mentioned.

APPENDIX IV C

STRATEGIC INVESTMENT PRIORITIES: QUESTIONNAIRE 1.

Question C 2.

	Investment option rating scores.								
	1	2	3	4	5	6	7	8	9
Respondents									
001	1	0	0	1	0	2	1	1	1
002	2	0	1	2	1	2	1	0	1
003	2	1	1	2	1	2	1	2	2
004	1	0	1	2	1	2	1	2	2
005	2	2	2	2	1	2	0	0	2
006	2	1	1	1	1	2	1	0	1
007	2	2	1	1	0	2	0	0	1
008	1	2	1	0	1	1	1	0	0
009	2	2	1	0	2	2	0	0	1
010	2	0	0	1	1	2	2	0	2
011	2	1	1	2	1	1	1	0	1
012	0	1	2	2	2	2	0	0	2
013	1	0	2	2	2	2	0	0	1
014	2	1	1	1	1	2	2	1	2
015	2	2	2	2	2	2	1	0	2
016	2	1	1	2	2	2	1	1	2
017	2	0	2	2	1	2	1	2	1
018	2	1	1	1	1	2	1	1	2
019	2	2	2	2	2	2	2	1	2
020	2	2	1	1	2	2	1	0	1
021	2	2	1	1	1	2	2	0	2
022	2	1	2	2	1	2	0	1	1
023	1	0	1	1	1	2	1	1	1
024	1	2	2	2	1	2	1	2	2
025	2	2	1	2	1	2	1	1	2

026 & 027 did not respond.

Investment Options: 1 = Diversification; 2 = Specialization; 3 = Employee benefits; 4 = Job creation and training; 5 = Pollution control; 6 = Modernization programmes; 7 = Materials (waste) recovery; 8 = Investments unrelated to fishing; 9 = Research and development.

Option rating: 0 = Unlikely; 1 = Likely; 2 = Very likely.

APPENDIX IV C

STRATEGIC INVESTMENT PRIORITIES: QUESTIONNAIRE 1.

Question C 3.

Rank ordered investment options.

Respondents	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
001	6	8	4	9	7	1	5	3	2
002	1	6	4	3	5	7	9	2	8
003	1	6	4	9	2	3	5	7	8
004	6	8	9	4	1	7	5	3	2
005	6	1	2	3	9	5	4	7	8
006	6	1	3	2	5	7	9	4	8
007	6	1	2	4	3	9	5	7	8
008	2	1	6	7	4	9	8	5	3
009	6	1	5	2	9	3	7	4	8
010	6	1	9	7	5	4	3	2	8
011	1	4	6	9	2	3	7	5	8
012	4	3	6	5	9	2	1	7	8
013	6	5	3	4	9	1	2	8	7
014	1	6	9	7	5	8	3	2	4
015	9	4	6	1	2	3	5	7	8
016	1	4	6	9	5	7	8	3	2
017	1	8	6	3	4	5	7	9	2
018	1	6	9	2	7	5	4	3	8
019	1	2	6	9	3	4	5	7	8
020	1	2	6	5	9	3	4	7	8
021	1	2	6	7	9	4	3	5	8
022	1	3	4	6	5	2	8	9	7
023	6	1	4	3	9	7	8	5	2
024	2	4	6	1	8	5	9	7	3
025	6	2	4	1	9	5	3	8	7

026 & 027 did not respond.

Investment Options: 1 = Diversification; 2 = Specialization; 3 = Employee benefits; 4 = Jobcreation and training; 5 = Pollution control; 6 = Modernization programmes; 7 = Materials (waste) recovery; 8 = Investments unrelated to fishing; 9 = Research and development.

APPENDIX IV C

```
NEW:  UNFOLD,STEVPR3.                    DATE 88/04/05. TIME: 15.51.12.

1NIPR  MULLER  UNFOLD V1.1  METRIC MULTIDIMENSIONAL UNFOLDING
OSTEVPR3 INVESTMENT PRIORITIES
0   8  24   2
    0   0   1   0     .000E+00     180     .00
OSCALED  LOG-LIKELIHOOD FOR GENERAL  ALTERNATIVE HYPOTHESIS OF NO
STRUCTURE :     .000
OFUNCTION VALUE UNDER B-T MODEL =-.31749782D+04

 SINGULAR VALUES
   11.76    9.58    7.18    6.75    4.38    3.38    2.83     .00

1INITIAL VALUES - (FIXED VALUES MARKED *)
OEXPONENT A :  4.000000
OMATRIX Y  (STIMULI)
 DI       .000*     .000*
 SP      1.000*     .000*
 EM       .628     1.743
 JO      -.474     2.074
 PO       .450     1.239
 MO      -.020      .868
 MA      -.174      .624
 RE     -1.344      .625
OMATRIX X
  1      -.577     1.265
  2       .038     1.190
  3      -.360      .959
  4      -.606     1.085
  5       .471      .636
  6       .440      .858
  7       .265      .675
  8       .392      .354
  9       .365      .698
 10      -.467      .546
 11      -.378     1.013
 12       .265     1.883
 13       .409     1.654
 14      -.469      .507
 15      -.689     1.123
 16      -.378     1.013
 18      -.255      .417
 19       .118      .329
 20       .473      .469
 21       .343      .349
 22       .178     1.356
 23       .041     1.229
 24       .303      .965
 25       .275      .945
OELAPSED TIME     .57 SECONDS
1           BEHAVIOR UNDER FLETCHER-POWELL ITERATIONS
0  IT TRY       F     MAX X-INC  I
    1  4   .54098791   1.2380  61
    2  2   .40492506    .6350  61
```

★ The unfolding solution of ranked investment options and managers in common joint space is given. The co-ordinates of stimuli (■) and ideal points (●) generated by the unfolding algorithm, as well as the total stress (▲) for this solution are indicated.

3	2	.36440828	.3264	9
4	2	.35298056	.1353	61
5	2	.33962235	.1938	9
6	2	.33082176	.1559	45
7	1	.32429190	.1380	7
8	2	.32037903	.1133	5
9	2	.31779410	.1026	52
10	2	.31627517	.0466	61
11	2	.31454440	.0862	52
12	2	.31317219	.0576	1
13	2	.31122407	.1010	45
14	2	.31026499	.0766	52
15	2	.30918875	.0761	5
16	1	.30829191	.0391	24
17	2	.30787199	.0371	52
18	1	.30735345	.0376	26
19	2	.30663391	.0641	28
20	2	.30628338	.0325	25
21	2	.30583594	.0600	5
22	2	.30519588	.0359	5
23	1	.30492602	.0454	5
24	2	.30436829	.0375	32
25	2	.30391181	.0712	4
26	1	.30321568	.0573	32
27	2	.30254679	.1157	5
28	2	.30225227	.0260	6
29	3	.30095808	.2103	5
30	2	.29968444	.1418	4
31	2	.29916327	.0335	5
32	2	.29849070	.1223	4
33	2	.29782605	.0603	57
34	1	.29725270	.0453	57
35	2	.29687236	.0365	28
36	2	.29650974	.0342	45
37	2	.29610440	.0753	4
38	2	.29575697	.0445	57
39	2	.29552503	.0702	57
40	2	.29517906	.0451	57
41	1	.29482620	.0613	57
42	2	.29451022	.0797	57
43	1	.29424828	.0876	57
44	2	.29404026	.0658	57
45	1	.29378101	.0538	57
46	2	.29366035	.0255	57
47	2	.29351494	.0743	57
48	2	.29338890	.0301	4
49	2	.29329990	.0442	57
50	2	.29316336	.0440	57
51	2	.29309800	.0251	57
52	2	.29299536	.0492	57
53	2	.29294456	.0291	57
54	2	.29284989	.0521	57
55	1	.29277483	.0441	57
56	2	.29273780	.0188	57

57	2	.29269594	.0204	27
58	2	.29267372	.0214	57
59	2	.29266432	.0173	57
60	2	.29265664	.0077	27
61	2	.29264730	.0197	57
62	2	.29263926	.0093	27
63	2	.29261847	.0330	57
64	2	.29261051	.0096	57
65	2	.29259583	.0367	57
66	2	.29259026	.0104	36
67	2	.29258557	.0088	57
68	2	.29258179	.0084	57
69	2	.29257829	.0183	57
70	2	.29257070	.0149	36
71	2	.29256776	.0070	5
72	2	.29256256	.0256	57
73	2	.29255846	.0092	28
74	2	.29255293	.0109	57
75	2	.29254890	.0191	57
76	1	.29254242	.0224	57
77	2	.29253866	.0127	57
78	2	.29253420	.0154	35
79	2	.29253001	.0248	58
80	2	.29252706	.0160	58
81	2	.29252207	.0219	58
82	2	.29251958	.0125	57
83	2	.29251379	.0150	35
84	2	.29250983	.0347	58
85	2	.29250415	.0210	58
86	2	.29249825	.0192	58
87	2	.29249591	.0159	57
88	2	.29249237	.0363	57
89	2	.29248941	.0110	58
90	2	.29248730	.0043	27
91	1	.29248528	.0050	35
92	2	.29248418	.0114	58
93	1	.29248349	.0114	58
94	2	.29248279	.0045	35
95	2	.29248238	.0116	58
96	2	.29248153	.0062	35
97	2	.29248107	.0032	13
98	2	.29248071	.0028	9
99	2	.29248038	.0061	58
100	2	.29248012	.0031	57
101	2	.29247993	.0022	57

OAPPROX. STANDARD ERRORS OF ESTIMATES

1	.390
2	.153
3	.252
4	.262
5	.390
6	.168
7	.055
8	.054

```
 9       .317
10       .365
11       .131
12       .283
13       .319
14       .262
15       .152
16       .111
17       .154
18       .140
19       .182
20       .239
21       .083
22       .110
23       .095
24       .129
25       .097
26       .117
27       .244
28       .355
29       .073
30       .122
31       .103
32       .152
33       .215
34       .189
35       .568
36       .259
37       .161
38       .102
39       .140
40       .198
41       .239
42       .262
43       .200
44       .197
45       .188
46       .170
47       .067
48       .133
49       .076
50       .169
51       .094
52       .214
53       .188
54       .098
55       .163
56       .146
57       .973
58       .965
59       .092
60       .152
61       .099
IND = 0
```

OELAPSED TIME 14.48 SECONDS

1FINAL VALUES - (FIXED VALUES MARKED *)

```
 G     -.000010    .000046    .000009    .000036   -.000062    .000056
        .000018    .000007   -.000029   -.000020    .000020    .000053
 G      .000022   -.000032    .000007   -.000032   -.000098    .000001
        .000057    .000001   -.000026   -.000034   -.000040    .000037
 G     -.000009   -.000010    .000027    .000008    .000036    .000030
       -.000020    .000015    .000021   -.000031   -.000004   -.000012
 G      .000021   -.000023   -.000007   -.000055   -.000035    .000059
        .000061   -.000011   -.000007    .000037    .000017    .000036
 G      .000022   -.000008    .000020    .000001   -.000059    .000024
       -.000041   -.000010    .000052    .000018   -.000039   -.000020
 G     -.000017
```

0 95. INVERSIONS IN 672 COMPARISONS.▲STRESS = .141

```
   STRESS PER STIMULUS :    .11   .12   .20   .18   .17   .11   .10   .15
 SUBJECTS    .14   .11   .07   .11   .07   .18   .11   .11   .14   .14   .21
             .11   .14   .18   .21   .18   .07   .11   .07   .07   .18   .07
             .32   .29
```

OEXPONENT A : 3.003340

■MATRIX Y (STIMULI)

```
 DI       .000*     .000*
 SP      1.000*     .000*
 EM       .073     1.383
 JO      -.595      .965
 PO       .287     1.410
 MO      -.060      .087
 MA      -.670     -.732
 RE      -.608     -.225
```

●MATRIX X

```
  1      -.654      .373
  2      -.072      .578
  3       .022      .368
  4      -.555      .306
  5       .360      .329
  6       .356      .455
  7       .259      .354
  8       .698     -.463
  9       .324      .371
 10      -.276      .056
 11      -.357      .440
 12      -.419      .989
 13       .091      .748
 14      -.096     -.097
 15      -.609      .394
 16      -.416      .448
 18       .140     -.173
 19       .476      .128
 20       .506      .285
 21       .444     -.465
```

```
 22       .069      .696
 23      -.226      .462
 24      2.294     -.363
 25       .470      .342
1RANKED STIMULI IN FINAL SPACE
  1       4   8   6   1   7   3   5   2
  2       6   1   4   3   5   8   2   7
  3       6   1   4   8   3   2   5   7
  4       8   6   1   4   7   3   5   2
  5       6   1   2   5   3   8   4   7
  6       6   1   2   5   3   4   8   7
  7       6   1   2   8   3   4   5   7
  8       2   1   6   8   7   5   4   3
  9       6   1   2   5   3   4   8   7
 10       6   1   8   7   4   2   3   5
 11       6   1   4   8   3   5   7   2
 12       4   3   5   6   1   8   2   7
 13       3   6   5   4   1   2   8   7
 14       1   6   8   7   2   4   3   5
 15       4   8   6   1   7   3   5   2
 16       6   4   1   8   3   5   7   2
 18       1   6   8   2   7   4   3   5
 19       1   6   2   8   5   3   4   7
 20       2   1   6   5   3   8   4   7
 21       1   2   6   8   7   4   5   3
 22       6   3   1   4   5   8   2   7
 23       6   1   4   8   3   5   7   2
 24       2   1   6   5   3   8   7   4
 25       1   6   2   5   3   8   4   7
OASYMPTOTIC LIKLIHOOD-RATIO TEST OF GOODNESS OF FIT
OCHI-SQUARE = 393.09  D.F. =  611   P = 1.000
1FINAL COMMON JOINT SPACE
OHOR  1VERT  2TITLE STEVPR3  INVESTMENT PRIORITIES
 WIDTH=  3.05317  HEIGHT= 2.20604NO=32
OELAPSED TIME 14.67 SECONDS
    14.677 CP SECONDS EXECUTION TIME.
```

APPENDIX IV D

RESPONSES TO CONCLUSION III: QUESTIONNAIRE 2.

Conclusion III:

If the fish processing industry is able to replace its aging assets and further improve its utilization of raw material, the need for major additional expenditure on waste recovery and pollution control can be expected to decrease accordingly.

Respondents	Conclusion III.
001 D	4
002 D	1
003 D	2
004 D	4
005 D	2
006 D	2
007 D	2
008 D	2
009 P	2
010 P	1
011 D	2
012 P	4
013 P	1
014 P	2
015 P	3
016 P	3
017 P	2
018 P	3
019 P	2
020 P	2
021 P	4
022 P	1

023 - 027 did not respond.

D = demersal sector; P = pelagic sector.

1 = Strongly agree; 2 = Agree; 3 = Uncertain; 4 = Disagree; 5 = Strongly disagree. Respondents 023 - 027 assumed to agree fully with the above conclusion (see Appendix III B).

APPENDIX IV E

FACTORS INFLUENCING WASTE CONTROL INVESTMENTS: QUESTIONNAIRE 1.

Question A 1:

	Decision factor rating scores.										
	1	2	3	4	5	6	7	8	9	10	11
Respondents											
001	2	2	2	2	1	1	1	1	0	0	0
002	2	0	0	2	0	1	2	0	0	0	0
003	2	2	2	1	2	1	2	1	1	0	0
004	2	0	0	2	2	2	1	0	0	0	1
005	2	0	0	2	0	2	0	0	0	0	1
006	2	1	0	1	0	0	1	0	0	0	2
007	2	1	0	1	2	2	1	0	0	0	2
008	0	2	2	2	1	2	0	0	1	0	0
009	1	2	2	0	2	1	1	0	0	0	1
010	1	2	2	1	2	1	1	0	0	0	1
011	1	1	1	2	1	2	2	0	0	0	0
012	0	1	1	1	1	1	2	0	0	0	0
013	0	0	2	2	2	2	2	1	0	0	1
014	0	1	2	2	2	2	2	1	1	0	1
015	1	1	1	2	1	1	2	1	1	0	2
016	1	2	1	2	2	2	2	1	1	1	2
017	2	2	2	2	2	1	1	1	2	0	0
018	1	2	2	1	2	2	2	2	1	0	1
019	1	1	1	2	2	2	2	0	0	1	1
020	2	2	2	2	1	1	2	0	1	0	1
021	0	2	2	1	2	1	1	1	1	0	1
022	1	2	1	2	2	2	2	1	1	0	0
023	1	2	2	1	2	2	2	0	0	2	0
024	1	2	1	2	2	2	1	0	1	0	0
025	1	2	2	1	2	2	1	0	1	0	0

026 & 027 did not respond.

Pollution Control Investment Decision Factors: 1 = Anti-pollution regulations; 2 = Quota size; 3 = Return on investment; 4 = Prevention of pollution; 5 = Profitability of the company; 6 = Cost of the system; 7 = Company image; 8 = Competitive advantage; 9 = Existing financial incentives; 10 = Pass on costs; 11 = Share-holders' interests.

Investment Decision Factor Rating: 0 = Unimportant; 1 = Important; 2 = Very important.

APPENDIX IV E

FACTORS INFLUENCING WASTE CONTROL INVESTMENTS: QUESTIONNAIRE 1.

Question A 2:

Rank ordered decision factors.

Respondents	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th
001	2	4	3	1	6	8	7	5	9	11	10
002	1	4	7	6	2	3	5	8	9	10	11
003	1	5	2	6	7	3	4	11	10	8	9
004	1	6	4	5	7	11	3	9	8	10	2
005	1	4	6	11	2	3	5	7	8	9	10
006	1	4	7	11	2	3	6	8	9	5	10
007	1	5	6	11	2	4	7	3	8	9	10
008	6	3	2	4	5	9	11	8	1	7	10
009	3	5	2	7	6	1	11	4	8	9	10
010	3	5	2	6	4	1	11	7	8	9	10
011	6	5	4	3	7	1	2	10	9	8	11
012	7	6	4	3	5	2	10	8	9	1	11
013	6	5	4	3	7	8	11	1	2	9	10
014	3	5	6	7	4	2	1	9	8	11	10
015	4	7	11	2	1	5	6	8	9	3	10
016	4	6	7	11	2	5	3	10	1	9	8
017	3	5	4	1	9	2	6	7	8	11	10
018	3	8	7	6	2	5	1	4	11	9	10
019	1	5	3	4	6	2	7	11	10	9	8
020	1	4	7	2	3	5	6	11	9	10	8
021	2	3	5	6	7	11	4	8	9	1	10
022	5	4	6	7	2	3	8	9	1	10	11
023	3	5	2	6	7	10	1	9	4	8	11
024	2	5	6	4	1	3	9	7	8	10	11
025	6	5	2	3	4	1	7	9	8	10	11

026 & 027 did not respond.

Pollution Control Investment Decision Factors: 1 = Anti-pollution regulations; 2 = Quota size; 3 = Return on investment; 4 = Prevention of pollution; 5 = Profitability of the company; 6 = Cost of the system; 7 = Company image; 8 = Competitive advantage; 9 = Existing financial incentives; 10 = Pass on costs; 11 = Share-holders' interests.

APPENDIX IV E

```
UNFOLD,STEVPR1

1NIPR  MULLER  UNFOLD V1.1  METRIC MULTIDIMENSIONAL UNFOLDING
         DATE:  89/03/08.  TIME: 17.47.35.
OSTEVEP1  WASTE CONTROL
0  11  25   2
    0   0   1   0   .000E+00    0     .00
OSCALED LOG-LIKELIHOOD  FOR GENERAL ALTERNATIVE HYPOTHESIS  OF NO
STRUCTURE : .000
OFUNCTION VALUE UNDER B-T MODEL =-.60824656D+04

 SINGULAR VALUES
  15.25  10.83  9.83  8.37  7.19  6.56  5.20  3.06  .00  .00  .00

1INITIAL VALUES - (FIXED VALUES MARKED *)
OEXPONENT A :  4.000000
OMATRIX Y  (STIMULI)
 AP       .000*     .000*
 QS      1.000*     .000*
 RI      1.339      .075
 PP       .412      .604
 PC       .914     -.400
 CS       .965      .166
 CI       .839      .858
 CA       .861      .322
 FA       .765      .227
 PO       .765      .227
 SH       .552      .416
OMATRIX X
  1       .689      .216
  2       .490      .443
  3       .591     -.096
  4       .437      .094
  5       .409      .295
  6       .406      .490
  7       .505     -.003
  8       .957      .280
  9      1.032      .174
 10      1.034      .006
 11       .870      .158
 12       .911      .585
 13       .870      .158
 14      1.030      .220
 15       .703      .606
 16       .716      .617
 17       .680      .075
 18      1.051      .447
 19       .575      .028
 20       .492      .403
 21      1.026      .014
 22       .768      .323
 23      1.034      .006
 24       .808      .094
 25       .998      .009
```

★ The presentation of the unfolding solution has been abbreviated to exclude the Fletcher-Powell iterations. Only the co-ordinates of the stimuli (■) and ideal points (●) in common joint space are given. The total stress value (▲) for this solution is also given.

```
 G    .000000   .000000  -.000003  .000000  .000000  .000000
     -.000001  -.000002   .000000
0 197. INVERSIONS IN  1375 COMPARISONS.▲STRESS = .143
  STRESS PER STIMULUS : .12  .18  .11  .13  .17  .13  .13  .16
    .17  .11  .17
 SUBJECTS      .18  .15  .13  .13  .15  .15  .18  .24  .13  .07
    .11  .11  .13  .07  .15  .16  .20  .20  .18  .16  .15  .09
    .16  .15  .07
0EXPONENT A :  2.560085
■MATRIX Y  (STIMULI)
 AP       .000*     .000*
 QS      1.000*     .000*
 RI      1.280      .470
 PP       .461      .918
 PC      1.002      .501
 CS       .848      .609
 CI       .594     1.292
 CA      1.099     2.167
 FA       .703     2.316
 PO       .437     2.624
 SH      -.426     1.693
●MATRIX X
  1      1.628    -1.854
  2       .138     .439
  3       .352    -.075
  4      -.138     .589
  5      -.295     .309
  6      -.428     .578
  7      -.483    -.092
  8      2.674     .042
  9      1.560     .321
 10      1.180     .298
 11       .799     .707
 12       .932    1.089
 13       .910     .881
 14      1.218     .736
 15      -.057     .969
 16       .237     .973
 17      3.280    -1.332
 18      2.093    1.091
 19       .248     .190
 20      -.062     .356
 21      1.921     .077
 22       .936     .952
 23      1.940     .299
 24       .701     .152
 25       .795     .377
1RANKED STIMULI IN FINAL SPACE
  1      2   3   5   1   6   4   7   8  11   9  10
  2      1   4   6   5   7   2   3  11   9   8  10
  3      1   2   6   5   4   3   7  11   8   9  10
  4      1   4   6   7  11   5   2   3   9   8  10
  5      1   4   6   5   7   2  11   3   9   8  10
  6      1   4  11   7   6   5   2   3   9   8  10
```

APPENDIX IV F

OPINIONS ABOUT ASPECTS OF POLLUTION CONTROL: QUESTIONNAIRE 1.

	Questions:					
	E 4	E 6	E 7	E 9	F1	
					C E	O E
Respondents						
001	2	4	2	2	1	1
002	4	2	4	5	1	1
003	3	4	3	2	1	1
004	2	4	4	3	1	1
005	2	4	4	2	1	1
006	2	4	4	3	1	1
007	4	3	4	2	1	1
008	3	3	1	3	1	1
009	4	3	2	3	1	6
010	2	2	1	3	1	2
011	4	2	4	2	1	1
012	5	2	4	4	2	2
013	2	2	2	4	3	2
014	2	2	2	4	2	1
015	4	4	4	3	1	1
016	4	2	3	4	2	1
017	1	4	5	4	1	1
018	3	2	3	2	1	1
019	2	2	2	4	6	6
020	3	2	3	3	1	1
021	4	1	2	3	6	6
022	5	1	2	3	3	2
023	3	2	4	4	2	1
024	2	4	1	4	1	6
025	2	4	2	4	1	6

026 & 027 did not respond.

Question Content: E 4 = Expense justifiable; E 6 = Increases costs; E 7 = Quota size influence; E 9 = Untreated waste harmful.
Question Coding: 1 = Strongly agree; 2 = Agree; 3 = Uncertain; 4 = Disagree; 5 = Strongly disagree.

Question F 1, Pollution Control Expenditure: C E = Annual capital expenditure; O E = Annual operating expenditure.
Question Coding: 1 = 0 - 4%; 2 = 5 - 9%; 3 = 10 - 14%; 4 = 15 - 19%; 5 = greater than 20%; 6 = can not be estimated.

APPENDIX V

APPENDIX V A

ASSESSMENT OF EXISTING REGULATIONS: QUESTIONNAIRE 1.

Question D 1.
Regulation characteristics.

Respondents	A	B	C	D	E	F	G	H
001	0	4	0	0	0	2	2	1
002	3	3	4	3	3	3	3	2
003	3	4	3	4	2	2	2	2
004	3	3	3	3	3	3	3	3
005	1	2	0	1	1	1	1	1
006	1	2	2	1	2	1	1	1
007	2	3	2	2	2	1	1	2
008	3	3	0	0	0	3	0	1
009	3	3	3	3	2	2	2	2
010	3	3	3	4	2	2	2	1
011	3	3	3	3	3	3	2	2
012	3	3	3	4	3	3	3	1
013	4	3	3	3	3	2	2	2
014	3	3	3	4	4	3	2	2
015	3	3	3	3	4	3	3	3
016	3	3	3	3	3	4	3	2
017	0	0	0	0	0	0	0	0
018	2	3	3	3	3	2	3	2
019	3	3	3	4	4	2	3	2
020	3	3	3	3	3	2	2	1
021	3	3	3	3	3	3	3	2
022	2	2	3	3	3	2	2	2
023	2	2	3	4	4	3	3	1
024	3	3	3	3	5	1	1	1
025	3	3	3	3	4	1	2	1

026 & 027 did not respond.

Characteristics Of Existing Regulations: A = Realism; B = Timing; C = Fairness; D = Penalties; E = Flexibility; F = Number; G = Complexity; H = Opportunity for representation.

Coding: 1 - 2 = Unfavourable; 3 = Adequate/Neutral; 4 - 5 = Favourable; 0 = Non-response.

APPENDIX V B

RESPONSES TO CONCLUSION I: QUESTIONNAIRE 2.

Conclusion I:

As the industry has more information than the government about the costs and benefits of various pollution control systems they should be consulted in the search for optimal and efficient solutions.

Respondents	Conclusion I.
001 D	2
002 D	2
003 D	2
004 D	2
005 D	2
006 D	2
007 D	1
008 D	2
009 P	2
010 P	1
011 D	2
012 P	1
013 P	1
014 P	1
015 P	2
016 P	1
017 P	1
018 P	1
019 P	1
020 P	2
021 P	1
022 P	2

023 - 027 did not respond.

D = demersal sector; P = pelagic sector.

1 = Strongly agree; 2 = Agree; 3 = Uncertain; 4 = Disagree; 5 = Strongly disagree. Respondents 023 - 027 assumed to agree fully with the above conclusion (see Appendix III B).

APPENDIX V C

OPINIONS ABOUT ASPECTS OF POLLUTION CONTROL: QUESTIONNAIRE 1.

	Questions:				
	E 1	E 2	E 3	E 5	E 8
Respondents					
001	4	3	5	2	2
002	5	3	4	2	5
003	4	2	5	2	2
004	4	3	3	3	3
005	4	4	2	2	3
006	4	4	3	2	2
007	3	3	2	2	2
008	4	2	1	1	2
009	4	4	1	2	3
010	5	4	4	1	4
011	4	2	2	2	3
012	2	3	2	1	2
013	5	4	2	1	4
014	4	4	1	2	4
015	2	3	4	2	2
016	4	2	4	2	3
017	5	3	5	1	2
018	3	4	4	2	2
019	3	3	1	1	2
020	1	2	2	3	3
021	2	2	4	1	4
022	5	4	1	4	2
023	4	2	1	2	5
024	2	2	1	1	1
025	2	2	1	1	2

026 & 027 did not respond.

Question Content: E 1 = Taxpayer should pay; E 2 = Problem with application of the law; E 3 = Each factory should be treated on case-by-case basis; E 5 = Government negotiates rather than prosecute; E 8 = Waste discharge should remain an offence.
Question Coding: 1 = Strongly agree; 2 = Agree; 3 = Uncertain; 4 = Disagree; 5 = Strongly disagree.

APPENDIX V D

POLLUTION CONTROL POLICY PREFERENCE: QUESTIONNAIRE 1.

Question B 1.

	Policy option rating scores.													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Respondents														
001	0	2	0	2	1	0	0	2	0	0	0	0	0	0
002	1	2	0	2	2	0	0	2	2	2	2	1	0	1
003	0	2	0	1	2	0	0	0	2	0	0	0	0	0
004	1	2	0	2	0	1	0	2	2	2	2	0	0	0
005	0	2	0	0	0	0	0	0	0	0	0	0	0	0
006	1	2	1	2	0	0	0	1	0	1	2	0	0	0
007	1	1	0	2	1	0	0	1	0	2	2	0	0	0
008	0	0	0	2	1	1	0	0	0	2	2	0	0	2
009	0	2	0	2	2	0	0	0	1	2	2	1	0	0
010	0	2	1	0	1	0	0	1	1	2	2	1	0	0
011	1	2	0	2	2	1	0	0	2	2	2	2	0	2
012	2	2	0	2	2	0	0	0	2	2	2	0	0	0
013	0	2	0	2	0	1	0	2	0	2	2	0	0	0
014	0	2	0	2	1	0	1	2	2	2	2	1	0	0
015	0	2	0	2	2	0	0	0	2	2	2	2	0	0
016	1	2	0	2	2	2	0	0	1	2	2	0	0	0
017	0	2	0	2	2	0	0	0	2	2	2	1	1	0
018	1	2	0	2	1	2	0	1	0	2	2	1	0	0
019	0	0	2	2	2	2	0	0	2	2	2	0	0	0
020	1	1	0	0	0	0	0	1	1	2	2	2	0	0
021	1	2	0	2	2	1	0	0	1	2	2	1	0	1
022	2	2	0	2	0	1	0	0	0	2	2	0	0	0
023	0	0	2	2	1	0	0	0	0	2	2	1	0	0
024	0	0	0	2	2	0	0	0	0	2	2	2	0	0
025	0	2	0	2	2	0	0	0	0	2	2	2	0	0

026 & 027 did not respond.

Pollution Control Policy Options: 1 = Equipment specification permit; 2 = Quality criteria permit; 3 = Private law remedy; 4 = Tax incentive; 5 = Prohibitory legislation; 6 = Compulsory insurance; 7 = Input surcharge; 8 = Emission tax; 9 = Non-compliance penalty; 10 =Anti-pollution equipment subsidy; 11 = Subsidy for in-plant modifications; 12 = Expropriation of obsolete equipment; 13 = Output tax; 14 = Pollution rights.

Policy option preference rating: 0 = No; 1 = Uncertain; 2 = Yes.

APPENDIX V D

POLLUTION CONTROL POLICY PREFERENCE: QUESTIONNAIRE 1.

Question B 2.

Rank ordered policy options.

Resp.	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th
001	8	2	4	9	5	6	1	3	10	11	12	14	13	7
002	11	10	8	9	2	4	5	1	12	14	3	6	7	13
003	2	9	5	10	8	11	7	4	1	3	6	12	13	14
004	10	11	4	2	8	9	1	6	5	12	14	7	3	13
005	2	3	4	8	10	11	1	12	5	6	7	14	13	9
006	2	4	11	10	8	5	9	1	3	6	7	12	13	14
007	4	10	11	2	1	8	5	3	12	6	7	9	13	14
008	4	10	11	5	6	2	7	3	1	9	12	8	13	14
009	4	11	5	2	10	12	9	1	8	7	14	13	3	6
010	2	10	11	9	8	5	3	12	4	1	6	7	13	14
011	10	11	12	4	5	1	2	9	6	13	14	8	7	3
012	4	10	5	2	9	1	11	3	6	7	13	8	12	14
013	11	10	4	8	2	6	1	14	5	7	9	12	3	13
014	2	4	10	9	11	8	12	13	14	1	3	5	7	6
015	4	10	11	5	2	12	9	3	8	1	7	6	13	14
016	4	10	11	5	2	9	8	6	1	3	12	14	7	13
017	4	2	5	9	10	11	12	8	1	13	14	3	6	7
018	4	10	11	2	6	12	1	5	8	9	7	13	14	3
019	10	1	4	6	1	2	5	12	7	9	8	3	14	13
020	10	11	12	8	9	1	2	4	6	3	5	7	13	14
021	2	4	5	10	11	1	6	9	12	14	3	7	8	13
022	10	11	4	2	1	6	8	3	5	14	7	9	12	13
023	10	11	4	3	5	12	2	1	6	7	8	9	14	13
024	10	11	12	4	5	1	2	3	9	14	8	7	13	6
025	10	11	4	2	5	12	1	9	8	6	7	3	14	13

026 & 027 did not respond.

Pollution Control Policy Options: 1 = Equipment specification permit; 2 = Quality criteria permit; 3 = Private law remedy; 4 = Tax incentive; 5 = Prohibitory legislation; 6 = Compulsory insurance; 7 = Input surcharge; 8 = Emission tax; 9 = Non-compliance penalty; 10 = Anti-pollution equipment subsidy; 11 = Subsidy for in-plant modifications; 12 = Expropriation of obsolete equipment; 13 = Output tax; 14 = Pollution rights.

APPENDIX V D

```
1NIPR  MULLER  UNFOLD V1.1  METRIC MULTIDIMENSIONAL UNFOLDING
          DATE:  88/03/31.  TIME: 12.37.59.
OSTEVPR2  POLLUTION CONTROL
0  14  25   2
    0   0   1   0   .000E+00    0    .00
OSCALED LOG-LIKELIHOOD FOR GENERAL  ALTERNATIVE HYPOTHESIS OF  NO
STRUCTURE : .000
OFUNCTION VALUE UNDER B-T MODEL =-.94586731D+04
 SINGULAR VALUES
   12.31 10.44  8.68  6.12  5.59  4.58  4.39  3.38  2.89  2.22
     .00   .00   .00   .00
1INITIAL VALUES - (FIXED VALUES MARKED *)
OEXPONENT A :  4.000000
OMATRIX Y  (STIMULI)
 EP      .000*    .000*
 QP     1.000*    .000*
 LR      .237     .011
 TI      .118     .837
 LP      .511     .735
 CI     -.036     .077
 IS      .179    -.011
 ET      .569    -.822
 NP      .829    -.457
 AS     -.254    -.075
 SM     -.669    -.217
 EO     -.134    -.207
 OT      .197    -.011
 PR      .197    -.011
OMATRIX X
  1      .889    -.111
  2      .240    -.667
  3      .820    -.259
  4      .099    -.198
  5      .554    -.111
  6      .244    -.147
  7      .024     .070
  8     -.100     .296
  9      .199     .324
 10      .385    -.576
 11     -.208     .071
 12      .577     .307
 13      .063    -.245
 14      .384    -.053
 15      .133     .294
 16      .133     .294
 17      .696     .303
 18      .017     .088
 19     -.294     .000
 20     -.065    -.702
 21      .346     .321
 22     -.017    -.003
 23     -.094     .177
 24     -.208     .071
 25      .111     .188
```

★The presentation of the unfolding solution has been abbreviated to exclude the Fletcher-Powell iterations. Only the co-ordinates of the stimuli (■) and ideal points (●) in common joint space are given. The total stress value (▲) for this solution is also given.

```
 G      .000017    .000041   -.000003   -.000003    .000033    .000029
       -.000010    .000020   -.000088    .000009   -.000030   -.000004
 G      .000007   -.000026    .000010
0 302 INVERSIONS IN 2275 COMPARISONS.▲STRESS =      .133
  STRESS PER STIMULUS :    .13  .10  .23  .08  .14  .19  .16  .12
       .14  .06  .06  .21  .10  .16
 SUBJECTS  .22  .05  .15  .08  .24  .09  .13  .12  .14  .10  .20
       .14  .18  .20  .10  .07  .11  .13   .10  .16  .12  .15  .14
       .15  .03
0EXPONENT A :  2.450630
■MATRIX Y  (STIMULI)
 EP       .000*     .000*
 QP      1.000*     .000*
 LR      -.200      .262
 TI       .710     -.162
 LP       .886     -.456
 CI      -.115     -.256
 IS      -.210     -.543
 ET      1.035      .572
 NP      1.282     -.097
 AS       .548      .070
 SM       .523      .128
 EO      -.070     -.001
 OT       .541    -1.319
 PR      -.471     -.244
●MATRIX X
  1      1.725      .776
  2       .761      .321
  3      1.152      .049
  4       .706      .153
  5       .404      .935
  6       .842      .086
  7       .605     -.056
  8       .534     -.239
  9       .716     -.194
 10       .881      .227
 11       .485     -.088
 12       .707     -.258
 13       .603      .216
 14       .908      .133
 15       .663     -.082
 16       .703     -.054
 17       .899     -.184
 18       .551     -.114
 19       .467     -.085
 20       .541      .442
 21       .600     -.294
 22       .541      .089
 23       .473     -.008
 24       .489      .041
 25       .611      .007
1RANKED STIMULI IN FINAL SPACE
  1      8   9   2  11  10   4   5   1  12   3   6   7  13  14
  2     11  10   8   2   4   9   5   1  12   3   6   7  14  13
```

APPENDIX V E

RESPONSES TO CONCLUSION II: QUESTIONNAIRE 2.

Conclusion II:

Should financial assistance not be available for pollution control expenditures, it would appear that the industry would be satisfied with the existing permit system which allows the discharge of effluents of a prescribed quality, while leaving the means of achieving the quality standard upto the individual company so that a least cost solution can be found.

Respondents	Conclusion II.
001 D	2
002 D	1
003 D	2
004 D	2
005 D	2
006 D	2
007 D	2
008 D	2
009 P	2
010 P	2
011 D	2
012 P	2
013 P	2
014 P	1
015 P	2
016 P	2
017 P	2
018 P	1
019 P	1
020 P	2
021 P	1
022 P	1

023 - 027 did not respond.

D = demersal sector; P = pelagic sector.

1 = Strongly agree; 2 = Agree; 3 = Uncertain; 4 = Disagree; 5 = Strongly disagree. Respondents 023 - 027 assumed to agree fully with above conclusion (see Appendix III B).

APPENDIX VI

APPENDIX VI A

ADDITIONAL COMMENTS ON THE IMPACT OF POLLUTION CONTROL

REGULATIONS: QUESTIONNAIRE 1

Although an "Other: please specify" category was provided, none of the respondents made use of it indicating that the choices presented in each section were representative of the major issues involved.

RESPONDENTS' COMMENTS:

001: Question E.1.: Other than tax allowances. One would hope that any controls or measures that are legislated are as a result of a fully proven need i.e. backed by hard scientific fact. Secondly one hopes that before submissions, the long term interests of the country as a whole be considered in the event of a conflict situation.

009: Question A.2.: As daar geen finansiële voordeel in besoedelingsbeheer b.v. ontreuker dan 1) G A D B K F E I J C H, as daar is voordele in besoedelingsbheer b.v. herwinning van olie en vaste stowwe uit afloopwater dan 2) C E B G F A K D H I J.

010: The plethora of different government departments involved greates a considerable amount of unproductive work for some senior personnel.

011: Question A.1.L: Most of our catch processing is done at sea and not on land. Our land based processing is very limited at this stage and we can forsee more attention being given to the recovery of offal as this increases.

012: Waterbesoedeling kan verdelik fyn gedefinieer word, dis sigbaar en

die gevolge tasbaar. Lugbesoedeling sal met omsigtigheid moet gedefinieer word. Met 1 000 neuse rondom 'n visfabriek kan dit gebeur dat een neus die hele amptenary laat bontspring terwyl die reuk die ander 999 glad nie hinder nie.

013: Question B.1.E: 'n Persoon is onskuldig totdat hy skuldig bewys word.

Question C.2.G: Tans word alle moontlike bruikbare materiaal herwin.

Questions E.9. & E.8.: Onbehandelde vis afval en afloopwater op 'n beperkte skaal rig geen betekenisvolle skade aan mariene omgewing maar wel behandelde afval.

014: Fish meal and fish oil production is becoming more expensive and could be uneconomical within ten years at the low levels of normal quotas. Pollution control investments could hasten the problems of the purse seine/fish meal industry.

019: Question E.9.: "Untreated effluent can result in harm". It depends to a very great extent on the geographical position of the factory concerned. Daar word te groot 'n bohaai deur die publiek en die media oor lugbesoedeling gemaak. Die reuk van vars vis wat verwerk word is selfs vir sommige mense onaanvaarbaar. Wanneer na onbehandelde afloopwater verwys word moet in gedagte gehou word dat fabrieke met inmakerye enorme hoeveelhede water gebruik word as vervoermedia.

022: The industry has over the years spent hundreds of thousands of rand in improvements to pollution control. Initially in those areas providing an economic return i.e. stick water plants. It has invested also in non-economic scrubbing towers to reduce the levels of air pollution, and more recently in "scum" tanks to remove the free oil and fine protenacious material from offloading water. Coversion to other improved types of air pollution control must go hand in hand in changes in marketing of product where we can negotiate improved price levels for example low temperature meals (where these can offset the tremendous expense of such equipment).

APPENDIX VI B

COMMENTS ON SUMMARY REPORT AND QUESTIONNAIRE 2

NOTE: Sections of the second questionnaire referred to by respondents are placed in quotation marks. These are followed by the comments of respondents

RESPONDENTS' COMMENTS:

001: Decisions to invest "are characterised by a high degree of uncertainty" - We do not experience uncertainty. "Decisions are often made on the basis of incomplete and sometimes conflicting information" - Not so

"Decisions are based on financial criteria such as ROI" only some of the time usually in the negative sense e.g. saving of financial penalties.

"Demersal sector were uncertain whether pollution control had been economically justifiable" - (again in terms of) saving of financial penalties.

"Discharge of untreated wastes should remain a criminal offence" - selected untreated wastes.

"Government would negotiate rather than take polluters to court" - should negotiate.

"The allowance system should be extended" - the tax payer should not have to pay for the equipment. "Allowances could be used to stimulate investment in new (and usually cleaner) production technology as current equipment is currently outdated and heavily depreciated" - we do not agree.

"The industry would like to see pollution control instruments based on positive financial incentives such as subsidies and allowances" - we do not agree with subsidies. Conclusion: "should financial assistance not be available for pollution control expenditures" - (financial assistance crossed out by respondent), permits for a prescribed quality agreed with; - If standards not met then graded penalties as to apply in the case of current effluent formulae.

"Operation of foreign vessels" - not that important.

Company image does not appear to be a major factor - The industry as a whole tends to take the blame.

Conclusion III: "... decreased need for *major additional expenditure*" - rather an increase in expenditure can be expected in view of greater volumes as improved utilization refered to.

003: "Demersal sector feels that untreated wastes could cause environmental harm" - pelagic waste far greater than demersal.

"Allowances should be used to stimulate investment" - Allowances create all types of schemes to increase the costs. Not in favour.

004: "Uncertainty in decision making" Agree in general; as far as the demersal sector is concerned there is not usually a high degree of uncertainty.

"It appears that decisions to invest in waste control are based on financial criteria" - such decisions can often be forced by the local authority.

Conclusion III: "Additional expenditure not required on pollution control ... better utilization of raw material" - Non sequitor.

011: "No financial incentives at present ... Allowance system should be extended" - This is contradictory. It was previously stated that the tax payer should not fund pollution control in a particular company. We agree with this (Respondent under the impression that pollution control equipment qualifies for tax allowance.)

013: "Additional comments" - Permit conditions state no discolouration or foaming of sea water must occur but these changes occur naturally without any effluent being discharged into the sea. How do we distinguish between natural foaming and discolouration to that which is caused by effluent discharge?

014: "Decisions to invest in waste control based on ROI" - taking all other factors (e.g. social inputs) into account; the possibility of the authorities penalising business for not conforming.

"The consumer pays not the tax payer" - unless innovations covers part of the costs.

"Expenditure economically justifiable" - only in the pelagic sector" - In certain cases it could be argued that investments are economically justifiable, in others not depending on the *timing* and technology.

"Size of the quota has an influence on recovery investments" - Rather the uncertainty of the quota / landings and the quality of raw fish.

The *intentional* discharge of untreated wastes should remain a criminal offence.

"At present no financial incentives for dedicated pollution control investments" - (Respondent unaware of this fact).

Conclusion I: "... least cost solution." - also at a mutually agreed time frame.

"Well managed fishery and a sound financial base" - and very/relatively unsophisticated systems/plants/vessels.

"Interests of the country rather than the needs of the few" - on condition that business remains viable.

Conclusion: "If the industry is able to replace .." - large If.

015: "Company image does not appear to be a major factor .." - company image can play a part in decision making.

016: "Pollution control ... economically justifiable" depends on the extent of control.

020: "Demersal sector perceive pollution control as the primary reason for making investments in waste control" - possibly because their factories are located in very sensitive areas.

021: "Large capital investment costs of pollution control" - to encourage and not restrict industrial development, areas should be zoned where the industry can operate without introduction of capital expenditure in anti-polution equipment of high capital cost.

"... the consumer rather than the general tax payer should absorb the cost" - provided controls are not extreme and too academic.

"Expenditure on pollution control ... economically justifiable" - In the case of stick water recovery and reintroduction into product and also dry-offloading, but *not* in the case of dryer gas scrubbing. Yes especially in the case of dryer deodorisers.

"Untreated wastes should remain a criminal offence" - this is a rather harsh statement. Each incident due to infrequency must be examined, possibly by a panel prior to law inforcement. Control could be exercised by a representative panel not for leniency but for economical and correct solution as applicable in each instance.

"Which regulatory instruments would the industry like to see used?" - ongoing consultation and recommendations prior to any thought of legislation. Caution to consider the introduction of any capital wasteful systems Pelagic industry is mainly localised in its industrial areas which towns and populations are dependant on industry.

"Permit system most prefered" This is a positive statement.

"Industry vulnerability analysis." - well managed, well maintained at a high cost, to maintain efficient performance.

"The presence of foreign vessels is cause for concern" - especially out of season on our fishing grounds.

"... not serving the interests of a few" - Western Cape fishing points are supporting the livelihood of populations in that region - both directly and indirectly.

"Significant investment areas" - fuller utilization, expansion of product range e.g. pet food and drying of pelagic fish. Hopeful T.A.C. increase of pilchards will expand canning industry.

022: "It appears that waste control investments based on financial criteria such as R O I" - profit margin of the different species may be the answer to this.

"Pollution control, what to do and how much" - this may be subject to the location of the factory.

"Expenditure on pollution control worthwhile" - for the pelagic sector this may be true up to a point. "Discharge of untreated wastes and harm to the environment" - only certain components of the waste could cause harm, others could be distroyed by wave action and oxidation.

APPENDIX VII

RESEARCH POPULATION

NAME	*COMPANY*
ATKINS C A	Irvin and Johnson Ltd.
BARNES W R	Marine Products Ltd.
BOTES C A	Marine Products Ltd.
BROEDER A	Oceana Fishing Group Ltd.
DEPÉNE W	Consortium Visserye Bpk.
DU PREEZ J	Suiderland Development Corporation Ltd.
FERNANDES J G	Lusitania Fishing Company (Pty.) Ltd.
FOSTER T R	Marine Products Ltd.
FOURIE L J	Irvin and Johnson Ltd.
KATZ D	Silverman Group of Companies.
KRAMER H E	Sea Harvest Corporation (Pty.) Ltd.
LATSKY T E	Oceana Fishing Group Ltd.
LEWIS A M	Irvin and Johnson Ltd.
LIEBENBERG D	Silverman Group of Companies.
MARCHAND H M	Silverman Group of Companies.
McGREGOR M	Sea Harvest Corporation (Pty.) Ltd.
MENDEL S C	Concentra Ltd.
MENGES H O	Consortium Visserye Bpk.
PECK B	Silverman Group of Companies.
POTGIETER M G	Oceana Fishing Group Ltd.
ROCHER P G	Suiderland Development Corporation Ltd.
SILVERMAN A	Silverman Group of Companies.
VILJOEN J P	Marine Products Ltd.
VAN DER WOUDEN J	Marine Products Ltd.
VAN ESSEN W	Southern Seas Fishing (Pty.) Ltd.
VAN HOORN C	Irvin and Johnson Ltd.
WEBSTER R	Sea Harvest Corporation (Pty.) Ltd.