WORKSHOP SERIES No. 15

Workshop on Oiled Seabird Cleaning and Rehabilitation

Proceedings of a workshop held in Townsville, Australia, 26 February 1991

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FOREWORD

The Great Barrier Reef is valuable to Australia as an economic and recreational resource and is of global ecological significance. This is recognised with the inscription of the Great Barrier Reef Region on the World Heritage List and the declaration of the Great Barrier Reef as a marine park under the *Great Barrier Reef Marine Park Act 1975.* The intensity of shipping within the Great Barrier Reef presents a very real threat to the Reef from oil spills. In response to this threat the Great Barrier Reef Marine Park Authority and the Commonwealth Department of Transport and Communication have developed REEFPLAN, the marine pollution contingency plan for the Great Barrier Reef Region. As of 1 January 199 1 the role of the Department of Transport and Communication under REEFPLAN has been taken over by the Australian Maritime Safety Authority.

Under REEFPLAN the Great Barrier Reef Marine Park Authority holds the positions of Scientific Support Coordinator and Media Liaison Officer. The role of Scientific Support Coordinator gives the Great Barrier Reef Marine Park Authority responsibility for coordinating support and advice regarding scientific and environmental matters in the event of an oil spill. The role of the Media Liaison Officer is to provide a single coordinated contact point between the media and the response team.

As part of its role as Scientific Support Coordinator, the Great Barrier Reef Marine Park Authority organises workshops to share and exchange information with other oil spill response groups. The Workshop on Oiled Seabird Cleaning and Rehabilitation was held on 26 February 1991 in response to a perceived need for an oiled seabird contingency plan for the Great Barrier Reef Region.

This report is a summary of the proceedings from the Oiled Seabird Cleaning and Rehabilitation Workshop, the first in Queensland to address this issue. It is hoped that more workshops will be held in the future.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

There are an estimated forty species of seabirds, over thirty species of waders and more than one hundred and fifty species of other birds found within the Great Barrier Reef Region. Many of these have their breeding sites within the Region' and several migrate to the area from other parts of the world. The effects of oil on birds are generally severe often resulting in mortality. Should an oil spill of any magnitude occur on the Great Barrier Reef there is little doubt that birds and their habitats would be impacted. The workshop held on 26 February 1991 by the Authority provided a forum for oil spill response agencies, scientists, environmental groups and industry to exchange information on oiled seabird cleaning and rehabilitation and make recommendations on the development of a contingency plan.

Participants agreed unanimously that an oiled seabird contingency plan is needed for the Great Barrier Reef Region. Such a plan could have ecological as well as public relations value. The visible state of oiled birds tends to evoke a great deal of public attention and responding to this could be more important then the ecological value of assisting oiled birds.

Experience to date in Australia has indicated minimal success rates of oiled bird rehabilitation. Incidents such as the Lake Liddell oil spill on 18 September 1990 demonstrated the need to improve success rates by developing contingency plans, improving capture and rehabilitation procedures, developing education programs and establishing species priority.

It was agreed that a contingency plan should be expanded to include other wildlife such as dolphins, dugongs, and turtles i.e. an oiled wildlife contingency plan should be developed as opposed to one specifically for seabirds. Emphasis was given to the ethics of wildlife preservation. In-depth debates centred on the basis of selective care. Some participants supported primary selection being given to the rare and threatened species while others felt that species of ecological importance to the damaged habitat should receive priority.

The Queensland Department of Environment and Heritage was unanimously nominated as the primary body responsible for developing and implementing the contingency plan, with the Great Barrier Reef Marine Park Authority and other agencies providing support. It was stressed that funding should be provided by the oil and shipping industries through the Australian Maritime Safety Authority and the Great Barrier Reef Marine Park Authority.

Participants delegated secondary responsibilities to a wide variety of organisations and agencies. As a result it was determined that all areas of society could play a role in an oiled wildlife contingency plan.

It was agreed that further research is needed to enhance the success of oiled wildlife response. A list of research needs was recommended by the workshop. This list includes:

- studies on survival rates;
- studies on species importance in order to establish the species that require priority attention; and .
- further research and development of methods and technology.

The results of the Oiled Seabird Cleaning and Rehabilitation Workshop helped to establish a clear framework for an oiled wildlife contingency plan. It is hoped that the recommendations of the Workshop will be implemented.

INTRODUCTION

In the event of an oil spill in the Great Barrier Reef Region it is most likely that seabird populations would be subject to significant impact. Rescue, cleaning and rehabilitation of oiled birds would form a major, high profile part of the response effort and would provide a useful activity for the multitude of concerned volunteers that would materialise in the event of a spill. There is currently no detailed plan for coordinating oiled bird cleaning and rehabilitation in the Great Barrier Reef Region. There is a pressing need to develop such a plan.

The effectiveness and success rate of oiled bird cleaning and rehabilitation may be subject to question and there is a need to identify ways in which it can be improved. Research is needed in this area.

It is therefore hoped that this workshop will initiate coordinated action by government, industry and environmental groups towards developing an oiled bird contingency plan for the Reef Region, and identify areas in which further research is needed.

OBJECTIVES

1. Review and summarise existing information, capabilities and techniques regarding oiled bird cleaning and rehabilitation.

2. Achieve agreement on the value of oiled bird cleaning and rehabilitation.

3. Initiate development of a dktailed contingency plan for oiled bird rescue, cleaning-and rehabilitation in the Great Barrier Reef Region which:

   - Identifies the various agencies and groups that would be involved, defining their responsibilities and roles and providing a clear organisational framework.
   - Provides for regular training exercises/workshops for these agencies and groups.
   - Identifies the resources required and establishes a network of these resources and procedures for their use.
   - Details a monitoring program to assess the effectiveness and success rate of the effort should a spill occur.

4. Identify and prioritise research needs with regard to oiled bird cleaning'and rehabilitation.

PROGRAM

Chairperson, - Ms Kath Shurcliff - Great Barrier Reef Marine Park Authority

The workshop was divided into two sessions:

A) Presentations

The morning session involved presentations from wildlife authorities giving background information on seabirds in the Great Barrier Reef Region, rescue and rehabilitation techniques, case histories, and research capabilities available in Australia.

8.30 am:	Registration
9.00 am:	*Opening Address* Dr Wendy Craik - Great Barrier Reef Marine Park Authority
9.15 am:	*Birds in the Great Barrier Reef Region - Species, Distribution, Ecology and Conservation Significance* Mr Terry Walker - Queensland Department of Environment and Heritage
10.00 am:	*The Effects of Oil on Birds* Dr Peter Dann - Phillip Island Reserve
10.40 am:	Morning Tea
11.00 am:	*Emergency Care at the Luke Liddell Oil Spill, NSW* Ms Erna Walraven - Taronga Zoo, Sydney
11.30 am:	*Management of Wildlife Operations* Mr Peter Brookhouse - NSW National Parks and Wildlife Service
12.10 pm:	*Products for Deoiling Birds* Mr Gideon Schuman - Low Energy Living Mr Reg Oxley - Absorbents Industrial A/Asia
12.30 pm:	Videos, slides and general discussion
1.00 pm:	Lunch

B) Workshop

The afternoon session involved breaking into several groups of six to eight people, each headed by a facilitator, for a brainstorming session to achieve the objectives listed above. Each group contained a cross-section of people from government, industry and conservation groups. After the brainstorming session of an hour or so the groups came back together and presented their results for general discussion to finalise achievement of the objectives.

2.00 pm:	Divided into groups and commenced brainstorming session
3.00 pm:	Afternoon tea
3.20 pm:	Presentation of results and general discussion - finalise achievement of objectives
5.00 pm:	Close

DISCUSSION GROUP RESULTS AND RECOMMENDATIONS

Each group was asked to discuss the following questions and,record their results. The, following is a summation of the results of the discussion groups.

Question One:
Is it agreed that cleaning and rehabilitation of oiled seabirds is a worthwhile and valuable exercise, and that a contingency plan should be developed for the Great Barrier Reef Region?

Response:
All groups were in agreement that a contingency plan should be established; however, three groups raised issues of wildlife management ethics. It was suggested by one group that selection of birds for treatment be based on species importance and the severity of injury. Two groups suggested that only birds with a greater chance of recovery be treated. If selection of birds is based on species it was debated as to whether preference should be given to rare and threatened species or to those that are of ecological importance to the oiled habitat. Three groups stressed the need to realise that other animals aside from birds may be affected by oil and need to be included in the contingency plan. Examples are dolphins, dugongs and turtles.

Four groups questioned the effectiveness of oiled bird treatment. It was mentioned by six groups that further studies must be made into the survival rate of treated birds. One group claimed that treating oiled birds may be ecologically ineffective except with regards to critical species.

Questions were raised with regards to the practicality of such a plan being deployed in the Great Barrier Reef Region. One group identified possible logistical difficulties stemming from the huge geographical area.

A variety of other factors were mentioned as the cause of some uncertainty towards the realisation of a contingency plan. Areas of concern were funding, methods and technology. However, these issues were touched on lightly and were pursued in more detail during the course of the workshop.

It became apparent to four of the groups that the overriding factor for the justification of this plan is political and public pressure. The groups which discussed the ineffectiveness of treating oiled birds all agreed that it may still be necessary to satisfy the demands of the public. One group suggested that the contingency plan be designed for accessible high profile areas only.

It is interesting to note that of the six groups involved there was a diversified response to the question at hand. One group agreed with the need for a plan without any qualifications. Another group focused solely on the ethical factors involved. Of the four groups remaining, each offered varying arguments against the creation of such a plan but recognised the demands of the public.

Question Two:
Which agency/organisation should have primary responsibility for developing and implementing such a plan?

Response:
Five groups suggested that the' Queensland Department of Environment and Heritage (QDEH) was the most appropriate organisation to take primary responsibility. QDEH was

selected because it is represented regionally along the coast and is the most appropriately trained, experienced, and equipped body in Queensland for this role. It was also mentioned that there should be support from the Great Barrier Reef Marine Park Authority. One group suggested that the responsibility of developing and implementing an oiled wildlife contingency plan lies with the groups involved in the National Plan to Combat Pollution of the Sea by Oil.

Question Three:
What other agencies/organisations should be involved and what should their respective roles be?

Response:
GREAT BARRIER REEF MARINE PARK AUTHORITY: GBRMPA was mentioned twice as a source of advice, planning, and research. One group suggested the Authority provide active participants and another group looked to the Authority for funding.

INDUSTRY: All groups stressed the need to involve the oil and shipping industries. Three groups held them responsible for funding while the others were unspecific as to what the responsibilities of industry entailed.

AUSTRALIAN INSTITUTE OF MARINE SCIENCE: AIMS was mentioned as a source of scientific information and equipment by two groups.

UNIVERSITIES: Two groups identified universities as being able to offer input into the proposed plan. However, the description of their role was vague. It was suggested by another group that universities could be of some help in monitoring the birds after their release.

ZOOS: Two groups recommended zoos as a source of expertise, manpower, treatment facilities, and resources.

ROYAL SOCIETY FOR THE PREVENTION OF CRUELTY TO ANIMALS: All groups stated the need for the involvement of the RSPCA, mainly as an adviser on issues such as euthanasia and rehabilitation but also as a provider of resources and manpower.

VETERINARIANS: Four groups felt that local veterinarians would be essential in areas such as treatment and rehabilitation as well as general advisers.

STATE EMERGENCY SERVICE: The SES was selected by three groups as a supplier of equipment. One group suggested that the SES would be helpful with regards to logistical support and transport.

LOCAL GOVERNMENT: Local governments were nominated by three groups to provide resources and to establish local treatment stations. Other groups mentioned local governments as playing a role in a contingency plan but did not specify what this entailed.

DEPARTMENT OF DEFENCE: One group nominated the Department of Defence as a supplier of resources and manpower.

COMMUNITY WILDLIFE CARE GROUPS: These organisations were mentioned by all discussion groups involved. It was determined that they could offer assistance in areas such as resources, advice and manpower.

WILDLIFE PRESERVATION SOCIETY OF QUEENSLAND: It was suggested by one group that this organisation could aid in the capture and treatment of injured birds.

QUEENSLAND BOATING AND FISHERIES PATROL: The QB&FP was listed by two groups as a source of transport and of resources.

OTHERS: There were a variety of other agencies and organisations mentioned during the workshop. Reef tourist operators, conservation groups, commercial fishermen, the media, scouts, guides and schools were all nominated to take on a variety of different responsibilities such as aiding with the capture and treatment of the oiled birds and providing resources such as transportation.

Question Four:
Briefly, what would be an appropriate organisational framework, including funding and ongoing training arrangements, for such a plan?

Response:
The Australian Maritime Safety Authority was nominated by four groups to fund the plan. Two groups proposed a joint effort between State and Federal government. Three groups targeted oil and shipping industries as a funding source.

A variety of different solutions were offered with regards to ongoing training. Two groups mentioned that QDEH should maintain a fully trained staff who could handle any situation pertaining to oiled seabirds. This staff would also be responsible for coordinating the training of others. One discussion group suggested training sessions be offered once a year in coastal centres. These sessions are to be run by QDEH and volunteers. Another group recommended training courses being offered through TAFE. Also mentioned as a source for education was the Great Barrier Reef Marine Park Authority.

Information sources was another issue tackled by two of the discussion groups. They recommended that a manual be put together to provide volunteers with necessary information. It was stressed that training aids such as manuals, videos, and courses be combined with other existing oil spill response courses offered by both State and Federal government.

Environmental groups and other agencies were nominated to aid in the training of community groups. Furthermore they could play a role in the hands-on training of volunteers at the site of an oil spill.

It was agreed that the main objective of ongoing training is to update and make readily available, through literature and workshops, the information to carry out a contingency plan effectively.

Question Five:
In what areas of oiled seabird cleaning and rehabilitation is further research needed?

Response:
All groups stressed the need for monitoring the success rate of oiled seabird cleaning and rehabilitation. **Two** groups stressed that attention should be paid to success rates in tropical areas as most work done to date has been done in temperate regions. Also recommended was the monitoring of long-term effects on birds that have been oiled but not treated.

Five of the six participating groups stressed the need for more research on equipment and technique. Specific attention was given to the types of detergents used, their effect on Australian birds and the possibility of using salt water with the detergents.

Three groups listed determination of species priority as a crucial area. If selective treatment is to be adopted, the understanding of the ecologically important species must be more detailed. The focus varied between rare and threatened types and those species important to the afflicted areas. It was emphasised by one group that a priority list of species to be treated be established.

As mentioned previously, there was some concern demonstrated regarding the amount and quality of literature available in this field. Two participating groups identified this problem and recommended determining a central source for existing literature in order to increase public access.

SUMMARY OF RECOMMENDATIONS

1. An Oiled Wildlife Contingency Plan, expanded to include all wildlife, not just birds, should be established for the Great Barrier Reef Region.

2. QDEH should have the primary reponsibility for developing, implementing and maintaining the contingency plan with support coming from other bodies.

3. The scope of the contingency plan needs to be determined in order to best respond to ecological requirements and public pressure.

4. An organisational framework that includes involvement from all areas of society needs to be created.

5. The involvement of oil and shipping industries should be ensured.

6. Training programs and literature need to be updated and maintained.

7. A priority of species to be treated should be established.

8. Further research in areas such as success rates, methods, and technology is needed.

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PAPERS PRESENTED

Seabird Cleaning and' Rehabilitation in the Great Barrier Reef Marine Park

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INTRODUCTION

On behalf of the Great Barrier Reef Marine Park Authority I would like to welcome you here today to the Marine Park Authority's workshop on seabird cleaning and rehabilitation. In the event of an oil spill in the Great Barrier Reef Region it is quite likely that some seabirds will encounter oil and there will be a requirement to clean those birds. The Great Barrier Reef Marine Park Authority, as Scientific Support Coordinator, has responsibility for environmental matters in the event of an oil spill. Under this umbrella comes the responsibility for seabird cleaning and rehabilitation. This is not an area that we have investigated to a great extent to date, and this workshop is the first step in a program to develop a seabird cleaning and rehabilitation response in the event of a spill. It is particularly pleasing to see so many people from volunteer groups here today because we believe that in the event of a spill it is most likely that we will be calling on volunteer groups' to assist with seabird cleaning and rehabilitation.

ORIGINS OF OIL IN THE SEA

To put things in perspective, figure 1 shows the origins of oil in the sea as determined by the US National Academy of Science in 1985. The figure demonstrates that for a six-year period to 1980 42% of the total amount of petroleum hydrocarbon entering the world's oceans was the result of shipping operations or casualties. The total amount of oil entering the sea in that period is a large figure - some 3.2 million tonnes. We are fortunate in the Great Barrier Reef Region that we have not yet been subject to a large spill like those that have occurred elsewhere in recent times such as the *Exxon Valdez.*

SHIPPING HAZARDS IN THE GREAT BARRIER REEF REGION

In the Great Barrier Reef Region there are a number of hazards to shipping. These include 2900 reefs scattered throughout the Great Barrier Reef Region, ranging in size from several hectares to thousands of hectares. Additionally there are some 300 coral cays and 600 high islands which in the event of a spill are likely to be subject to some of the particularly severe effects of the spill. Many of the reefs are submerged or are shoals; shipping lanes, particularly in the northern part of the Great Barrier Reef Region are very narrow and shallow and circuitous, making a direct passage for a vessel difficult. Throughout much of the year the Great Barrier Reef Region is subject to strong trade winds which in the event of a spill would push the oil towards the shore. Even when the trade winds are not blowing, the winds from the north-east would have the same ultimate effect. The Reef Region is also subject to occasional cyclones and in certain areas to localised very strong currents. To cap it off the Great Barrier Reef remains, even in 1991, incompletely charted.

Figure 2 shows the shipping routes throughout the Great Barrier Reef Region. The north-south shipping route follows the coast very closely from Torres Strait down to just north of Port Douglas. South of Port Douglas the main shipping route tends to be more distant from the coast and the shipping lanes are deeper and wider. There are several passages from the

Coral Sea to the inside of the Great Barrier Reef, principally Grafton Passage and Palm Passage, the particularly narrow Hydrographers Passage and the Capricorn Passage.

It is estimated by the Federal Department of Transport and Communications that approximately 2000 vessels pass through the Great Barrier Reef Region each year. Of these about 200 are tankers.

To minimise the likelihood of a spill, pilotage of these vessels has been recommended by the International Maritime Organization for vessels over 100 metres. It is estimated that some 90% of vessels are piloted and each year about 10 tankers pass through the Reef Region unpiloted. In late 1990 the International Maritime Organization declared the Great Barrier Reef Region to be a 'particularly sensitive area', the first such area in the world. As a result of this declaration, the IMO supported the Australian Government's intention to make pilotage compulsory for vessels over 70 metres in the northern Great Barrier Reef Marine Park and through Hydrographers Passage.

As mentioned above, the Marine Park has been relatively free of large spill incidents. Attempting to compile reports of large spill incidents shows that since 1970, for vessels over about 24 metres there are about 175 **recorded** incidents in the Great Barrier Reef Region. Most of these incidents have occurred in ports and about 6 of these are pollution incidents. The last major spill near the Great Barrier Reef Region was in 1970 when the ***Oceanic*** Grandeur ran aground in Torres Strait spilling an estimated 1400 to 4000 tonnes of oil. It is believed that the disappearance of pearl beds was attributable to this spill and clean-up efforts.

IMPORTANCE OF THE GREAT BARRIER REEF

The Great Barrier Reef is a particularly significant natural formation. It was inscribed on the World Heritage List in 198 1, the International Maritime Organization has designated 'areas to be avoided' within the Great Barrier Reef Marine Park and as mentioned above the IMO has designated it as a particularly sensitive area. The Great Barrier Reef Marine Park is zoned to permit a range of uses in different parts of the Park; these zones meet categories established by The World Conservation Union (IUCN) for management of protected areas.

In addition to its international significance the Great Barrier Reef has economic significance. The two major commercial activities are tourism and fishing. Tourism is estimated to be growing at approximately 10% per annum. In 1990 it was estimated that about 2.5 million visitor trips were made to the Reef Region including the adjacent mainland. Tourism is believed to generate some $400 million per annum. Within the Reef Region there are some 21 resorts and about 300 charter boats.

Commercial and recreational fishing are also significant income generators. They are believed together to generate an estimated $400 million per annum. The main commercial fishery is trawling which occurs between the coast and the main block of reefs. Recreational fishing is chiefly from small boats for highly prized reef fish.

SEABIRDS

It is estimated that there are some 242 species of birds found within the Reef Region. Of these, approximately 40 species are seabirds. Twenty-one breeding colonies of seabirds have been identified within the Reef Region making it of international significance. Some 202 species of land birds have been identified and for these about 109 breeding sites have been identified.

Some of the earliest research in the Great Barrier Reef Region was conducted by ornithological expeditions, so historically the Great Barrier Reef Region is also important for seabirds.

REEFPLAN

Because of its concern about an oil spill, the Great Barrier Reef Marine Park Authority approached the then Federal Department of Transport to develop an oil spill contingency plan for the Great Barrier Reef. In 1987 that plan, REEFPLAN, came into effect. REEFPLAN is a supplement to the National Plan to Combat Pollution of the Sea by Oil.

The objectives of REEFPLAN are:

1. to provide guidance for a pollution response;

2. to provide guidance for planning; and

3. to provide guidance for intergovernmental cooperation and response.

Figure 3 shows the structure of the REEFPLAN response. There is a Queensland State Committee concerned with oil spill matters, on which the Great Barrier Reef Marine Park Authority sits. Other environmental authorities including the Queensland Department of Environment and Heritage also sit on this committee and provide input. Interstate authorities liaise through the Queensland State Committee with Queensland State Committee members and other Federal and state agencies also liaise through this committee. In the event of a spill, the committee provides advice to the On Scene Coordinator who is in charge of response operations.

Figure 4 shows the structure of a REEFPLAN response which is established in the event of a spill. The On Scene Coordinator has overall control of the clean-up and the response. The OSC is advised by the State Committee, and the Media Liaison Officer (MLO) reports directly to the On Scene Coordinator. The Scientific Support Coordinator (SSC) for the Great Barrier Reef Marine Park area is the Great Barrier Reef Marine Park Authority. The SSC is responsible for coordinating environmental and scientific advice to the On Scene Coordinator. Various deputy On Scene Coordinators for specific geographic areas are appointed by the OSC and report directly to that person. An important person is the Administrative Support Coordinator who is in charge of keeping records of logistics etc.

The Great Barrier Reef Marine Park Authority's role in REEFPLAN is twofold i.e. as Scientific Support Coordinator and as Media Liaison Officer. The Scientific Support Coordinator is responsible for developing a scientific database to be used in the event of a spill, providing coordinated advice on environmental matters to the On Scene Coordinator in the event of a spill, and monitoring the effects of a spill should one occur.

In fulfilling its role as SSC the Great Barrier Reef Marine Park Authority has conducted workshops on matters relevant to spills for example, a workshop on bioremediation, workshops on the role of SSC etc. The Marine Park Authority was also responsible for the development of a pilot computerised coastal resources atlas. This concept has now been picked up by the State Committee and the Federal Department of Transport and Communication and a computerised atlas for the entire coast of Queensland is being developed. The atlas identifies resources and incorporates a basic spill model to enable forecasting where the spill might go. Additionally the Marine Park Authority has funded research into the effects of dispersants and oil on corals. This study is looking at the dispersants BPAB and Ardrox.6120, the two dispersants held in stockpiles in the Reef Region. Additionally the Marine Park Authority is completing a pamphlet to identify oil slicks as distinct from *Trichodesmium* (algal) slicks and coral spawn slicks.

The role of the media liaison officer (MLO) is to coordinate the media response in the event of a spill. Experience shows that a spill excites extraordinary media interest no matter what the size of the spill and the MLO is required to coordinate that response and be the conduit between the media and the response team.

OBJECTIVES OF THIS WORKSHOP

This workshop is designed to fulfil a number of functions. The objectives of this workshop are to:

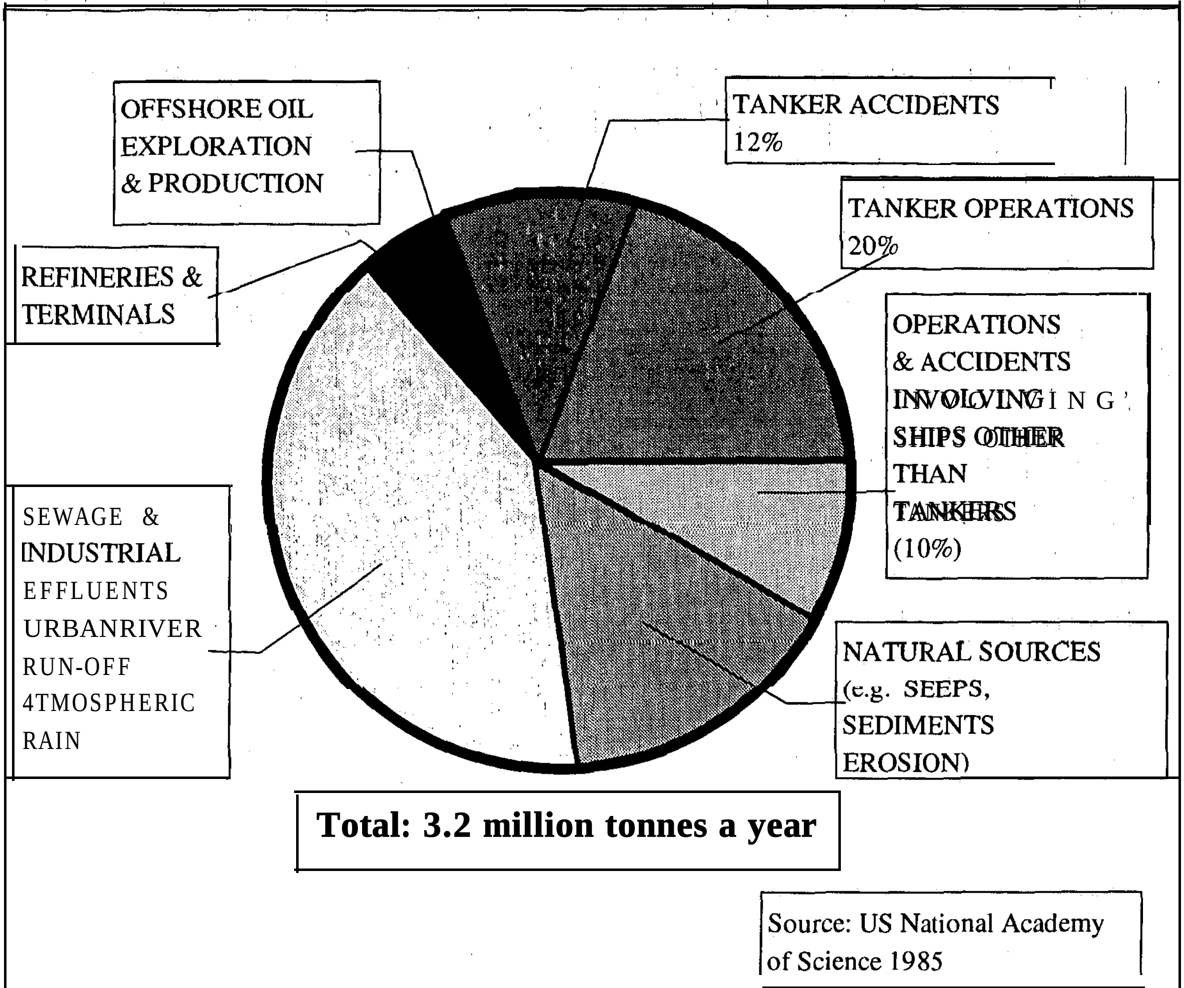
1. review existing information on oiled bird rehabilitation;

2. achieve agreement on the value of oiled bird cleaning and rehabilitation;

3. initiate development of contingency plans for oiled bird rescue, i.e. identifying:
   - agencies and groups
   - roles and responsibilities
   - resources required
   - training required
   - monitoring program; and

4. identify research required.

This is a challenging agenda and I hope at the end of the day we will be able to come out with the first steps of a plan which could be put into place in the event of a spill.



From 1974 to 1980 it is estimated that 42% of the total amount of petroleum hydrocarbon entering the world's oceans was the result of either shipping operations or casualties.

Figure 1. Origins of oil in the sea

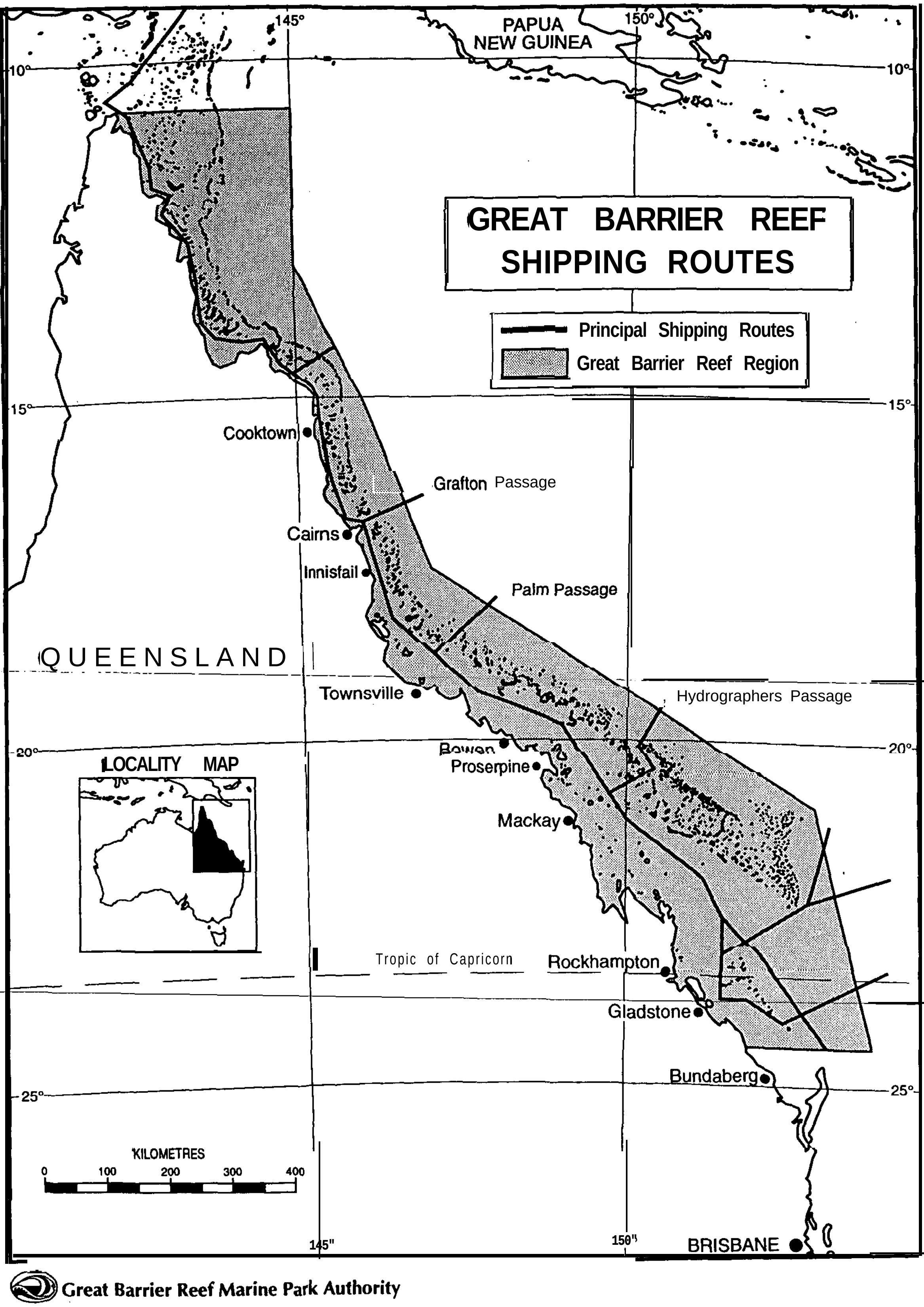


Figure 2. Great Barrier Reef Region Shipping Routes

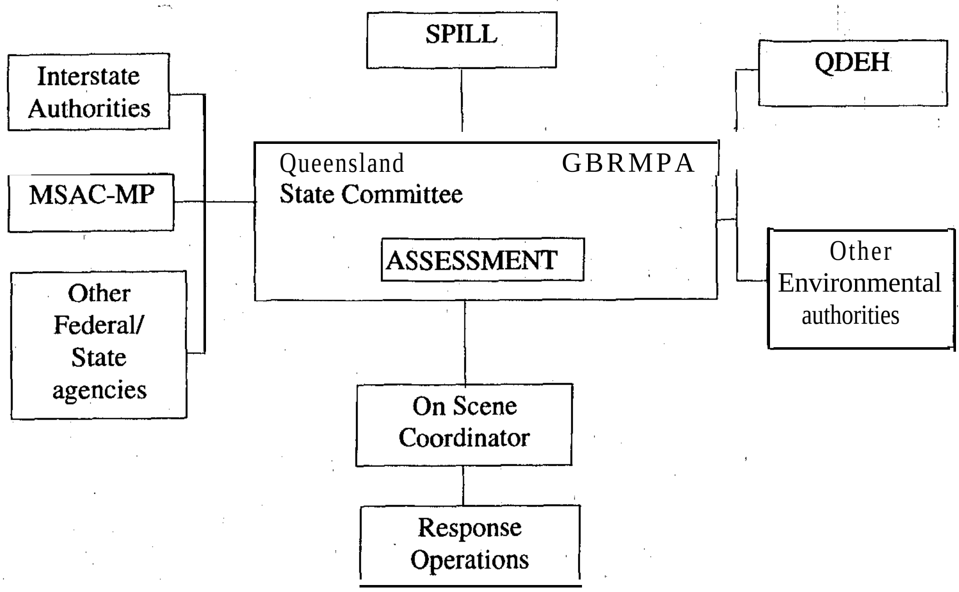


Figure 3. Organisational structure for REEFPLAN

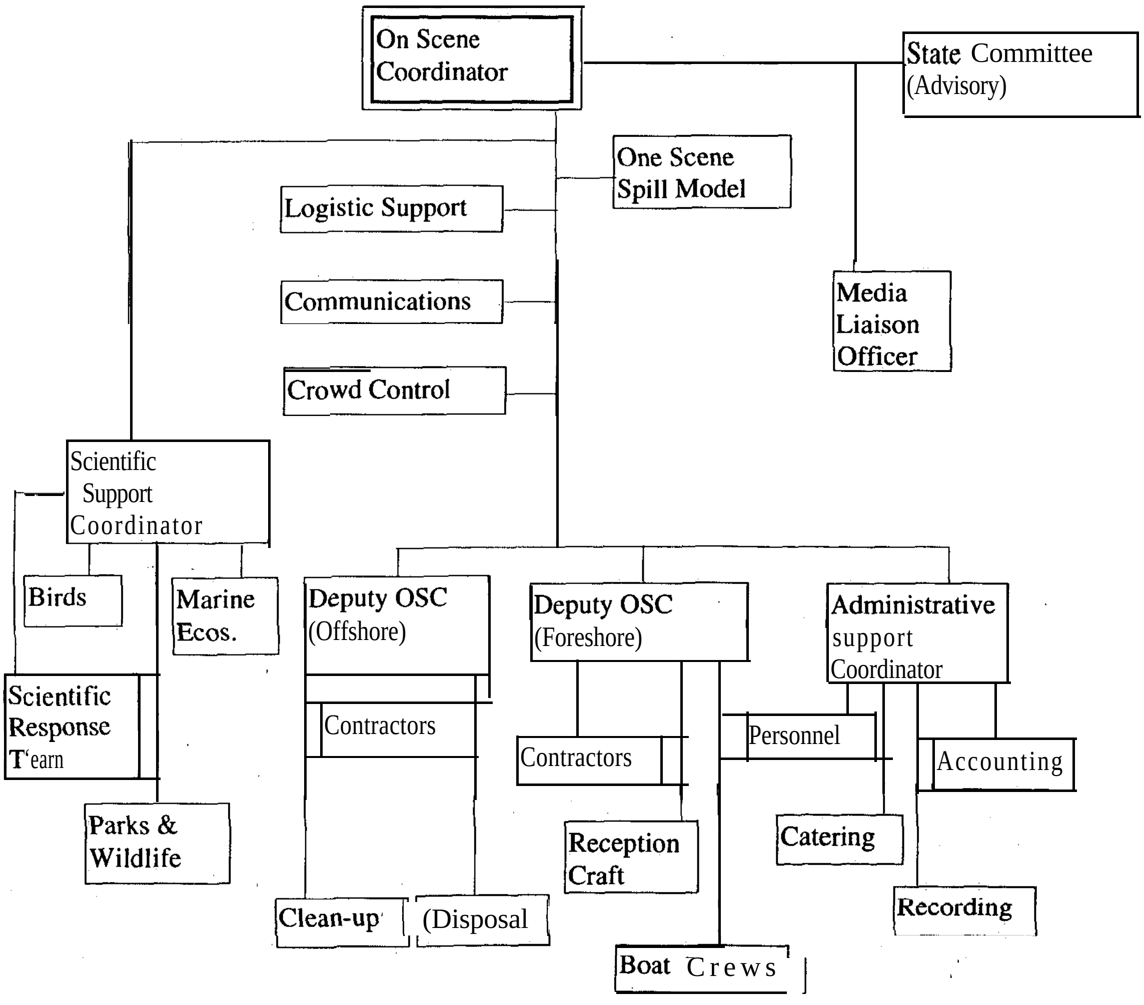


Figure 4. Structure of REEFPLAN response in the event of an oil spill

Seabird Distribution on the Great Barrier Reef

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The potential for oil spills to impact on seabird populations on the Great Barrier Reef depends on the distributions and behaviours of the various species of seabirds that feed and breed in the area. Twenty-three species of seabirds are known to breed on Great Barrier Reef islands and a few non-breeding migratory species visit primarily in the austral summer. The resident or breeding birds are particularly at risk as they have behaviourial ties to their nests or territories and are more reluctant to move from the area of an oil spill than are non-breeding or nomadic birds. Roughly 70% of seabirds migrate from the Great Barrier Reef or disperse over the ocean following breeding.

Breeding is strongly seasonal in some seabird species and particularly on southern Great Barrier Reef islands or on islands close to the mainland. Fifteen of the breeding or resident species on the Great Barrier Reef are warm-water marine birds distributed across one or more ocean basins. The remaining species extend to temperate regions and, with the exceptions of the Crested Tern and Roseate Tern, range through inland waterways in Australia. Five of the latter species are aquatic\estuarine species with limited geographical ranges outside of Australia or Australasia.

The cross-shelf distribution of each seabird species is illustrated in Table 1. Inner shelf and coastal birds are most at risk from spills in the lagoon shipping lane because the predominant winds are south-easterly on the Great Barrier Reef and oil spills therefore move towards the coast. There are large inner shelf colonies of terns. Coastal colonies are small but the only endangered seabird in the region, the Little Tern, breeds almost entirely along the coastline. Outer shelf colonies could be impacted by spills in the Coral Sea or during the few summer months when north-west monsoonal winds blow from the mainland on the northern third of the Great Barrier Reef or westerly winds blow over the southern end of the Great Barrier Reef.

The latitudinal distribution of breeding colonies is distinct and four general breeding distributions are apparent for the numerically dominant species: 1) scattered colonies along the full length of the Great Barrier Reef; 2) colonies almost entirely on the northern half of the Great Barrier Reef; 3) colonies primarily at the southern and sub-northern ends of the Great Barrier Reef; and 4) colonies almost entirely at the southern end of the Great Barrier Reef. Table 2 summarises the times and places where seabirds are most abundant on the Great Barrier Reef. This gives a general indication of when and where oil spills would be most damaging. Seabirds nest on roughly one-fourth of all Great Barrier Reef islands and data from colony census give an estimated 1.7 million seabirds breeding annually in the Great Barrier Reef province. There is presently no estimate of non-breeding seabirds but at a guess they might be equal to 25% or so of the breeding numbers. The Capricorn-Bunker islands at the southern end of the Great Barrier Reef support 73-75% of all breeding seabirds and seabird biomass on the Great Barrier Reef, by virtue of their monopoly on the two most abundant species, the Wedge-tailed Shearwater and the Black Noddy. Half of all Great Barrier Reef seabirds nest on the largest Capricorn-Bunker cay, North West Island.

The biology and behaviour of each species ofseabird further modifies its susceptibility to physical, physiological or toxic effects of oil. Table 3 lists some biological and ecological characteristics of Great Barrier Reef species that might be expected to reduce 'the impact of oil spills on those species.

Seabird Species; Characteristics

Wedgeftailed Shearwater *Puffinus pacificus*

About 50% of the total breeding seabirds on the Great Barrier Reef are Wedge-tailed Shearwaters and 90% of the eastern Australian Wedge-tailed Shearwater population'breed on the Capricorn-Bunker islands. A small number of birds are reported to occur on one or two northern cays during winter but as a rule this species migrates from the Great Barrier Reef and Australia in April-May following breeding. Arrival on the Great Barrier Reef is punctual each year in about the second week of October. The adults tend to fish far offshore and might escape serious impacts of an oil spill in the Capricorn-Bunker region but the young birds can be expected to suffer. My only knowledge of a Great Barrier Reef seabird oil kill is for scores to hundreds'of dead shearwaters reported floating in an oil-like slick near North West Island.

Herald Petrel *Pterodroma arminjoniana*

A few nests and birds of this petrel occur at Raine Island but it is unknown elsewhere on the Great Barrier Reef. This outlying colony is at the far western extremity of the species distribution across the south Pacific Ocean. It is invariably listed as breeding in the Coral Sea but the accumulating data from these islands indicates that the species is rare and does not breed.

Australian Pelican *Pelecanus conspicillatus*

This pelican is endemic although it episodically disperses to neighbouring countries where small colonies are reported to have persisted in recent decades. It is mainly a freshwater aquatic bird that breeds in large numbers following the rare seasons of heavy rainfall that fills temporary inland lakes. A few small Great Barrier Reef.breeding colonies occur on cays off southern Cape York Peninsula and on two islands in Shoalwater Bay. Birds from these colonies possibly use the islands as predator-free nest sites while primarily feeding in mainland waterbodies.

Red-footed Booby *Sula sula*

This oceanic booby feeds in the Coral Sea and rarely on the Great Barrier Reef. Raine Island is used for nesting because of its location on the edge of the shelf beside a steep drop-off to the deep water of the Coral Sea. Other cays on the shelf edge are unsuitable for nesting or roosting because they do not have trees or shrubs which are required by this species (stray pairs nest on herbs near Raine Island at Moulter Cay). Nesting occurs year-round.

Masked Booby *Sula dactylatra*

This oceanic booby feeds primarily in the Coral Sea. Several vegetated and unvegetated cays on the outer shelf are used for, nesting throughout the year. Raine Island supports the largest colony on the Great Barrier Reef.

Brown Booby *Sula leucogaster*

This widespread booby breeds on outer cays off Cape York Peninsula and at the southern end of the Great Barrier Reef. Nesting is year round at most colonies although seasonal peaks appear in spring or autumn and birds are largely absent from the southernmost colonies (Capricorn-Bunker) in winter. Large roosting aggregations occur on some inner shelf islands.

Pied Cormorant *Phalacrocorax varius*

This primarily aquatic and estuarine species has island breeding populations of a few hundred in the Whitsunday area and in Keppel Bay. Small populations occasionally occur elsewhere on inner shelf islands. Breeding occurs in winter.

Little Black Cormorant *Phalacrocorax sulcirostris*

This aquatic/estuarine cormorant is uncommon on inner shelf islands and is not known to breed. A notable exception is the resident (breeding not seen) population of less than two hundred birds on the Capricorn-Bunker islands.

Little Pied Cormorant *Phalacrocorax melanoleucos*

This aquatic/estuarine species is uncommon on inner shelf islands but resident populations are known on several cays. Breeding is only recorded on two or three occasions (Capricorn-Bunker islands and off Cape York Peninsula).

Least Frigatebird *Fregata ariel*

This species breeds on three outer islands off Cape York Peninsula and on Bell Cay on the southern Great Barrier Reef. Colonies contain tens to hundreds of pairs. Laying occurs in autumn or early winter and juveniles fledge six months later but remain under parental care at the colony for many more months. Frigatebirds are probably less susceptible than other seabirds to direct oiling because they do not enter or alight on the sea. They can also forage long distances from the colony and may therefore be able to avoid oiled areas.

Great Frigatebird *Fregata minor*

A few birds nest amongst Least Frigatebird colonies and birds are often present at inner or outer shelf islands. Most nesting occurs on islands in the Coral Sea.

Red-tailed Tropicbird *Phaethon rubricauda*

This oceanic species feeds in the Coral Sea and appears to only come ashore on the Great Barrier Reef islands to breed. About 1000 pairs nest at Raine Island and 5-6 pairs nest at Lady Elliot Island. Some birds are always present at Raine Island but they are absent from Lady Elliot Island in winter.

Silver Gull *Larus novaehollandiae*

The Silver Gull, like other gulls, is largely a temperate or sub-tropical species though it breeds in small numbers along the Great Barrier Reef on inshore and offshore islands. The largest colonies contain up to 200 pairs but are uncommon and sited almost entirely on the southern half of the Great Barrier Reef. Some of these colonies are artificially large as a result of feeding on human garbage and fishing discards. Breeding occurs primarily in winter on the northern half of the Great Barrier Reef and is minimal in winter on the southernmost Capricorn-Bunker Group. The region in-between supports moderate nesting in all months except mid-summer. Silver Gulls are probably less at risk from oil than other seabirds because of their intelligence and ability to modify behaviour in response to changing environmental conditions.

Caspian Tern *Hydroprogne caspiu*

This large coastal and inland tern breeds singly or in pairs on several inner shelf islands on the northern Great Barrier Reef. On the southern half of the Great Barrier Reef a few colonies with up to 10-15 pairs occur on inshore islands. Nesting takes place from May to July.

Roseate Tern *Sterna dougallii*

This tern is threatened in the northern hemisphere and the Great Barrier Reef population may constitute up to 15% of the remaining world population. The principal breeding area is a group of inner shelf cays off the northern Cape York Peninsula where nesting occurs mainly in autumn. Another large population breeds on Capricorn-Bunker islands and several smaller colonies occur on inner shelf islands along the Great Barrier Reef. These are summer-autumn colonies and most birds appear to be absent from the Great Barrier Reef in winter. This tern is particularly at risk from potential oil spills in the northern lagoon shipping lane.

Black-naped Tern *Sterna sumatrana*

This tropical tern is normally found in association with coral reefs though it often feeds over deeper water beyond the reef. It is resident on the Great Barrier Reef throughout the year but numbers appear to be lower in winter (but could be just more dispersed). Nesting occurs primarily in summer with some winter breeding on offshore cays. Colonies range from a few pairs to 300 pairs and are widely scattered along the Great Barrier Reef on inshore and offshore islands. South of Mackay the species is absent or rare in the lagoon and inshore area (probably associated with the poor development of reef in this area) but abundant on the outer cays.

Sooty Tern *Sterna fuscata*

This oceanic tern visits the outer cays of the northern Great Barrier Reef to nest and subsequently disperses over the Coral Sea. Nesting occurs in packed colonies of up to 40 000 birds capable of fishing hundreds of kilometres out to sea from the nest. Timing of nesting is complex. At the southernmost colony on Michaelmas Cay (neglecting a few pairs that nest on the southern Great Barrier Reef) breeding is year-round with an 8-9 month cycle of peak laying. At the northernmost colony at Bramble Cay there may also be an 8-9 month cycle but the cay is deserted for a few months between cycles. In-between these colonies nearly all nesting records are during winter months. Because it nests on outer cays and fishes mostly in the Coral Sea the Sooty Tern would mainly be immune to oil spills in the lagoon except during the December-February period when the north-west monsoon blows seaward from Cape York Peninsula.

Bridled Tern *Sterna anaethetus*

This a tropical tern that breeds on Australian islands but migrates to the northern hemisphere for the austral winter. It arrives punctually in September (northern islands) or October (southern islands) each year. Birds depart the Great Barrier Reef from January to March. On a few offshore cays off Cape York Peninsula (e.g. Raine Island) there is a small winter breeding population (less than 5% of total Great Barrier Reef) that does not migrate or else migrates with a reverse timing to the main population. Breeding occurs along the length of the Great Barrier Reef on inshore and offshore islands in colonies from a few pairs to about 4000 pairs. Bridled Terns have high breeding site fidelity and would be unable to shift colony sites in the event of an oil spill being present when they arrive to breed.

Little Tern Sterna *albifrons*

This is the only endangered seabird on the Great Barrier Reef. It is mainly a coastal resident that breeds on beaches in small colonies but occasional nesting occurs on islands. Because of the coastal habitat it is particularly susceptible to oil spills that tend to blow towards the coast. Breeding occurs in summer.

Crested Tern Sterna *bergii*

This is the most widespread tern in Australian waters and is the seabird most frequently encountered in the Great Barrier Reef region (though not the most abundant). It nests in colonies from a few pairs to 4000 pairs on inshore and offshore islands along the length of the Great Barrier Reef. Breeding occurs at any time of the year on the northern third of the Great Barrier Reef and on the Swain Reef cays near the southern end but is restricted to summer months elsewhere. Colonies at Bramble Cay and other Tort-es islands at the northern end of the Great Barrier Reef also appear to have little or no winter breeding. Breeding Crested Terns are constrained to feeding within 20 km of their densely packed colonies and would be unable to forage further away in the event of an oil spill.

Lesser Crested Tern *Sterna bengalensis*

This tern is a summer breeder that is mostly absent from the Great Barrier Reef during winter. A few birds nest on southern cays but most breeding occurs on the northern half of the Great Barrier Reef excluding Torres Strait. Colonies of up to 3000 pairs nest and these large colonies are almost always sited on coral cays in the lagoon though there is wide intra-annual variation between nesting islands. Lesser Crested Terns could be severely impacted by a summer oil spill in the region between Cardwell and Cape York.

Common Noddy *Anous stolidus*

This noddy breeds mainly at the same cays as the Sooty Tern on the northern half of the Great Barrier Reef. A few colonies with many thousands of pairs nest in this region. A few small colonies also nest on southern cays. Periodicity of nesting is irregular or undetermined at most islands but winter nesting is most often recorded off Cape York Peninsula and summer breeding predominates further south.

Black Noddy *Anous minutus*

This tree-nesting noddy nests at a few northern islands but nearly all breeding occurs in summer on the Capricorn-Bunker islands at the southern end of the Great Barrier Reef. It is the second most abundant seabird on the Great Barrier Reef (about 25% of total seabird numbers) and populations could be devastated by a large summer oil spill in the vicinity of the Capricorn-Bunker islands. Birds disperse in winter and very large roosting populations occur on certain northern islands and offshore cays. The Capricorn-Bunker population appears to have increased substantially in recent decades and may be recovering from a catastrophic event in the past (cyclone, epidemic, etc.).

Table 1. Basic seabird distribution patterns across the Great Barrier Reef

		COAST	INNER SHELF	OUTER SHELF	CORAL SEA
Phalacrocorax varius	Pied Cormorant	■	▒		
Hydroprogne caspia	Caspian Tern	■	▒		
Phalacrocorax sulcirostris	Little Black Cormorant	■	▒		
Pelecanus conspicillatus	Australian Pelican	■	▒		
Phalacrocorax melanoleucos	Little Pied Cormorant	■	▒		
Sterna albifrons	Little Tern	■	▒	▒	▒ (a)
Larus novaehollandiae	Silver Gull	■	■		
Sterna bergii	Crested Tern	■	■	▒	▒
Sterna bengalensis	Lesser Crested Tern		■		
Sterna anaethetus	Bridled Tern		■	■	
Sterna dougallii	Roseate Tern		■	■	
Sterna sumatrana	Black-naued Tern		■	■	
Sula ***leucogaster***	Brown Booby		■	■	■
Anous stolidus	Common Noddv		■	■	■
Anous minutus	Black Noddy		■	■	■
Fregata ***ariel***	Least Frigatebird		■	■	■
Fregata minor	Great Frigatebird		■	■	■
Puffinus pacificus	Wedge-tailed Shearwater		■	■	■
Sterna fuscata	Sooty Tern			■	■
Sula dactylatra	Masked Booby			■	■
Sula sula	Red-footed Booby			■	■
Phaethon rubricauda	Red-tailed Tropicbird			■	■
Pterodroma arminjoniana	Herald Petrel			■	■

(a) Identity of breeding Little or Fairy Terns is uncertain.

Table 2. Aproximate seasons and localities where seabirds are most concentrated and therefore most vulnerable to oil spills (Sp - Spring; Su - Summer; Au - Autumn; Wi - Winter)

	Northern Barrier Reef from Torres Strait to the Howick Group				Central and southern Barrier Reef minus the southern cays				Southern cays of the Swain, Bunker and Capricorn Groups			
	Sp	Su	Au	Wi	Sp	Su	Au	Wi	Sp	Su	Au	Wi
Puffinus pacificus												
Pterodroma arminjoniana												
Pelecanus conspicillatus												
Sula sula												
Sula dactylatra												
Sula leucogaster												
Phalacrocorax varius												
Phalacrocorax sulcirostris												
Phalacrocorax melanoleucos												
Fregata minor												
Fregata ariel												
Phaethon rubricauda												
Larus novaehollandiae												
Hydroprogne caspia												
Sterna dougallii												
Sterna sumatrana												
Sterna fuscata					(a)	(a)	(a)	(a)				
Sterna anaethetus												
Sterna albifrons												
Sterna bergii												
Sterna bengalensis												
Anous stolidus					(a)	(a)	(a)	(a)				
Anous minutus												

(a) Michaelmas Cay only

Table 3. Some characteristics of seabird species that might reduce their susceptibility to oil spills

	don't rest on sea or submerge	can fish far from colony or oil areas	intelligent opportune foragers	colonies to east of shipping lane	gone from GREAT BARRIER REEF for part of the year	colonies numerous & widely dispersed
Puffinus pacificus						
Pterodroma arminjoniana						
Pelecanus conspicillatus						
Sula sula						
Sula dactylatra						
Sula leucogaster						
Phalacrocorax varius						
Phalacrocorax sulcirostris						
Phalacrocorax melanoleucos						
Fregata minor						
Fregata ariel						
Phaethon rubricauda						
Larus novaehollandiae						
Sterna Hydroprogne						
Sterna dougallii						
Sterna sumatrana						
Sterna fuscata						
Sterna anaethetus						
Sterna albifrons						
Sterna bergii						
Sterna bengalensis						
Anous stolidus						
Anous minutus						

Great Barrier Reef breeding islands and the numbers of seabird species known to nest are listed below in approximate order of decreasing biomass of breeding seabirds (biomass determined from the highest numbers of each species reported). The list will be expanded when future field surveys provide more information. Islands at the bottom of the list are in most cases insignificant and support only a few nesting gulls. Islands at the top of the list support highly important seabird colonies. The two principal breeding areas are the Capricorn-Bunker Islands and the region off Cape York Peninsula from 1 1°-12° S. As well as Raine Island the latter area includes the Wallace Island region where most eastern Australian Roseate Tern nesting occurs. The location of each island is shown in the last column as a percentage of its distance from the coast to the shelf edge (200 metre contour).

Island	Lat. S	Long. E	Spp. nos	From coast
North West I.	23°18	151°42	3	58
Raine I.	11°36	144°02	15	99
Masthead I.	23°32	151°45	8	50
Heron I.	23°26	151°57	3	73
Michaelmas Cay	16°36	145°59	7	60
East Fairfax I.	23°51	152°22	6	82
Bramble Cay	9°08	143°52	5	39
Sandbank No 8	13°22	143°58	9	98
Tryon I.	23°14	151°49	5	67
Lady Musgrave I.	23°54	152°25	6	79
West Hoskyn I.	23°48	152°18	6	81
MacLennan Cay	11°19	143°48	4	80
Wilson I.	23°18	151°57	7	81
Stapleton It.	14°20	144°52	10	58
Moulter Cay	11°26	144°00	7	99
Eshelby I.	20°01	148°37	4	7
Lady Elliot I.	24°07	152°43	9	90
Wreck I.	23°19	151°59	6	82
Sudbury Cay	16°57	146°08	6	39
Gannet Cay	21°59	152°28	3	83
Davie Cay	13°59	144°27	5	92
Stainer I.	13°57	143°50	6	25
Pelican I.	13°55	143°50	9	30
Rocky Its. (mid)	14°51	145°28	2	38
Turtle No 6	14°43	145°11	4	25
Tydeman Cay	13°59	144°30	4	92
Price Cay	21°47	152°27	7	86
Frigate Cay	21°44	152°25	10	85
Baird I.	12°15	143°13	1	15
Pelican Rk.	22°21	150°15	5	3
Quoin I.	12°24	143°29	7	45
Wallace It.	11°27	143°02	6	16
Combe It.	14°25	144°55	6	49
Taylor Cay	17°50	146’34	5	64
Sandbank No 1	14°12	144°53	3	97
Sand Cay	18°01	146°51	3	87
Sandbank No 7	13°26	143°58	4	97

Bell Cay	21°49	151°15	8	39
Akens I .	22°22	150°16	1	2
West Fairfax I.	23°51	152°22	8	8 1
One Tree I.	23°31	152°08	8	83
Sisters I.	17°45	146" 10	5	8
Thomas Cay	21°39	152°22	5	84
Bird I. (N)	11°46	143°05	7	14
East Hoskyn I.	23°48	152°18	5	83
Cholmondeley It.	11°23	143°03	3	17
Beaver Cay	17°51	146°29	4	55
Ashmore Bank (SE)	11°55	143°38	4	75
Jardine It.	11°23	143°02	3	15
Eagle It.	14°42	145°23	6	40
Riptide Cay	21°14	151°51	3	79
Erskine I.	23°30	151°46	7	54
Chapman I.	12°53	143°36	4	24
Fife I.	13°39	143°43	5	32
Burkitt I.	13°56	143°45	1	18
East Rk.	20°20	148°52	4	2
Bacchi Cay	21°38	152°23	7	84
Sherrard I. (NW)	12°59	143°34	4	21
Magra It.	11°51	143°17	2	18
Cay 10-338	10°46	142°59	4	24
Stephens I.	17°44	146°10	2	7
Sir Charles Hardy (S)	11°56	143°29	2	38
Bylund Cay	21°47	152°25	6	84
Mantaray I.	20°05	148°30	1	c l
Ingram I.	14°25	145°53	1	42
North Reef I.	23°11	151°54	4	83
Saunders It.	I1°42	143°11	4	24
Beesley I.	12°11	143°12	1	15
Restoration Rk.	12°37	143°28	1	2
Sinclair I.	14°33	144°54	1	14
North Brook I.	18°09	146°18	4	28
South Brook I.	18°09	146°18	3	30
Low Wooded I.	15°06	145°23	3	21
Ulfa Rk.	I0°45	142°37	2	1
Sir Charles Hardy (N)	11°54	143°28	2	37
Cordelia Rks.	19°00	146°41	3	16
Morris I.	13°30	143°43	4	34
Gore I.	I1°59	143°15	3	2
Wharton Cay	14°10	144°02	5	31
Pelican Rk.	23°15	150°52	2	3
Don Cay	9°35	144°10	2	83
Calf I.	20°25	148°51	1	<1
Olden Rk.	20°06	148°34	3	1
Sherrard I. (NE)	12°59	143°34	1	21
Three Isles (NW)	15°07	145°25	1	32
Holboume I.	19°43	148°22	3	26
White Rk.	20°18	148°49	3	1
Mackay Reef	16°03	145°39	1	46
Purtaboi I.	17°56	146°08	4	5
Rocky' Its. (E)	14°51	145°29	6	41

I

Two Isles (E)	15°01	145°27	5	26
Sinclair It.	11°07	143°01	2	18
Three Isles (E)	15°07	145°25	3	32
Petrel Islets (mid)	20°12	149°07	1	24
Dove It.	10°00	143°02	4	48
Lloyd Bay Is.	12°45	143°24	2	3
Turtle No 5	14°42	145°12	2	25
Kusamet Is.	10°07	142°05	2	27
Tween Brook I.	18°09	146°18	1	29
Middle Brook I.	18°09	146°18	1	29
Brook Islands Rock	18°09	146°18	1	30
Tern I.	20°54	150°02	3	44
Keppel Rks.	23°26	151°03	2	2
Osprey It.	14°40	145°27	3	56
Creek Rk.	23°12	150°48	2	1
Ridge It.	21°40	149°38	1	7
Booby I.	10°36	141°55	1	17
Albany Rk.	10°43	142°38	2	3
Kircaldie Cay	10°20	142°50	2	30
Kay It.	12°14	143°16	1	22
Turtle No 3	14°44	145°11	1	19
High Rock	14°50	145°33	1	56
Little Fitzroy I.	16°55	146°00	1	12
Eva I.	18°14	146°19	1	25
Bailey It.	21°02	149°33	1	17
Little Grassy I.	20°08	148°36	3	2
Distant Cay	21°06	152°29	3	93
Woody It.	16°23	145°34	3	25
Haycock I.	16°44	145°42	1	4
Nymph I.	14°40	145°15	2	37
Double Cone I. (W)	20°06	148°43	1	6
Manley I.	11°51	143°18	1	20
Two Isles (W)	15°01	145°27	2	23
Ashmore Bank (NE)	11°53	143°38	1	75
Seabird It.	14°42	145°28	3	58
Bray It.	19°15	147°04	1	1
Cullen It.	21°25	149°30	I	6
Irving I.	[illegible]	149°28	1	3
Connor It.	21°43	149°40	1	8
Redbill I.	20°58	150°04	2	44
Edwin Rk.	20°07	148°37	1	3
Bresnahan I.	17°40	146°10	3	4
Peerahmah I.	18°00	146°09	4	8
Channel I.	10°21	142°14	1	20
Esk I.	18°46	146°31	2	20
Nares Rk.	19°46	148°22	2	20
Reid It.	21°22	149°39	1	14
Hannibal I. (NW)	11°35	142°56	3	8
Farmer Cay	12°14	143°13	2	16
Clerke I.	11°58	143°17	2	7
Wolngariu I.	17°58	146°11	4	10
Bush It.	10°43	142°36	3	2
Tuesday No 4	10°33	142°20	2	10

Nob I.	11°57	143°16	2	6
Tuin Rk.	10°13	142°10	1	24
Jaylag I.	10°21	142'07	1	21
Travers I.	10°22	142°22	1	18
Roko I.	10°44	142°25	1	1
East Hope I.	15°44	145'28	1	22
Horseshoe Reef	22°02	152°36	3	87
Milman It.	11°10	143°01	1	17
East Strait I.	10°30	142'27	3	12
Bay Rk.	19°07	146'45	2	6
Conical Rock	15°17	145'20	1	16
Pethebridge I. (E)	14°45	145°06	2	14
MacArthur Is.	11°44	142'59	4	13
Bird I.	20°06	148'52	1	14
Strait Rk.	10°33	142°23	2	10
Waratah I.	21°31	149°43	1	11
Buchan Rock	11°51	143°19	1	20
Bald It.	19°16	147°04	1	<1
Rocky Its. (SW)	14°52	145°28	3	37
Sun I.	22°19	150°14	2	2
Sir Charles Hardy (M)	11°55	143'28	2	38
Channel Rk.	10°33	142°15	3	12
Round Rks. (SW)	23°18	150°50	2	2
unnamed, Repulse Bay	20°29	148°48	1	1
Twenty Foot Rk.	19°12	147°02	1	1
Low I.	20°09	148°35	2	<1
Lowrie I.	13°17	143'36	2	17
Albino Rk.	18°47	146°43	2	34
Upolu Cay	16°40	145'56	1	40
Stone I.	20°02	148" 17	1	1
Turtle No 4	14°44	145°12	2	22
Smith I.	18°02	146°12	1	15
Perry I.	11°58	143°15	1	2
Cay 1 1-034 (W)	11°10	143°05	1	23
Bird I. (S)	11°48	143°05	1	14
Almora It.	20°14	148'46	1	c l
Dalrymple I.	9°37	143°18	1	40
North Direction I.	14°45	145°31	1	52
Infelix Is. (SE)	22°02	149°50	2	8
Albany I.	10°44	143°36	1	1
Little Boydong It.	11°29	143'02	1	17
Forbes Is. (N)	12°17	143'25	1	32
Pelican Rk.	20°48	149°16	1	15
Night I. (N)	13°11	143°35	1	12
Twin I.	10°28	142'27	2	14
Cairncross It. (W)	11°14	142'56	1	9
Pethebridge I. (W)	14°45	145°05	1	13
Fitzroy 1.	16°55	146'00	1	9
Normanby I.	17°12	146'05	1	17
Dingo Rocks	20°05	148'30	1	<1
Pipon I. (NW)	14°08	144°31	2	20
Boulder Rock	14°09	144°29	1	9
Turtle No 1	14°44	145°11	1	19

Brampton I.	20°49	149°16	1	14
Reef It.	21°58	149°36	1	4
Boydong I.	11°29	143°01	1	17
Dido Rk.	18°47	146°31	2	20
Pipon I. (SW)	14°08	144°31	1	20
Buddibuddi Rk.	20°15	149°11	1	26
Hammond Rk.	10°31	142°13	1	15
Coquet I.	14°32	144°59	1	24
unnamed, Conway Bch.	20°29	148°45	1	<1
Edward I.	22°18	150°18	1	4
Henning I. (NW)	20°19	148°56	1	6
Dunk I.	17°56	146°09	2	5
Coombe I.	18°03	146°11	1	13
Bramble Rk.	19°01	146°38	1	11
Russell I.	17°14	146°06	1	17
Russell I. (NE)	17°14	146°06	1	17
Old Man Rk.	12°38	143°27	1	3
Deloraine I.	20°10	149°04	1	21
Pine Its.	21°39	150°13	1	24
Ashmore Bank (NW)	11°53	143°38	1	69
Kodall It.	9°44	143°27	1	51
Wheeler I.	18°02	146°10	1	11
Sail Rk.	18°12	146°09	1	14
Bare It.	19°15	147°04	1	1
Cairncross I. (E)	11°14	142°56	1	9
South Direction I.	14°50	145°32	1	56
Victor It.	21°20	149°19	1	1
Bedarra I.	18°00	146°09	1	6

The Effect of Oil on Birds
- an evaluation of the birds at risk along the Great Barrier Reef and a brief general review of the effects of oil on individuals and populations

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BIRDS MOST AT RISK

All seabirds are not equally at risk from oil po'llution and it is possible to make some predictions about which species will be most vulnerable in a particular area.

For example, although 90 species made up the 30 000 dead birds retrieved from polluted areas following the *Exxon Valdez* spill off Alaska in 1989, relatively few species made up the majority. Eighty-one per cent (24 300) were alcids (murres, guillimots, auks) and 5.3% (1590) sea ducks (Piatt et al. 1990). Similarily, of 12 400 dead birds found affected by oil in a spill off the north-eastern coast of Britain in 1970, 66.1% were alcids and 20.2% were sea ducks (Greenwood et al. 1971). These two groups of birds, together with cormorants (including shags) and divers, are more affected by oil spills than are other groups in the northern hemisphere.

In the southern hemisphere, the groups of birds usually affected are quite different, there being no alcids and few sea ducks or divers. Penguins, gannets and cormorants are the main groups involved in southern Africa (Rowan 1968), and in southern Australia, oil spills in marine areas have effected mainly penguins, but also cormorants, grebes, gulls and some wader species (Jessop et al. 1990, Dann; unpublished data).

The groups of birds more affected by oil spills throughout the world show considerable similarities in feeding techniques and largely belong to two feeding guilds. Therefore, 'by examining the foraging methods of an area's seabirds, it is possible to make some predictions about those most at risk.

Ashmole classified the foraging of seabirds (Ashmole 197 1, see figure 1).

The predominate foraging methods of the birds most at risk are: pursuit diving (southern hemisphere - penguins, cormorants and grebes; northern hemisphere - alcids, seaducks, cormorants and divers); deep and pursuit plunging (gannets and some terns). Surface seizers (gulls in particular) also become involved in some spills. The evidence for the impact of oil on surface plungers (most tern spp.) is contradictory - they have been reported as being attracted to patches of oil while feeding (Boume 1968) but have failed to appear in significant numbers in most oil-spill mortalities.

It is possible to make some predictions about which birds might be most affected in an oil spill along the Queensland coast based on the species present (Walker,-these proceedings) and their feeding behaviour (Marchant and Higgins 1990; Walker, pers. comm.).

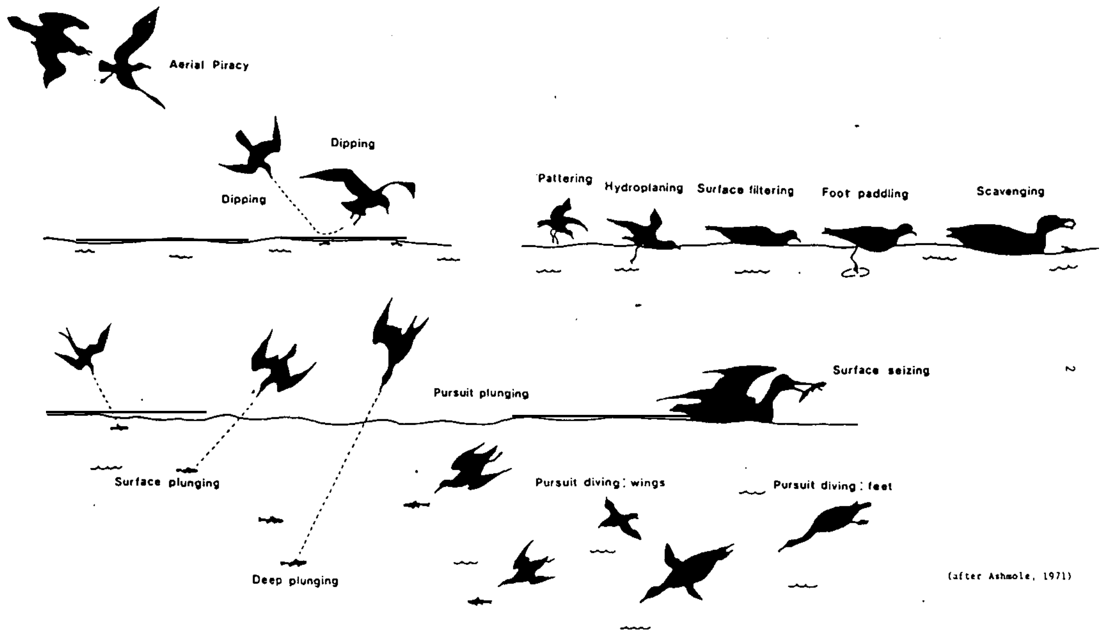

Figure 1. Ashmole's (197 1) classification of the foraging methods of seabirds

Table 1. Seabirds likely to be most at risk of oil contamination along Queensland Coast

Pursuit Divers	Pied, Little Pied and Little Black Cormorants
Deep and Pursuit Plungers	Brown, Red-footed and Masked Boobies, Red-tailed Tropicbirds, occasionally Wedge-tailed Shearwaters, some terns
Surface Seizers	Silver Gulls, Pelicans
Perhaps Surface Plungers	Tern spp.

Once the oil has reached the shore:

Intertidal Foragers	Waders, gulls, some wading birds, breeding birds, Terns, some waders

PHYSIOLOGICAL EFFECTS OF OIL ON BIRDS

The physiological effects of oil on birds varies with the properties of the oil. The volatile fraction of petroleum oils evaporates in the initial stages of the spill and weathering brings about a further physical change whereby the continous liquid layer breaks up into smaller patches of 'mousse'. Mousse is much thicker oil which has been whipped up by water and wind action.

The lethal effects of oil on birds fall into four categories:

1. Asphyxiation
2.. Immobility
3. Poisoning
4 . Hypothermia

1. Asphyxiation

Saturation of the air immediately above the water with the volatile component of the oil can cause death through lack of oxygen. Post-mot-terns' reveal extremely oedematous or 'wet' lungs and death occurs rapidly (Harrigan, pers. comm.). This type of mortality is more common with the more refined and volatile oil products. Few, if any, birds affected in this way reach the shore alive and are therefore are unlikely to require rehabilitation.

2. Immobility

Coatings of thick oil can cause immobility and/or loss of water repellancy and the birds subsequently drown or are consumed by predators. Most of the live birds that wash ashore during a spill are affected in this way and suffer the two following complaints to varying degrees.

3. Poisoning

Oil ingested at sea or from preening after being oiled can cause poisoning in the short or long terms. Ingested oil may result in renal and hepatic failures, pneumonia and enteritis. In 1990 several penguins died at Phillip Island some months after being oiled and cleaned and post-mortems showed that the long-term effects of oil ingestion were the probable cause of death. Their livers were three to four times the average size and showed large black concentrations along the distal margins suggesting considerable hepatic damage. Most of the live birds that wash ashore covered in oil will suffer some degree of poisoning which will be exacerbated if precautions are not taken. Quick removal of the oil or the use of cloth 'ponchos' to stop further oil ingestion will minimise this risk.

4. Hypothermia

Increased heat loss occurs because of damaged plumage and compensatory increases in metabolic rate and lack of feeding result in accelerated starvation and rapid death by hypothermia. Irritation of the skin increases vascular activity and further increases heat loss (Harrigan, pers. comm.). It is important that the birds be kept warm before and after cleaning until the insulatory properties of the plumage are restored.

Non-petroleum oils can have lethal consequences also e.g. 1800 L of rapeseed oil was spilt in Vancouver Harbour in 1987 and 88 birds were apparently affected (Anon, 1990a). However, there was no recorded seabird mortality associated with a spill of c. 100 tonnes of coconut oil in Port Phillip Bay in 1990 (Dann, pers. obs.).

SECONDARY EFFECTS

Mortality can occur during rehabilitation due to shock and fungal, bacterial and viral infections. For example, during the rehabilitation of 30 penguins from an oil spill in 1989 at Portland in western Victoria, all birds died after contracting salmonella (Victorian Department of Conservation & Environment, unpublished data). It is important to monitor the health of the birds during rehabilitation so that steps can be taken to arrest infections. in addition, it is crucial to ensure that the risks of infection are minimised through proper husbandry.

There are also a variety of secondary effects which can follow even light oiling of birds and a few of these are:

A. An inhibition of acetylcholinesterase activity (Hartung and Hunt 1966) causing unco-ordination which may result in reduced feeding or anti-predatory behaviour.

B. A reduction in breeding success (Ainley et al. 1981; Coon et al. 1979).

C. Predators may feed on oiled birds and subsequently die either from poisoning or being oiled while feeding. This was a serious problem for Bald Eagles during the Exxon ***Valdez*** spill.

EFFECTS ON POPULATIONS

Oil can be released into the sea from a variety of sources: accidents with ships and oil-rigs, bilge flushing, land storage operations and natural seepage. The relatively infrequent, large spills attract the most attention but it appears that the cumulative effects of the often undetected, smaller spills may be cause for concern also.

MINOR SPILLS

Figure 2 illustrates that there have been many incidents of penguins being oiled along the Victorian coast during the past 23 years (1.4 occasions per annum) but only a few large oil spills have been identified during that period. In fact, oiled penguins are often the first indication that there is an oil slick in the area. The sources of information on oiled penguins have increased in recent years and this may have been responsible for the apparent increase in incidents.

It is difficult to evaluate the effect of these sorts of spills on populations around Australia but it is probably slight in general. However in some circumstances, the consequences can be severe. For example a small spill in Portland Harbour, Victoria in 1989 resulted in the deaths of 40% of the small population of penguins (c. 100) that bred there (Victorian Department of Conservation & Environment, unpublished data). Such localised effects could be catastrophic for restricted or endangered populations.

In some areas these small spills are so numerous that they may have more significant consequences. It was estimated that about 25 000 seabirds were covered by oil from illegal dumping off the coast of Newfoundland in the first six months of 1990. This estimate was based on the 2500 birds actually recovered. The Canadian Coast Guard have found that some ships dump oily bilge water at sea to avoid the expense and time-consuming process of waste removal in port (Anon. 1990b). This practice is a likely source of the minor spills in Australia also.

Even with relatively small spills, the interaction between the birds and oil can last for many days and therefore requires repeated beach patrols to ensure that all the affected wildlife is found. Figure 3 shows the period during which live penguins were recovered in a spill near Phillip Island in 1986 (a spill which was so small it was never located). Oiled live penguins were collected over a period of nine days and dead birds washed ashore for more than two weeks.

Frequency of separate incidents Involving oiled penguins In Victoria.

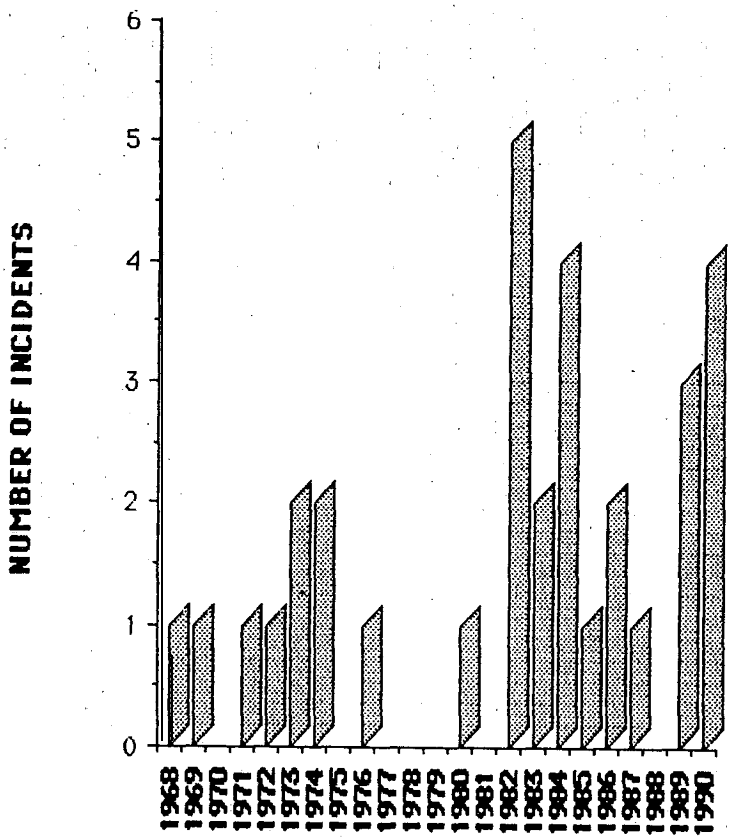

Figure 2. The frequency of known incidents involving oil and penguins along the Victorian coast between 1968 and 1990. An incident was defined as an occasion when one or more oiled penguins were found ashore either alive or dead more than a month since the last oiled bird was reported.

Number of oiled penguins found daily during June, 1986.

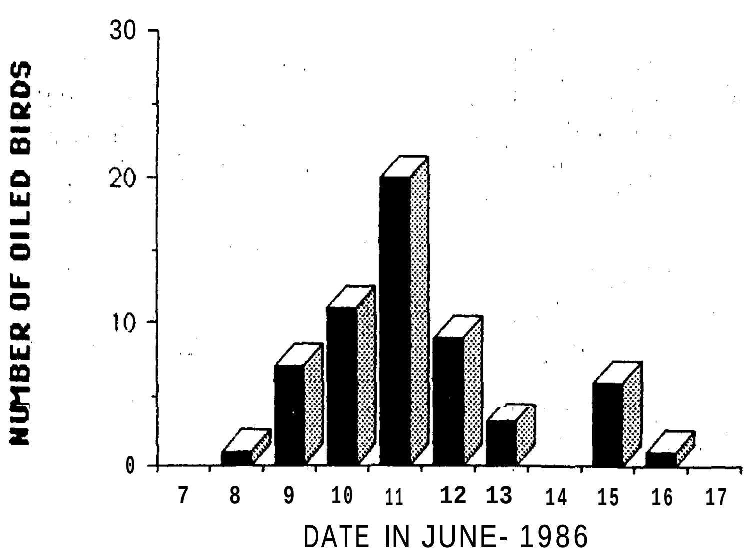

Figure 3. Number of oiled live penguins found daily during June 1986

MAJOR SPILLS

Major spills of the scale of *Exxon Valdez* or of the 1991 Persian Gulf disaster seem far more likely to have significant influences on populations. Table 2 shows the numbers of birds found dead after some major oil spills in the northern hemisphere. It is important to note that these figures do not represent the full extent of the mortality because many oiled birds are not retrieved. Estimates of the percentage of affected birds washed ashore after a spill range from 0 *to* 59% (Hope-Jones et al. 1978; Bibby and Lloyd 1977).

Table 2. The total numbers of birds found dead after some major oil spills in the northern hemisphere

OIL SPILL	NUMBER OF BIRDS	SOURCE
Torrey Canyon	c. 10000	Smith 1968
NE Britain	12 400	Greenwood et al. 1971
Amoco Cadiz	4 572	Hope-Jones et al. 1978
Exxon Valdez	30 000	Piatt et al, 1990

The central question is: Is the mortality caused by oil spills additional or compensated for? i.e. does density-dependent mortality decrease as a consequence of the spill thus allowing the population to increase and return to its previous level. In most cases there are insufficient data available to answer this question. Despite the large numbers of seabirds killed, it is not usually possible to assess the long-term effects of most large spills because it is necessary to have population estimates preceding the events.

Even when population estimates are available, population regulating mechanisms and life history parameters may further mask the effects of oil pollution. Most seabirds have relatively low reproductive rates and so recovery from environmental disasters is slow. Despite this, some British seabird populations have continued to increase despite high mortalities from oil pollution, while others have declined sharply in association with very poor reproductive success which was possibly related to more to food shortages than oil pollution (Dunnet 1982). However Clark and Kennedy (1968) noted that ‘despite the lack of conclusive evidence, it is clear that the high level of oil pollution at sea has serious immediate and long-term effects on a number of species of seabird’. Piatt et al. (1990) stated that populations of alcids may fully recover from the *Exxon Valdez* oil spill in 20-70 years but that it may prove difficult to identify sources of population variability beyond the first year. The lack of information on the long-term effects of large spills highlights the need for long-term population monitoring in areas considered to be of high risk of oil spillage.

Acknowledgments

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Emergency Care for Birds at Lake Liddell Oil Spill

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ABSTRACT

In September, 1990 at least 10 000 litres of diesel spilled into a cooling lake at Bayswater Powerstation in NSW. Taronga Zoo staff were requested by NPWS to attend the emergency treatment of birds on site. This paper outlines the emergency treatment given and provides recommendations for possible future oilspills.

The following species were given emergency treatment:

- Pied Cormorant
- Little Black Cormorant
- Black Swan
- Black Duck
- Crested Grebe
- Little Grebe
- Australian Coot
- Dusky Moorhen
- Australian Pelican
- Eastern Swamp Hen

Approximately one hundred and forty birds were transported to Sydney for cleaning and rehabilitation while 5 1 were immediately relocated and released and 54 were found dead on site.

Only black swans were released after rehabilitation; no other birds survived.

INTRODUCTION

At least 10 000 litres of diesel accidentally leaked through a retaining wall at the NSW Electricity Commission's (Elcom) Bayswater Power Station on 18.9.90. The diesel spilled into Lake Liddell which is the principal cooling water dam for the power station. Late on the following day Taronga Zoo received a request from the New South Wales National Parks & Wildlife Service for assistance with emergency treatment for affected birds, but actual treatment did not commence until early on 20.9.90.

Approximately one hundred and forty birds were transported to Sydney for cleaning and rehabilitation while 5 1 were immediately relocated and released and 54 were found dead on site.

PROCEDURES

1. Emergency hospital

An emergency hospital was set up as a first priority and was established well away from the main activity and noise of vehicles and boats to avoid further stress to the birds. The treatment room consisted of the back of a tabletop truck which was later shaded by a tarpaulin. A tent was also erected later to store the birds boxed for transport. Requests for equipment such as plastic gloves, goggles, sun hats, sun cream, soap, water, rags, paper towels etc. were met by Elcom staff without delay.

2. Handling

Birds were retrieved from reeds and water by Elcom and NPWS staff, either on foot or by boat. Some NPWS personnel were experienced bird handlers, but overall handling experience was low. Birds were then placed in hessian bags by retrievers and taken to the emergency hospital.

3. Treatment

Triage was applied to all patients as follows:

i) Reasonable chance of recovery of rare species, treat first.
ii) Medium chance of recovery, treat as second priority.
iii) Poor chance of recovery, treat last.

and euthanasia was provided to a small number of birds which were obviously close to death.

a) Removal of diesel

As much diesel as possible was removed from the birds' feathers by running hands firmly down the body of the birds and wiping with towels, wiping down the bill and cleaning the nostrils with a clean rag. Nearly all birds requiring treatment were completely drenched with diesel, had severely inflamed eyes and skin.

b) Eyes

All birds; eyes were wiped with a clean rag and an anti-inflammatory and antibiotic ointment applied.

c) Oral fluids

Oral fluids were given for dual purposes; they help flush out toxins and counteract the dehydrating effect of the diesel. We administered to each bird a volume of fluid which varied with the size of the species. Fluids were given until it could be seen welling up in the throat, the tube was then gently removed and the birds given the opportunity to discard excess.

d) Corticosteroids

Dexamethasone was administered at the appropriate dose rate for each species. This treatment is believed to assist the body in combating stress.

e) Taping bills

Prior to boxing for transport, the birds' bills were taped with masking tape to prevent preening and further ingestion of fuel. Of course, care was taken not to cover the nostrils.

f) As only two veterinary staff were available it was decided to speed up the treatments. It would have been preferable to take temperature'and weight for each patient.

4. **Records**

Elcom supplied a records clerk, in order to be able to keep an accurate record of treatment for each bird. Each bird was given an arrival number and the following details were recorded:

Species ,
Triage
Amount of fluid given
Eye ointment used
Amount of oiling
Amount of corticosteroids
Special reference was made to cygnets being found with adults, so that they would not be separated.

5. **Boxes**

Cardboard boxes for transport measuring approximately 60 x 60 x 80 cm were supplied by Elcom and assembled by Elcom staff.

Large ventilation holes were made in the boxes in each of the four sides and the boxes were lined with thick paper towelling but they still became unstable after very wet animals were inside for some time.

6. **Transport**

Taronga Zoo staff recommended that cleaning facilities were sought nearby to avoid prolonged transport due to the weak condition of most birds. However, transport arrangements had already been made and birds were transported to Sydney, approximately a four-hour drive. One truck departed to Sydney 20.9.90 and another one the following day. In some cases birds would have been in boxes for almost 24 hours. Birds held for long periods were tubed with fluids again whenever possible prior to transport.

Most birds arrived in Sydney in a dehydrated and hypothermic state.

7. **Cleaning**

The authors were not involved in the cleaning process as they remained at the spill site, but following is a brief account of the cleaning procedure at Taronga Zoo:

Birds were washed in subsequent baths of warm water (40.5°C) with a detergent solution.
Patients were then rinsed and placed in drying rooms with heaters maintaining an ambient temperature of approximately 28°C.

DISCUSSION

Most birds died within 24 or 36 hours of arrival, both in the R.S.P.C.A. and Taronga Zoo facilities.

Post-mortem results at Taronga Zoo showed signs of severe dehydration in all deaths.

Each segment of the emergency procedure is listed below and recommendations for future reference are given.

Emergency hospital

Although the hospital was initially established at a site well away from the main activity of the rescue operation it became a focal point in its own right. The site was chosen to reduce noise stress on the patients but seemed to attract all workers during their break. Later the SES erected two big staff tents next to the hospital while vehicles tended to stop and slam doors next to the treatment area.

The initial lack of shade also posed a problem not only to workers but to the patients as well. Birds retrieved from the spill site were placed in hessian bags while awaiting treatment. During this waiting time they were often in bright sunlight as no shade was available. As much as possible the shade cast by the tabletop truck was used but this was not enough for the large number of birds. Also during the treatment stress would have increased the birds' temperature which would have been exacerbated by direct sunlight.

It would be recommended that shelter from the elements for the hospital site is provided as soon as possible, while noise levels are kept to minimum.

The on-site construction of holding pens where birds can be held prior to transport may also be beneficial.

Handling

Most workers on the site were unfamiliar with handling birds. It would be an advantage to develop a handling manual for rescue processes and/or have several verbal demonstrations during the rescue operations:

Treatment

Perhaps more veterinary assistance would have allowed for taking of temperatures and weights which would have helped to assess the birds' condition more accurately and helped to further assess the impact of transport.

Records

Unfortunately record keeping was inadequate. The records people frequently changed and they varied in their ability, to keep records. One or two people experienced in taking notes are essential.

Boxes

As described, cardboard boxes were inadequate as they disintegrated with moisture and oil and did not allow for sufficient ventilation. Animals would be better transported in individual wire cages in an air conditioned truck or plane.

Transport

Long distance transport was possibly responsible for the poor survival rate. It is recommended that treatment centres are set up as close to the spill site as possible to avoid transport-induced hypothermia or hyperthermia and dehydration. Volunteers could be trained and supervised to receive, clean and maintain birds after emergency treatment on site.

Safety

Several workers suffered from skin rashes due to contact with diesel. Two people received 'an eyewash at the veterinary hospital for diesel in the eye, while the authors suffered from 'nausea, headache, sore throat and runny eyes during the rescue operation.

Exact information on the possible effects of the pollutants on humans should be available on site and safety precautions taken.

CONCLUSIONS

Oil affected birds can be successfully treated, rehabilitated and released (Frink 1987; Lauer et al. 1982; Jones 1982) as our experience in Taronga Zoo has shown. Over the years we have successfully treated individually oiled birds of various species, most of which were later able to be released. There are difficulties associated with on site treatment facilities. However, the experience at Lake Liddell has placed all those involved in a better position to make a valuable contribution to this developing field of expertise. Very much needed now is the development of manuals on handling the different species of birds, cleaning procedures, husbandry, housing, and diet and release guidelines for all bird species likely to be affected by oil spills.

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Management of Wildlife Operations

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Introduction

The management of wildlife rescue operations should be no different to the management of any other type of incident.

Conservation agencies are responsible for managing a variety of incidents, including fire control, search and rescue, cetacean strandings, pollution events and storm damage clean-up. The management of each of these incidents differ in their objectives and tasks, but the processes for their management are the same.

Management has four processes (Stoner et al. 1985):

- planning
- organising
- leading
- controlling

Only the planning and organising processes are pertinent to this workshop, and will be discussed. The leading and controlling processes come into effect during the operations of an incident.'

I refer to pollution events thoughout this paper. This is because I believe that the planning discussions engaged in here today are pertinent to the range of pollution events that occur. And secondly, I regard the rescue of and rehabilitation of wildlife as part of the overall operations associated within a pollution event.

Planning

Planning is defined as the development of objectives and policies, and the setting up of procedures to achieve those objectives and policies.

The development of contingency plans has four requirements:

- the. identification of the risk;
- identifying the authorities that would be involved in managing the event;
- developing the cooperative arrangements between the different authorities.; and
- developing procedures in-house (Brookhouse 1990b).

Identifying the risk

The committment by the Great Barrier Reef Marine Park Authority to developing a contingency plan highlights the preceived risk of a major marine pollutionevent.

However, it is still worthwhile looking at the broad factors to assess risk. For pollution events these are:

- the environmental values and wildlife at risk from pollution;
- the history of pollution events in the subject area;
- potential sources of risk - storage facilities in the catchment of reserves and other significant conservation sites;
- potential pollutants - what are in those storage facilities;
- transport routes through the reserve or waterways adjacent to the reserve;
- potential pollutants transported; and
- the resources available for containment and clean-up operations (Brookhouse 1990a).

The level of planning required is determined by the likelihood of an event occurring, and its potential severity.

Identifying the authorities that would be involved in managing the event

Various authorities are empowered by legislation to be responsible for the management and integrity of different facets of the social and physical environment.

A number of authorities may have a legal or moral responsibility to be involved in an incident.

A review of all pertinent legislation is essential. In the case of the Reef, the review must take in both state and commonwealth legislation. This has already been done with the publication of REEFPLAN.

REEFPLAN is the umbrella document for managing pollution on the Great Barrier Reef. It describes the basic responsibilities of the various agencies, and the command for an oil spill.

Developing the cooperative arrangements between the different authorities

The effective management of pollution events must ensure that the statutory requirements of all the 'interested' authorities are met.

Clarification of the roles of each authority, and the in-charge arrangements for the facets of the operations are necessary perquisites.

The term to describe these arrangements is 'cooperative arangements'.

The participating organisations are the 'cooperating agencies'.

Failing this, disputes can arise, operations can become mis-managed, efforts duplicated and brawls erupt in the media.

The NSW National Parks and Wildlife Service's experience in fire control has shown that cooperative arrangements between authorities are necessary for the management of fire operations. District fire committees have been established in local government areas, and now provide an effective forum to develop these arrangements.

The issues that must be addressed in the cooperative arrangements for all pollution events are:

- the appropriate in-charge arrangements for various land tenures and different types of pollution events;
- management requirement for different tenures;
- the command structure to be used for managing an incident;
- immediate advice of pollution events within the catchment of reserves and conservation sites affecting or likely to affect significant wildlife populations;
- call-out arrangements;
- disposal arrangements;
- resources available for clean-up operations; and
- debriefing after joint operations (Brookhouse 1990a).

The product of developing cooperative arrangements should be the preparation of a *plan of operations* for all cooperating agencies to work by.

Developing procedures in-house

The development of procedures must ensure consistency by an organisation in the approach for managing events.

Therefore, procedures need to developed on a state level.

The level of preparedness will vary according to local conditions. Therefore procedures'must be prepared at the regional and districts.

State-wide planning requires the preparation, of a manual which includes:

- sections of legislation pertinent to pollution events
- glossary of terminology used
- procedures for various pollution incidents
- planning procedures
- containment techniques
- material used in clean-up operations
- Incident Control System

Regional planning requires the preparation of procedures and information which include:

- rostering of regional duty officers
- *resource atlases* for areas within the region

- contact lists for key personnel in the cooperating agencies and important resources

District planning requires the preparation of procedures and information which includes:

- call-out procedures
- cooperative arrangements with locally based organisations
- schedule of equipment
- *resource* atlases for areas within the district
- risk analysis for conservation areas and other important sites
- contact lists local personnel in the cooperating agencies and important resources

The presentation of the documents is very important. It should be always remembered that most personnel will not read these procedures until an event occurs.

Some tips in presentation are:

- don't use complicated flow charts to describe the decisions to be made for the course of the whole operation, the lay-out of the procedures should be concise and clear enough;
- prepare a simple flow chart which presents only the initial actions to be taken when-an-incident-is-reported,_and.put_itn*ear the front;
- all information must be accessible, therefore it must brief and divided into clearly identified sections and subsections;
- group information, policies and procedures into sections according to subject (see diagram 1);
- do not cross reference, if the same policy or procedure is appropriate to more than one subject area, repeat it in each appropriate section;
- prepare the document in a loose leaf folder format, this allows for the easy updating of superseded information; and
- have a good table of contents and index.

A guiding principle in the preparation of procedures is that they should provide guidelines to the personnel managing and carrying out the operations, and not satisfy the needs of planners and specialists. They should describe the best way of managing resources within the constraints that incident managers will be working. Conservation guidelines should be built into the procedures.

Some tips for developing the procedures document are:

- use a small committee that is representative of the organisation's expertise to develop the working draft;
- to get review comments, don't send numerous draft copies out with a request for comments, organise a workshop to review the draft and finalise the document during the workshop; and

- get the document out; a few typographical errors and draft sections are better than managing an incident without procedures.

Organising

Organising is the development of structures to achieve organisational goals, and in the case of incidents, to manage the incident. The effectiveness of incident mangement relies heavily on the command structure that is put into place.

Staff preparing contingency plans in the past have spent a great deal of time defining the necessary positions within a command structure, along with their roles.

A restricting attitude of the past was that each type of incident was unique, requiring a command structure that reflected the incident's characteristics.'

Regardless of the type of incident, four functions are common in incident management (Carlson 1983):

- control - overall management
- operations management - implementing strategies and tactics
- planning and intelligence - collecting, evaluating and disseminating information about the incident, resources committed and available to be committed
- logistics - provision of support services

Essentially, the only 'difference between incidents are the tasks, the operations, that need to be performed.

These four functions form the basis of the Incident Command System.

Incident Command System

The Incident Command System is a component of the U.S. National Inter-agency Incident Management System (NIIMS) which was developed to provide a common system that fire agencies can utilise at the local, state and federal levels.

The Australian versions are currently being introduced by the Autralian Association of Rural Fire Authorities, to be known respectively as the Incident Control System and the Australian Inter-agency Incident Management System. (AIIMS).

The Incident Command System (ICS) is a command structure that is appropriate to the management of any incident: It lists all the possible positions required to manage an incident, and their reponsibilities. Diagram 2 illustrates the full command structure of the ICS. Diagram 3 illustrates an abridged command structure appropriate for wildlife operations.

The cornerstone of the system is the method of implementation. The structure grows from the top down with the appointment of an Incident Controller. The four functions of control, operations, planning and logistics must be considered from the commencement of any operation. The number of people required to perform each function is dependant on the requirements of the incident. Responsibilities are delegated down when the responsible officer cannot attend to each duty in sufficient time. This means that the incident defines the number of personnel required, and not a predetermined format which defines at which stage the incident is at.

Another important characteristic of the system are the incident management teams. An incident will have a different team for each shift. This ensures that the leadership can sustain all the requirements of a lengthy operation. This is an important lesson from fire operations. Fire controllers in the past felt compelled to keep working until they dropped. One could question their suitability to be in charge of the safety of fire fighters after 72 hours.

Command structure for wildlife operations

A command structure for wildlife operations is illustrated by diagram 3.

For most marine pollution incidents, the conservation agency will not be the authority in-charge of the pollution control operations.

The wildlife operations will be part of the overall pollution operations, and part of the overall command structure.

The Controller (Wildlife Operations) will need to report to the Incident Controller for the pollution event.

The Operations Section has two distinct tasks: capture of wildlife and the treatment of wildlife. A Sector Commander can be appointed to be in charge of each task.

In developing your command structure, the ICS forms a sound basis. Very little really needs changing from the model.

The Department of Conservation and Environment (Victoria) adopted the ICS for their Large *Fire Organisation* document. For each position, the listed duties became primary duties with more fire specific duties listed underneath.

In NSW, we have unashamedly taken up their *Large Fire Organisation*, and included it in our *Fire Management Manual,* and entitled it the *Incident Control System.* In developing the *Marine Mammals Management Manual,* the fire specific duties will become whale stranding specific duties.

The major benefit of the adopting the ICS is that staff can apply the system to any incident. However, training in using the Incident Command System is important. A good way of doing this is encouraging the field managers to use this system in day-to-day operations. So when the big event happens, their management of operations will be more effective.

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31.0 Prescribed Fire

31.1 Introduction

31.1.1 Prescribed fire is intended to bum within predetermined control lines and at a predetermined intensity.

31.1.2 A prescribed fire may be used to reduce fuel levels for hazard reduction,' to manage species or for experimental purposes.

31.2 Policy

31.2.1 Prescribed fire will be used to achieve Service management objectives and responsibilities.

31.3 Procedure's

31.3.1 Each District should progressively prepare procedures for prescribed fire.

3 1.3.2 The procedures should include:

- a schedule of appropriate authorities to contact, including:
  - * fire authorities
  - * Police
  - * Road Traffic Authority
  - * State Rail Authority
  - * State Pollution Control Commission
  - * electricity supply authorities
  - * public utilities
  - * concessionaires
- appropriate action for public notification.

31.313 Environmental Impact Assessment procedures will be carried out as part of the planning for prescribed fire operations.

31.3.4 All prescribed fire operations should be planned in cooperation 'with the appropriate and relevant authorities.

31.7.5 Other authorities undertaking approved prescribed fire operations within Service areas must notify the Senior Duty Officer at least 24 hours before the commencement of the bum. The burn must be an approved fuel management work.

31.7.6 A Service officer shall present during all prescribed fire operations undertaken by another authority on Service areas.

31.3.7 The Superintendent should ensure that procedures for the notification to the Service of prescribed fire operations outside reserves are contained within any co-operative plan of operations.

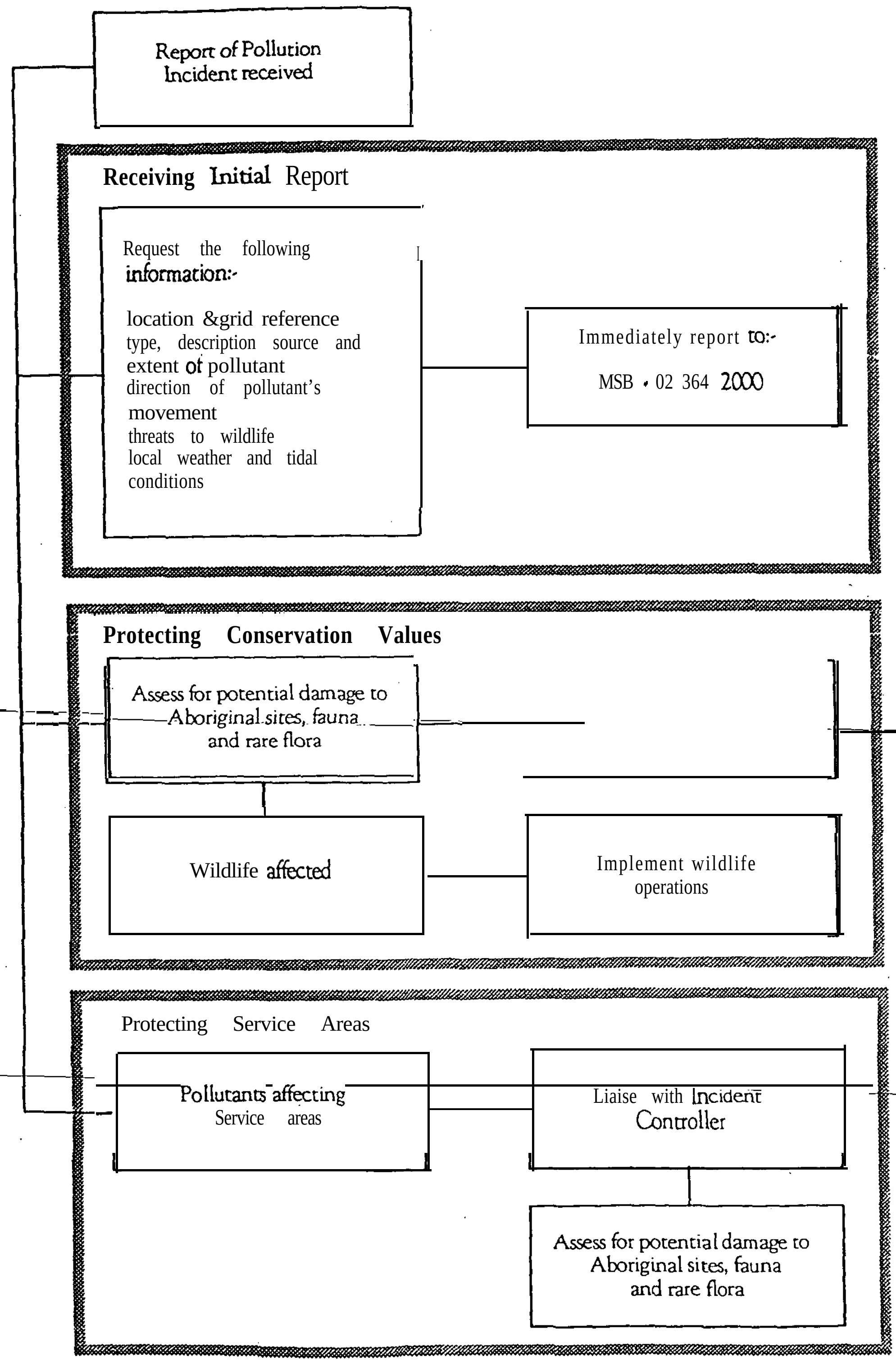
NSW NATIONAL PARKS AND WILDLIFE SERVICE

Diagram 1 Information, policies and procedures grouped into sections according to subject

Central Region

Marine Pollution

Immediate Actions



NSW NATIONAL PARKS AND WILDLIFE SERVICE

Diagram 2 Full command structure of the Incident Command System (ICS)

Command Structure
Wildlife 'Operations

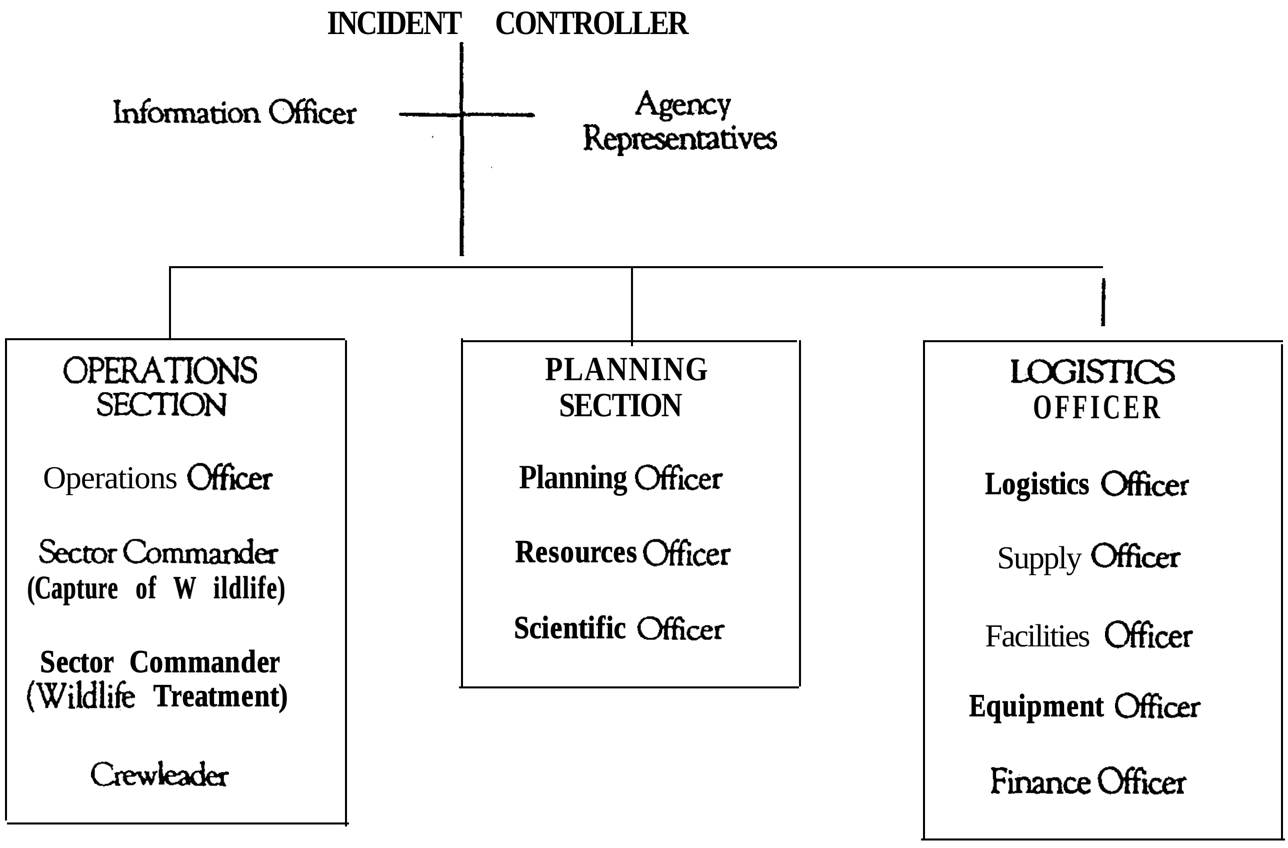


Diagram 3 Command structure for, wildlife operations

MATERIAL SUBMITTED

Rescuing Oiled Seabirds

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These are personal views and are not the official opinion of the NSW National Parks and Wildlife Service.

LESSONS TO BE LEARNED FROM THE LAKE LIDDELL OIL SPILL

What and where was the Lake Liddell Oil Spill?

Lake Liddell is in NSW on the road between Musswellbrook and Singleton. It is a large freshwater lake beside ELCOM electricity generating plant (the waters are used for cooling in the power plant). Waterbirds, which include Grebe, Swans, Coots, Ducks, etc. are prolific.

On 18 September 1990, while pumping distillate from one holding tank to another, several thousand litres (the exact figure was elusive) leaked into an emergency containment reservoir (which failed to hold it) and thence into the lake.

While ELCOM officials contacted NPWS swiftly there was much that could have been done to prevent the situation from worsening.

What was done?

A series of containment booms were placed across the lake at intervals away from the point of discharge into the lake. Oil was skimmed from the Lake by various means. Absorbant mats were also used.

The NSW National Parks and Wildlife Service undertook a series of forays using several small boats onto the lake over a number of days (approx. 7) collecting birds and returning them to veterinarians from Taronga Zoo. These vets treated the birds on the shores of the lake in a makeshift field hospital, from which the birds were transported where necessary in boxes to another rehabilitation centre at least 3 hours away.

Some of the healthy birds that were caught were transported to another nearby lake.

What aspects were poorly managed and how could these have been improved upon?

1. Finding a suitable method for cleaning up distillate effectively. While containment booms were quickly set into place there was still leakage from these and this situation was not monitored carefully enough. Absorbant and.dispersing material was not made sufficiently available to decrease the likelihood that more and more birds would not be affected. The clean-up was generally slow. It would appear that a product known as SANSORB is highly effective and relatively non-toxic.

2. Person-power was poorly.distributed. Too many people were involved in chasing birds and not enough helping with the clean-up itself. Some chasing of birds was unnecessary, e.g. unaffected birds, swans in moult, nesting, and cygnets that could not fly anyway.

3. In the worst affected area (a small bay in a comer of the lake) some manipulation of the reed beds (e.g. burning or slashing) could have occurred to prevent waterbirds from returning and retreating into these oily areas.

4. As a general rule (as gleaned from the literature) the more highly processed crude oil is, the worse the effect for birds, so that chemicals such as distillate which are tapped from well up the fractionation column are more lethal than crude oil itself. Usually chemicals such as distillate affect respiratory organs. Smaller birds are always more at risk than larger birds. Thus the protocol should have been to treat small birds last, to avoid keeping birds for long periods in boxes and to have minimised transportation.

5. All birds that were caught should have been banded, particularly affected ones, so that some monitoring of effects and success could have taken place.

6. Birds were kept in boxes for too long. Some closer rehabilitation centres should have been found.

7. Following capture, some birds, particularly swans, had their necks kinked. The hessian sacks used to hold birds in transit from the lake to the makeshift hospital became fouled with distillate and this further affected rescued birds detrimentally.

P.S. For the huge investment of person-power only a handful of birds were saved in the end and it is unknown what the survival rate of translocated birds was.

A PROTOCOL FOR DEALING WITH OILED SEABIRDS

PRIORITY 1

Minimise risks to human safety then initiate containment of the spill! More long-term benefit will be gained by minimising the spread of the problem. Maximum person-power investment required. Use local knowledge of current patterns, seabird distributions, etc. to strategically target the problem. Monitor the situation carefully.

Resource requirements:
Oil containment booms, Sansorb products (powder, booms and mats).

PRIORITY 2

Catch and transport injured birds.

Capture
Usually best undertaken from a small dinghy. Collect birds that are affected first. Concentrate on those obviously least stressed. Large birds should be collected before smaller ones. Some attention should be paid to the status (endangered, rare or whatever) of the bird. Preferably have an experienced 'birdo' and bird handler with each round-up team. At Lake Liddell we simply caught affected birds by hand from a small boat or in the case of the more mobile birds we had to chase these and then use a catch net on a pole.

As a first aid procedure wipe the bill free of oil and place the bird into a quiet and dark place. Avoid stressing birds by placing-in sun, subjecting to loud noise, etc. If using hessian sacks to hold birds then make sure these are clean or thoroughly rinsed. Do not lie birds in sacks on top of one another as this could lead to asphyxiation!

Resource 'requiremknts

Hand held nets on a long pole (or poles of varying length may be useful), ponchos (to prevent birds from preening oiled plumage), towels, cardboard boxes with holes, or hessian bags.

Transportation

Return of birds to some initial treatment site should be undertaken as soon as possible. Avoid keeping birds in the bottom of the boat for long periods as they'will overheat'. Long distance travel should be avoided to prevent excessive peribds in confinement. Use.suitable transportation (e.g. helicopter if necessary, but remember noise stresses birds) or set up bird hospitals in strategic locations on-site if possible. If the spill is localised then dinghies fitted, with outboard will be appropriate.

A computer-based inventory of boats available, nearby ports, holding and treatment facilities is required.

PRIORITY 3

Assess and sort birds at the initial treatment site (i.e. makeshift hospital) according to the extent to which birds are affected. Perry et al. (in prep.) provide categories for sorting. Euthanasia in some cases is necessary and probably the most humane course of action.

PRIORITY 4

Emergency treatment. Provide fluid therapy (e.g. Lectade orally, 50 mL per kg of bird),, administer eye ointments if necessary, cortisone for shock, wipe off excess oil, prevent the bird preening itself by providing ponchos, rub feathers with SANSORB or other oil absorbing powder.

Avoid further transportation where possible although some birds may need to be moved to allow further treatment.

PRIORITY 5

Longer term rehabilitation for hopeful cases. See Perry et al. (in prep.), BOC 1989, Tri-State Bird Rescue (198?) and others.

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The principal organiser of the workshop was Steve Raaymakers of the Great Barrier Reef Marine Park Authority. Further information on any aspect of this report, of the workshop, or on oil spills in the Great Barrier Reef Region in general may be obtained from:

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