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REPORT NO 2 - 1978

PROGRAMME TO ASSESS THE ECOLOGICAL EFFECTS OF OIL SPILL IN COASTAL AREAS OF NORWAY

Forskningsprogram om Havforurensninger

The Norwegian Marine Pollution Research and Monitoring Programme

C.M. 79/E:70

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PROGRAMME TO ASSESS THE ECOLOGICAL EFFECTS OF OIL SPILL IN COASTAL AREAS OF NORWAY

The Norwegian Marine Pollution Research and Monitoring Programme
Wergelandsveien 15, Oslo 1, Norway
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PREFACE

During the first days of the "Bravo" blow-out in the spring 1977, professor John S. Gray of the University of Oslo worked out on behalf of The Norwegian Marine Pollution Research and Monitoring Programme (FOH) a draft plan on the role of marine biologists in the case the oil reached the coastal area of Norway. The draft plan was subsequently discussed in an ad hoc group of FOH, presented to the steering committee of FOH, and after beeing adopted offered to the "Action Command".

The "Action Command" is a governmental body which is immediately called upon in the case of major oil spill in Norway. The "Action Command" consists of four named members and is the authority in charge of all operations in this event and has also been responsible for the preparation of the contingency plan. The "Action Command" has within its organization a number of executive and advisory groups, out of which the "Marine biological advisory group" constitutes one.

The "Action Command" responded positively to the draft-plan presented by FOH and according to its decision FOH was asked to finalize the plan. At the same time it was made clear that the "Marine biological advisory group" shall cover "all types of water". This means in practise that FOH will cover the coastal areas, whereas the Institute of Marine Research (IMR), Bergen, covers, "open ocean waters". Thus the present plan constitute just one part, a similar plan covering open ocean waters will in due time be presented by IMR. I presume that also ornithologists will soon be engaged.

It should be stressed that the primary task of the "Marine biological advisory group" is to advice the "Action Command", for instance whether or not a chemical dispersant should be applied in a given situation. But at the same time the "Action Command" expressed their support for necessary studies by the group, also for a period of time after an action itself has been closed. The present plan is worked out on this basis.

The finalization of the present plan has been delayed. This is due to the fact that the International Council for the Exploration of the Sea (ICES) in 1977 established an ad hoc "Oil incident group". The ad hoc group met in Brest,

France, in June 1978, but no formal report was presented to the ICES's Statutory meeting in November 1978. The ad hoc group was thus asked to meet again early 1979 in order to produce a harmonized plan for studies in connection with a major oil spill. Even if we can see the advantage of an internationally agreed plan of studies, the unforeseenable delay of the work of the ICES's ad hoc group created an undesirable situation to us. Thus, I have the pleasure to present the finalized version of "PROGRAMME TO ASSESS THE ECOLOGICAL EFFECTS OF OIL SPILLS IN COASTAL AREAS OF NORWAY". Obviously, however, the present plan is open for adjustments when this appears desirable.

A lesson learned during the "Bravo" blow out was that it is highly desirable to have immediate access to necessary equipment. Thus, FOH has sponsered the purchase of equipment listed in the present plan. One set of equipment is now being distributed to each of the "team-leaders" and it is stocked and maintained at their institutes.

As will appear from the present plan, it is the result of the initiative and voluntary work of a number of Norwegian scientists. I take the opportunity to thank them all on behalf of FOH.

Oslo, Desember 1978

Rolf Lange

PROGRAMME TO ASSESS THE ECOLOGICAL EFFECTS OF OIL SPILLS IN COASTAL AREAS OF NORWAY

by

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Tromsø Museum
Tromsø

CONTENT:

1. INTRODUCTION

The basic biological effects of oil spillage on coastal ecosystems is quite well documented following the Torrey Canyon and the Santa Barbara, California spills. Both these areas can be expected to be quite different biologically from the Norwegian coasts. The Torrey Canyon oil affected areas of Britain and Brittany are characterised by large tidal ranges and rapid tidal currents, whilst the Pacific coast of the U.S.A. has considerably different ecosystems. Thus although the experience of the above cited spills can be used the biological effects will need to be monitored anew in Norway. The following plan draws on the reports of the above two disasters.

Both the Torrey Canyon and the Santa Barbara data suffer from having almost no pre-spill studies and the same is true for the recent Amoco Cadiz disaster. The result is that most of the data available is qualitative and merely descriptive. The programme described here is designed to achieve a quantitative assessment of the effects of oil on shallow water biota and covers the whole of the Norwegian coast. The programme is based on the assumption that the oil results from a blow-out and will come ashore in fairly small amounts in restricted areas. No general pre-discharge survey can be made due to the extent and complexity of the Norwegian coastline and a great deal of time and money may be wasted by studying the wrong areas. The programme depends, however, on a thorough and reliable study of the areas likely to be affected and thus relies heavily on accurate predictions of the stranding of the oil slicks. The programme can, of course, be used to follow the effects of a tanker disaster without the pre-effect study.

2. THE PLAN

2.1. Likely areas to be affected

One of the most important aspects to study is the fate and degradation of the oil at sea prior to any stranding on shore. Oil weathers fairly rapidly at sea and can be rendered relatively non-toxic by such processes. This factor must be carefully followed as the spill moves so that the decision as to whether or not detergents should be used on shore cleaning operations can be based on the best available information. Clearly the spill will be followed at sea by aerial surveys and close coordination between biologists and the aerial surveys is vital. It is hoped that the biologists would be given one, preferably two days notice of the areas of coast that are likely to be affected by oil. This notice would allow the following strategy to be put into effect.

2.2. Aerial photography

Complete a low level photo reconnaisance of the coastline that is likely to be affected. The area is unlikely to be greater than 100 km. and thus a detailed survey could be done with the primary aim of locating suitable monitoring sites. Such sites should be found by means of analyses of the pictures obtained considering:

1) biological criteria (suitable rocky shores ecosystems adjacent to sandy areas),
2) accessability by road for the follow-up survey team,
3) possibilities for long-term study in areas not under great tourist pressure etc.

2.3. Monitoring sites

Based on the data obtained from the aerial assessment of sites establish 4 monitoring sites within a 50 km. length of coastline. Send two teams of biologists to the area so that at each site the pre-oil surveys can be made using to following general methods:

1. Set up 4 transects of typical rocky shores marking fixed areas and using

photographic methods obtain quantitative data. Take samples for chemical analysis. (Detailed methods are outlined in section 3.1., 3.3.).

2. Set up 4 transects on sandy beaches and take samples of the fauna and sediment for chemical analyses. (Detailed methods are outlined in section 3.2.0 and 3.30.).

3. Rapid qualitative surveys should be done between the main sampling sites.

2.4. Following oil spill

1. Repeat the aerial survey with photographs to check that the designated monitoring sites are within the affected areas. Adjust sites if neccessary.

2. Liase closely with the local counties to establish the types of treatment that is being considered and to inform them of the position of the primary sites which should on NO ACCOUNT have detergents used. (It was almost impossible to find areas in the Torrey Canyon affected area that had not suffered from use of detergent. So no control "oil only" sites were available). If detergents are being used establish sites to monitor the effects.

3. Assess the damage caused at the primary monitoring sites in a quantitative manner.

4. Assess the damage between primary sites qualitatively, preferably by the use of colour photography.

5. Damage assessment should be made during the oil stranding and for the first two weeks after the stranding at almost daily intervals. Following this the sampling period could be reduced to monthly bu must continue for at least a year.

6. During the biological assessment of damage samples must be taken for chemical analysis so that the fate of the oil fractions in the organisms can be followed.

7. As soon as is practical after the stranding, diving surveys, initially qualitative, and then quantitative should be made. The quantitative

surveys should as far as is practical follow the intertidal monitoring stations subtidally. These samples should follow the intertidal survey work.

8. Offshore research using boats should be done in cooperation with Fiskeridirektoratets Havforskningsinstitutt (Institute of Marine Research), but concentrating on the non-commercial species.

2.5. Organisation

Surveys of the type envisaged will rely heavily on the available expertise. It is important that the whole of the Norwegian coast is covered. The whole Norwegian coast has been divided into 6 regions (fig. 1). The person responsible for each region is an experienced ecologist with practical knowledge of rocky and sandy shore ecology. The scientific complement of each team will include a zoologist, an algologist and four additional persons, either staff members of the respective institutes or research students. In addition to the six teams covering the coast the Norwegian Institute for Water Research has a team available to support the work of any of the aforementioned teams. Each team will need to meet for training at least once per year and all team leaders will need an annual meeting to coordinate their activities. The team leaders are:

District 1: Tromsø and Finnmark:
Førstekonservator W. Vader, Tromsø Museum, 9000 Tromsø. (Telephone (083) 86080, Residence (083) 86729).

District 2: Nordland Fylke:
Amanuensis S. Skreslet, Nordland Distriktshøgskole, 8000 Bodø, (Telephone (081) 25040, Residence (081) 25263).

District 3: Nordland Fylke border to Stat:
Førsteamanuensis J.- A. Sneli, Biologisk Stasjon, Bynesvei 46, 7000 Trondheim, (Telephone (075) 21358, Residence (075) 20917).

Distict 4: Stat to Lindesnes:
Førsteamanuensis T. Brattegard, Institutt for Marinbiologi, Universitetet i

Bergen, Espegrend, 5065 Blomsterdalen, (Telephone (05) 226200, Residence (05) 226200).

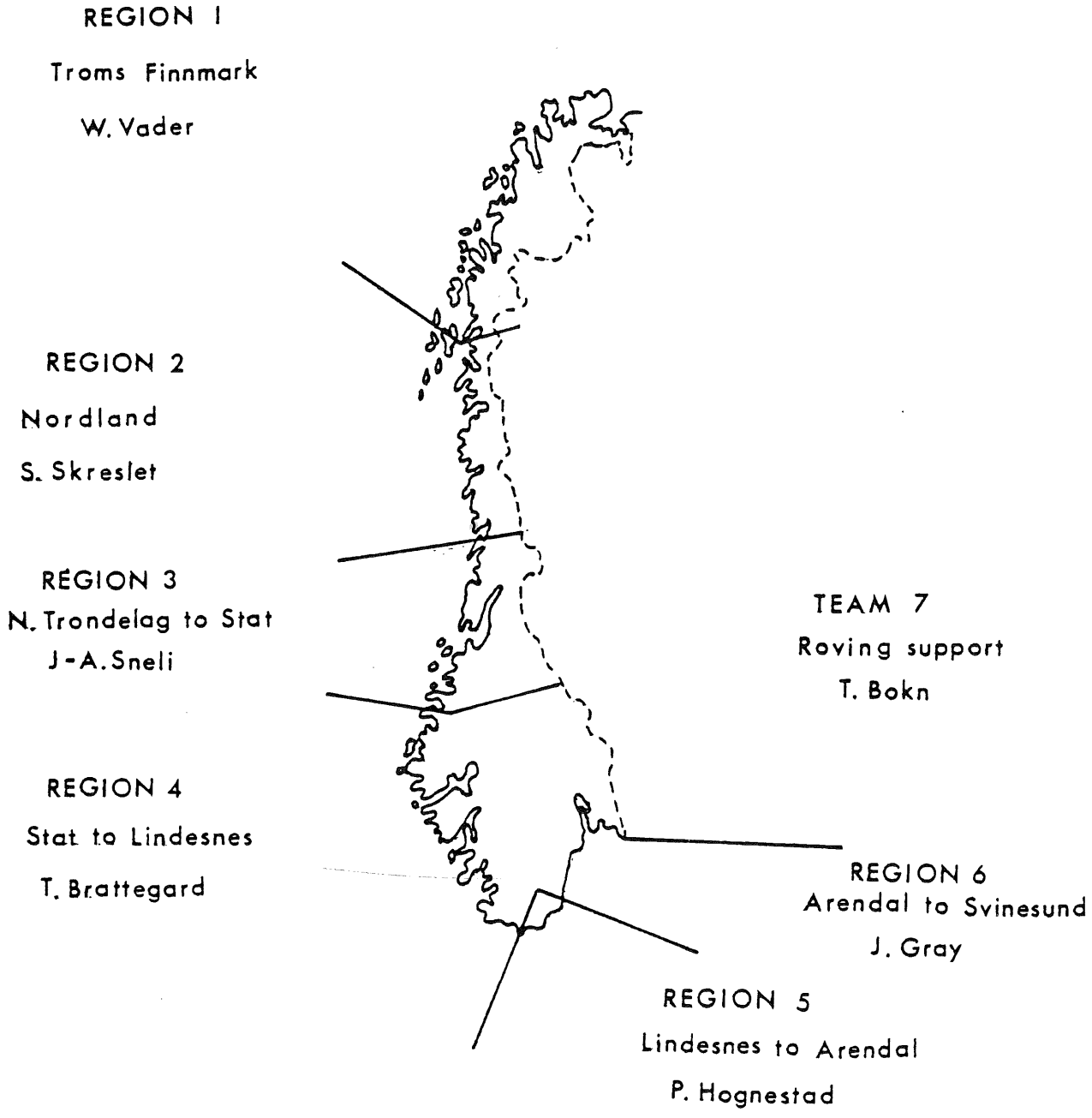
District 5: Lindesnes to Arendal:
Bestyrer P. Hognestad, Statens Biologiske Stasjon Flødevigen, 4800 Arendal, (Telephone (041) 20580, Residence (041) 20541).

District 6: Arendal to Swedish border:
Professor J. S. Gray, Institutt for Marinbiologi og Limnologi, P.B. 1064, Blindern, Oslo 3, (Telephone (02) 466800, Residence (02) 988000 - ask for Haga 5221).

Roving Team:
Forsker T. Bokn, NIVA, Gaustadalléen 25, Oslo 3, (Telephone (02) 235280, Residence (02) 741362).

Chief Administrative Coordinator:
Professor R. Lange, FOH, Wergelandsveien 15, Oslo 1, (Telephone (02) 206535, Residence (02) 552366).
(The link between the "Action Command" of the Ministry of the Environment and State Pollution Control Authority will be maintained by the Chief Administrative Coordinator).

OIL POLLUTION EMERGENCY PLAN FOR COASTAL ECOSYSTEMS



2.5.1. Aerial photography

Aerial photography of likely impact sites is an essential part of the project. Facilities must be made available for the use of military helicopters and photographers to help with a low-level photoreconnaisance of likely areas to be affected and also with follow-up surveys.

2.5.2. Transport

Hire of commercial vehicles will be essential for the rapid transit of personell to the affected areas. Finance must similarly be available for the NIVA team to fly to any locality that they are requested. Link must also be maintained with the coastguard and marine rescue service for the use of their inshore boats to enable diving surveys to be made.

2.5.3. Food and Lodging

In the event of a major spill logistic support will be given by the Army/ Navy/Coast Defence. Following a small scale spill local arrangements will be made by the team leader;

2.5.4. Radio connection

Loan of military short-wave or V.H.F. radios to enable contact to be maintained with the groups is mandatory and facilities should be available.

2.5.5. Public relations

An important and essential part of this study will be given accurate and informative scientific data to the press and media. If the oil spill is a large one then the publicity interest will be high. A daily press conference from the H.C. based on a meeting of the teams prior to the conference will be important. Lange should be spokesman for the group.

A coordinated project of this nature must receive a thorough documentation in the scientific literature and a complete report be prepared for Miljøverndepartmentet (Ministry of the Environment) to act as a basis for any future

catastrophies of a similar nature.

2.6. Summary of plan

The following is a brief overview of the project as put forward:

1. Based on the best available predictions identify the areas of coastline that are likely to be affected by an oil spill. When this area is accurately predicted to be down to 100 km. set in motion 2.

2. Assemble 4 teams of experienced ecologists in the centre of the predicted disaster area.

3. Complete a low level photoreconnaisance of the likely affected areas to isolate potential monitoring sites.

4. Establish monitoring sites and survey these by photographic methods for rocky shores, sampling without sorting for sand, and photography subtidally to an agreed plan.

5. Obtain animal samples from such sites for chemical analysis.

6. Do rapid qualitative assessment between the major quantitative sites.

7. When oil arrives repeat aerial survey to establish extent of effect.

8. Reassess monitoring sites in light of 7, establish liason with the authorities on type of treatment likely to be used.

9. Assess the effect on primary sites using quantitative methods.

10. Use rapid methods for qualitative assessment at other affected areas.

11. Take samples of flora and fauna and sediment for chemical analysis.

12. Repeat quantitative assessment at 2, 4, 6 weeks and then monthly for at least one year, together with chemical analysis.

13. Write reports for Miljøverndepartementet and scientific journals.

3. DETAILED DESCRIPTION OF THE BIOLOGICAL SAMPLING METHODS

Theoretically it is possible to describe a community in the intertidal zone to any degree of detail if one is not bound by resources such as qualified personel, time, equipment and money.

In relation to oil pollution in coastal areas investigations of the conditions in the littoral, before, during and after the oil's contact with the intertidal zone is resource-limited.

- time at one's disposal for the investigations will be limited,
- the number of qualified personel whom can be used in the study will be limited,
- the equipment will in practice be limited to the type of equipment that it is relatively easy to transport and which can be used, (i.e. which functions) under often difficult field conditions.

It is calculated that 4-6 persons will constitute a working group (team) and that these shall undertake the investigations of:

- rocky intertidal
- intertidal sediment
- diving and equipment used in shallow waters.

In areas with tides one must undertake most investigations in the intertidal around lowwater, i.e. one has about 3 h at one's disposal every 12 h. In order to utilise full the relatively short working time at intensively studied localities one must have a limited study programme which concentrates on specially picked ecological areas, which is expedient for the equipment available and has biologists present with the relevant practical experience.

The goal for the investigations is to answer the questions to what extent and in which way are communities in the intertidal areas and shallow waters in a given area change under the influence of oil. In all probability drastic changes will occur at the biochemical and physiological level. Such changes are albeit of a temporary nature even if the end result is the death of an

organism. It is the ecological changes that is the focus of this programme and it is, therefore, the populations and communities that are the objects of the study.

3.1. Sampling rocky shores

A complete description of any community is in practice impossible. Therefore, one must prior to a study choose plants and animals which will be object of study. Even with chosen species it is in practice impossible to work in such a quantitative manner that the results are representative of a larger region, but it is possible to work semi-quantitatively if one limits the study to non-randomly chosen areas with fixed stations and limits for the sizes of organisms covered. In general the biological and ecological changes in the littoral zone can be recorded, but one must not expect to obtain numbers of for example biomass and production concerning large areas. The question for quantativity will even with such limitations be difficult to obtain because of the limited time available at one's disposal. Up to a point this can be overcome by the use of such techniques as carefully planned systematic photography.

In the littoral area at each point in space and time there will be a set number of species present. From this set of species one can choose a smaller number which can be used for the observations. Such species can be divided into two groups: The first group concerns a relatively small number of species which are more important than the majority because they play a central role in structuring the littoral ecosystem. The second group concerns a relatively large number of species of which most are of minor importance in the overall in ecological processes. By use of data on their presence and absence one can obtain insights into the community's composition and function.

The quantities of the important ecological species (key species) should be estimated as accurately as is practically possible. The natural variations in abundance of a littoral species with a relatively short life-cycle is so great that an accurate count of the individuals present in an ecological context is like taking a sledg-hammer to crack nuts. An estimate of the numbers and ranges in classes, (preferably based on a geometric scale) is often useful, either as numbers of individual or as percentage cover. For example:

a species can either be present or absent. If present then the number of individuals per area can be counted or estimated and thereafter classified into abundance classes e.g. I 1-9, II 10-99, III 100-999, IV 1000-9999, and so on.

With replicates of the estimated abundances of a species in a locality one will be able to judge whether or not the abundance falls within the same abundance class, or whether or not there are one or many abundance class differences. It is recommended that differences in abundance of only one class are not regarded as significant, but that significantly different classes will be at least two classes difference. Even with a small number of species recorded as abundance classes the possible descriptions of the species's abundance on the beach is very large. For example 3 species graded from absent to 5 abundance classes gives 441 theoretically possible combinations. If one extemds the difference to more than 2 abundance classes so that the conditions have changed from time 1 to time 2 one still has 100 possible combinations which indicate a difference.

It is important in this connection to remember that it will need extensive photography of the chosen areas. The photographs will be used as documentation, possible act as controls and in any case enable more accurate abundance estimates to be made than would be possible in the difficult conditions in the field where time is severely limited and it may not be possible for example to discriminate between living and dead barnacles.

3.1.1. List of organisms

Sessile organisms on fixed substrate

Halichondria panacea		max 7 classes
Actinia equina		+/-
Balanus balanoides	1 year	max 7 "
Balanus balanoides	"	" " "
Balanus improvisus	1 "	" " "
Balanus improvisus	"	" " "
Nucella lapillus egg	capsules	+/-
Mytilus edulis	15 mm	max 7 classes
Mytilus edulis	30 mm	" " "

Sessile organisms on algae (Fucus or Laminaria)

Clava squamata	+/-
Dynamena pumila	+/-
Spirorbis borealis	max 5 classes
Tanais cavoline	+/-
Littorina obtusata egg capsules	+/-
Membranipora membranacea	+/-
Electra pilosa	+/-
Alcyonidium spp	+/-
Flustrellidra hispida	+/-

Mobile on hard substrata

Patella aspera	+/-
Patella vulgata	max 7 classes
Littorina littorea	" " "
L. saxatilis	" " "
L. neritoides	+/-
Nucella lapillus	max 7 classes
Asterias rubens	" 3 "
Marthasterias glacialis	" " "
Echinus esculentus	" " "
E. acutus	" " "

Mobile species in or around algae and in rockpools

Idotea pelagica	+/-
I. granulosa	+/-
I. baltica	+/-
Praunus flexuosus	+/-
Patina pellucida	max 3 classes
P. pellucida feeding marks	+/-
Littorina obtusata	max 3 classes
Gibbula cinneraria	" " "
Hyale nilssoni	+/-

Extra

A half liter jar with Corallina officianalis clumps fixed in formalin and then transferred to ethanol.

Plants

Flowering plants	max 7 classes
Grey and green lichens	" " "
Orange and red lichens	" " "
Verrucaria maura	" " "
Verrucaria mucosa	" " "
Lichina confinis	" " "
Spongomorpha sp.	" " "
Cladophora rupestris, spp.	" " "
Enteromorpha spp	
Ulva lactuca	" " "
Codium fragile	" " "
Fucus distichus, NB note (Dependent on locality, spp edentalus, spp anceps, spp distuchus)	" " "
Pelvetia canaliculata	" " "
Fucus spiralis	" " "
Fucus vesiculosus	" " "
Ascophyllum nodosum	" " "
Fucus serratus	" " "
Alaria esculenta	" " "
Himanthalia elongata	" " "
Laminaria digitata	" " "

Plants

Laminaria saccharina	max 7 classes
Laminaria hyperborea	" " "
Porphyra umbilicalis	" " "
Lithothamnium/Phymatolithon	" " "
Polysiphonia lanosa	" " "
Gigartina steelata	" " "
Ceramium spp	" " "
Palmaria palmata	" " "
Corallina officinalis	" " "

3.1.2. Procedures

Intensively sampled areas

1. Choose rocky shores which are topographically homogeneous.
2. Select transects and set up transect lines and permanent markers (bolts, paint).
3. Select areas for photography and set up permanent markers.
4. Select algae - estimate cover - take photographs.
5. Select animals - estimate numbers - check presence/absence - take photographs of sessile and motile animals on, in, or around algae and in rock-pools.
6. Select animals - estimate numbers - check presence/absende - take photographs of sissile and motile animals on hard substarta.
7. Sample Corallina officinalis for accompanying flora and fauna.
8. Take samples of selected algae and animals for chemical analysis.
9. Survey and describe subtidal flora and fauna in practical.

Between intensively sampled areas

If time permits take photographs of zone forming organisms and other dominant organisms to ensure base-line data if oil hits secondary targets.

After oil pollution

As for sediment group.

3.1.3. Equipment necessary for the Rocky shore group

The equipment which is underlined can be obtained and packed when a warning of an oil spill is received. The remaining equipment must be ready-packed. (Equipment ready-packed, one set available at each of the team leaders laboratory).

Case 1

Marine chart over the likely affected areas.

1 roll of plastic film to overlay chart.
1 set Cappelens road maps of Norway.
Copies of the Norwegian Pilot.
1 current Tide Table.
1 dictaphone.
2 Nikonos III cameras (it is expected that there will be private cameras in use also).
2 electronic flash for above.
Spare batteries for above.
25 rolls of Kodacolor 25.
25 rolls of HS Ektachrome 200.
25 rolls Ilford HP5.
2 Notebooks with stiff covers.
1 block of graphpaper.
1 tube glue
3 PVC plates for writing on.
PVC paper with species lists and place for numbers etc.
2 clipboards for A4 paper.
2 blocks A4.
12 pencils HB.
6 rubbers.
2 packets steel clips.
12 felt pens waterproof.
12 ballpoint pens.
1 VHF radio. (Not in ready-packed equipment).

Case II

1 25 m. measuring tape.

1 100 m. length nylon rope 1/4 " knotted at 10 m. intervals.
1 100 m. length nylon rope 3/8 ".
1 compass.
1 hammer.
6 spray paint cans, phosphorescent yellow/orange.
3 meter pole with level.
24 marking plugs, nylon.
24 rawl bolts.
1 combined hammer/axe.
1 packet yellow plasticine.
1 packet chalk.
100 m. steel wire.
1 pair pincers.
6 water-tight lamps.
1 roll Tesa tape.
1 roll masking tape.
6 sheathknives.
3 counting frames, adjustable.
1 under water viewing box.
3 vernier calipers.
100 marking rings for algae.
2 thermometers -5^{o} to 50^{o}.
1 measuring cylinder, I l see thru plastic.
1 hydrometer.
2 paint scrapers.
1 chisel.
1 sieve 1 mm. mesh.
6 tweezers.
6 "lyktluper", cf. I.M.B. Bergen.
1 steel brush.

3.2. Sampling the fauna of sediments

It will be important to assess the effects of oil on the fauna within sediments since in many known cases oil has laid buried, (yet still toxic) for many years. Long-lasting effects on the fauna can therefore, be expected.

Sampling sedimentary environments is done blind and destructively and thus,

rather than actual population counts as can be achieved on the rocky shores only population estimates will be available. There is no generally accepted way to sample sandy beaches and local conditions will largely dictate the protocol. Steep, coarse-grained high energy beaches are poor in fauna, whereas shallow-sloping, finegrained low energy beaches are usually extensive in width and rich in fauna. The most widely used technique is to lay out transect lines with samples taken at regular intervals down the lines. The placement of the transect lines themselves, will be based largely on the practical experience of the team leader. Transect lines should be permanently marked with poles above the strand line and marked ropes laid out to delimit the transect. Quadrats, ($0.32 \times 32 m^2$) should be dug out to a depth of 30 cms and the sediment sieved through a 0.5 mm. sieve on the spot. The fauna remaining on the sieve should be preserved for later identification. A minimum of three samples per station will be necessary to give some sort of statistical limits. The number of stations will be dependant on the width and accessability of the beach but in tidal areas upper mid and low tide areas would seem to be a minimum.

Whilst most emphasis will clearly be placed on the macrofauna it is quite possible that each team will have access to a person skilled in meiofauna techniques. The meiofauna probably represent a sensitive part of the fauna and have been shown to give interesting data in relation to oil spills and recovery. Cores (7cm. diam.) down to 15 cm. can be taken and separated into jars with three depth zones (0-5 cm. 5-10 cm. and 10-15 cm) and preserved by adding formalin. At least four cores per station will be needed to give reliable statistical estimates. Even if there is no obvious person available to analyse the data it is recommended that such samples be taken since such data could be worked up at a later date if necessary and takes little time to collect.

Divers may well be able to continue the transect lines subtidally at say 2 m., 5 m., and 10 m. depths taking large cores for macrofauna (20 cm. diam. to 15 cm.) and the meiofauna samples as for the intertidal.

3.2.1. Procedures

Intensively sampled areas

1. choose beaches which are topographically homogeneous.
2. Set up transect lines with permanent marking above tide-line.
3. Take macrofauna samples 3 x 0.32 x 0.32 m^2 per station down to 30 cm. depth.
4. If time permits sieve and extract fauna on spot otherwise preserve whole sample for later sorting.
5. Take meiofauna cores (7 cm. diam. to 15 cm. depth) min. 4 per station.
6. Separate to depth classes and preserve.
7. Take separate faunal and sediment samples for chemical analyses, placing them in glass jars with screw tops for deep-freezing.
8. Extend the sampling subtidally if practical.

Between intensively sampled areas

If time permits take spot samples to ensure that transects have recorded the typical fauna.

After oil pollution

1. Make rapid surveys along the strand-line to record numbers and types of dead organisms.
2. After rapid assessment judge if transect lines previously designated need readjustment, but make sure that polluted and control areas are equally represented.
3. Repeat sampling programme as for pre-oil and continue at reasonable intervals thereafter.

3.2.2. Equipment necessary for sand group

The equipment listed here will in many cases duplicate that already listed for the rocky shore group, but since their work areas will be different such duplication is necessary.

Equipment underlined can be obtained and packed when warning of an oil spill is given.

Case 1

Marine chart over the likely affected areas.

1 roll of plastic film to overlay chart.
1 set Cappelens road maps of Norway.
Copies of the Norwegian Pilot.
1 current Tide Table.
1 dictaphone.
2 Nikon III cameras (it is expected that there will be private cameras in use also).
2 electronic flash for above.
Spare batteries for above.
25 rolls of Kodacolor 25.
25 rolls of HS Ektachrome 200.
25 rolls Ilford HP5.
2 Notebooks with stiff covers.
1 block of graphpaper.
1 tube glue.
3 PVC plates for writing on.
PVC paper with species lists and place for numbers etc.
2 clipboards for A4 paper.
2 blocks A4.
12 pencils HB.
6 rubbers.
2 packets steel clips.
12 felt pens waterproof.
12 ballpoint pens.
1 VHF radio.

Case II

1 25 m. measuring tape.
1 100 m. length nylon rope 1/4 " knotted at 10 m. intervals.
1 100 m. length nylon rope 3/8 ".
1 compass.
12 stakes (2 m. x 2 cm.) to mark transect lines.
1 hammer.
2 0.32 x 0.32 sampling frames.
67 cm. diam. x 20 cm. length perspex tube marked at 5 cm. intervals.
2 thermometers -5^{o} to 50^{o}.
1 transparent plastic measuring cylinder 1000 ml.
4 plastic washbottles.
2 x 5l formalin.

Case III, IV and V

Equipment common to both groups

100 x 1l. plastic bottles with screw tops.
100 x 250 ml. bottles with screw tops.
100 x glass kilner jars for chemical analyses.
100 x plastic bags 20 x 40 cm.
100 plastic bags heavy duty 20 l.
20 plastic sacks.
10 plastic buckets with tops.
10 plastic dustbins with screw caps.
2 cooling bags.
20 cooling elements.
2 rolls string.
2 pairs scissors.
4 small knives.
sticky labels.
plastic paper.
6 plastic petri dishes.
6 plastic bowls.
2 x 5 l. formalin.
10 l. ethanol.
6 white plastic rulers.
1 dark plastic rulers.

Case VI

6 sets thermal suits
6 boiler suits.
6 protective helmets with lights.

Case VII

6 sets of waterproof clothing (Peter Storm).
6 sets waders.
6 sets boots with studs.
6 life-jackets.

Special equipment

A collapsible aluminium ladder.
Frames for carrying cases.

3.3. Samples for chemical analysis

Samples of both animals and sediment must be taken for chemical analysis. It is suggested that representative samples, (based on practical expediency) be taken of the macrofauna, both intertidally and subtidally. Samples should be placed in glass kilner jars, (without rubber liners) and the whole samples frozen. Sediment samples should be taken by cores separated into depth ranges and then frozen in glass containers as for the animals. The freezing must be done as soon as is possible after collection.

Forskningsprogram om Havforurensninger (FOH) ble opprettet ved Kgl. Res. av 5. mars 1976.

FOH ledes av et styre med seks medlemmer, hvorav forskningsrådene (NAVF, NFFR og NTNF) i fellesskap har oppnevnt 3 representanter, Miljøverndepartementet og Fiskeridepartementet en representant hver samt styrets formann. Styret står ansvarlig overfor Miljøverndepartementet for gjennomføringen av forskningsprogrammet.

FOH's organisasjon omfatter foruten styret, et fast sekretariat og faggrupper. Sekretariatet er administrativt knyttet til NAVF og det ledes av en heltidsansatt sekretariatsleder, som er mellomleddet mellom styret og faggruppene og de enkelte institusjoner. Han tilrettelegger sakene for styret og leder den praktiske gjennomføringen i henhold til styrets beslutninger. Sekretariatet står også for en viss litteraturtjeneste og andre felles informasjons- og datainnsamlingsoppgaver.

Fem faggrupper innen biologisk, fysisk og kjemisk oseanografi har utarbeidet statusrapporter innen de respektive fagområder, samt fremmet forslag til forskningsprosjekter. På grunnlag av blant annet disse rapporter har styret vedtatt en Rammeplan for FOH (juni 1977).

FOH finansieres primært ved midler over statsbudsjettet (Miljøverndepartementet), men det forutsettes at også forskningsrådene skal bidra til finansieringen. En del av forskningsprogrammet vil inngå i institusjonenes vanlige virksomhet og finansieres over institusjonenes ordinære budsjetter.

The Norwegian Marine Pollution Research and Monitoring Programme (FOH) was established by Royal Decree on 5 March 1976.

The programme is administered by a committee of 6, consisting of a chairman, proposed jointly by the Ministry of the Environment and The Ministry of Fisheries, one representative from each of these Ministries and 3 proposed jointly by the research councils (NAVF, NFFR and NTNF). The committee is responsible to the Ministry of the Environment for effecting the programme.

In addition to the committee, FOH's organization includes a permanent secretariat and scientific groups. The secretariat is administratively attached to NAVF and is led by a full-time head who acts as liaison between the committee, the scientific groups and the individual research institutes. He is responsible for preparing matters for discussion by the commttee and sees to it that their decisions are put into practice. The secretariat is also responsible for the collection of certain relevant literature and other tasks of a general nature connected with the spread of information and collection of data.

Five scientific groups concerned with biological, physical and chemical oceanography have each prepared reports on the status of research within the relevant scientific fields and made proposals for definite research projects. On the basis of these reports, the committee has worked out a preliminary framework for the programme (June 1977).

FOH is financed primarely from the fiscal budget (Ministry of the Environment), but it is assumed that the research councils will also contribute to the programme. A certain amount of the research will be incorporated into the normal activities of the research institutes and will thus be financed from the institution budgets.

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