TCP/IND/6712
Field Document No. 2

TECHNICAL COOPERATION PROGRAMME

TRAINING IN SEA SAFETY DEVELOPMENT PROGRAMMES

Based on the Work of

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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Acronym

AD	Assistant Director (of Fisheries)
AFPRO	Action For Food Production an NGO
AIF	Assistant Inspector of Fisheries
AIR	All India Radio
CASA	Church's Auxilliary for Social Action
CCPA	The Cyclone Contingency Plan of Action of GOAP
DoF	Department of Fisheries
DRDA	District Rural Development Agency
FDO	Fisheries Development Officer
FTO	Fisheries Terminal Office
GOAP	Government of Andhra Pradesh
GOI	Government of India
HP	Horse Power
IMD	Indian Meteorological Department
MMD	Mercantile Marine Department
NGO	Non Government Organisation
NIO	National Institute of Oceanography
NPD	National Project Director
OBM	Out Board Motor
RCC	Reinforced Cement Concrete
RDD	Regional Deputy Director
SLHPSC	State Level High Power Standing Committee
SSAG	Storm Safety Action Group
SSEO	Storm Safety Extension Officer
TCDC	Technical Collaboration among Developing Countries
VHF Set	A Very High Frequency Radio Set
VHF	Very High Frequency

Summary

Following FAO Fishery Industry Officer Jeremy Turner's visit to Hyderabad and Kakinada in May 1997 to check on all matters relevant to the effective implementation of TCP/IND/6712 the first visit by the Team Leader, Paul Calvert, was held pending completion of certain prerequisites, namely:

- Clearance for radio tower erection and shore station construction;
- Block License for fishing vessel VHF operators;
- Radio towers erected;
- Base line survey completed;
- Renovation of the project headquarters at Department of Fisheries Terminal Office Building at the Kakinada Fisheries Port. Installation of telephone and fax.

These largely being achieved, with the exception of erection of the two radio towers, the next stage of the project is clear to proceed.

The baseline survey by AFPRO clearly indicates that the two primary groups amongst whom loss of life was heaviest in the cyclone of 6 November 1996 were the shrimp seed collectors and crews of mechanised boats.

Consequently the project feels justified in making these groups their primary target groups.

Since the principal causes of loss of life were lack of a clear timely warning and poor disaster preparedness, the project will endeavor to reduce the vulnerability of these groups to cyclones through the following activities:

- Establishment of a VHF communication system to enable both villages and mechanised boats to receive more timely and specific cyclone warnings in their own dialect.
- Establishment of volunteer Storm Safety Action Groups in the villages to develop a greater level of disaster preparedness in the villages and ensure there are contingency plans to rescue shrimp seed collectors from the outlying sand banks.
- Improvements in safety of mechanised boats and their crews.
- A workshop entitled "Measures to Reduce the Loss of Life Amongst Fisherfolk During Cyclones" to review the events of the November 1996 cyclone, share regional experience and develop a set of recommendations to GOI and GOAP.

Others in the community and groups such as inland fishers should also benefit.

1. RESUME OF MISSION

The Team Leader's visit started with meeting Jeremy Turner in Hyderabad on 11 March followed by a **project review meeting** at the Department of Fisheries (DoF) on the 12th. That evening they proceeded to Kakinada, Jeremy Turner and this consultant returning to Hyderabad on 13th and 19th respectively, and the National Consultants to Vishakhapatnam on 20th to make arrangements for the September workshop.

During the period in Kakinada the villages of Balusutipa, Bhairavapalem, Masanitipa and Teerthalamundi were visited with DoF, AFPRO and ACTION. The VHF shore station sites, project office and Fisheries Training Institute were inspected. The details of the **Workshop, Training Courses** and **Project Workplan** (Annex 1) were developed. Meetings were also held with a number of NGO's involved to varying extent with disaster preparedness, management and relief.

Back in Hyderabad the team leader subsequently had meetings with the National Project Director (NPD), and with NGOs on 20 and 21 March to **develop the Storm Safety Extension Officer Training Course through an NGO Committee.** Amongst these, AFPRO, CARE and OXFAM expressed a positive interest in participating in the committee and Mr. C. M. Muralidharan of AFPRO is presently the acting coordinator.

2. FINDINGS

2.1 The findings of Jeremy Turner in his Report of 11- 18 May 1997 and of the AFPRO base line survey report were generally reinforced by the short visits made to the affected areas.

2.2 A considerable pace of rebuilding/replacement of housing often with own funds was very much evident in Balusutipa and Bhairavapalem. These houses were invariably on a raised (infilled) plinth and were of RCC frame construction with RCC roof terrace. This is obviously seen by inhabitants as their chief insurance against loss of life and property in future.

2.3 Outboard motors were not at all in evidence in the project area. Motorised navas use principally 10HP inboard and occasionally 20 HP inboard diesel engines.

2.4 The foundations for the radio towers at Balusutipa and Kakinada (adjacent to the project office) were under preparation. Similarly the radio room at Balusutipa was at the foundation stage. The FAO national expert (Radio Communications) assured that all this work would be completed by 25 May.

2.5 The project office, in the Fisheries Terminal Office Building opposite Kakinada Fishing Harbour, has been renovated to a good standard and a fax/phone installed. The number is 0884 72658 though operation seems to be intermittent and requires attention. The address is Training in Sea Safety

Development Programmes, Fisheries Terminal Office Building, Opposite Fisheries Harbour, Kakinada, 533007, Andhra Pradesh.

2.6 The DoF's Fisheries Training Institute, funded by the World Bank, is nearing completion and will provide a suitable venue for most training courses.

2.7 The village of Masanitipa and adjacent shrimp seed collection area are visited. Accounts from these survivors who had lost relatives there, and who were again engaged in shrimp seed collection during our visit, told of the warning signs they experienced. *"From 4 to 8 pm the wind came from the west very strong and in fact caused problems for operators who had picked up collectors in that they couldn't get back to the villages. After 8 pm the wind stopped for five minutes then came very strong from the East with rain. The sea water rose to 7 - 10 feet (2-3m) in half an hour or so, but also during the time of water receding, currents were very strong - this was when most lives were lost by being swept out to sea".*

2.8 In general all the circular cyclone shelters visited were in an appalling state of disrepair. Built mostly in the early eighties using reinforced concrete they are severely damaged by corrosion as a result of poor quality control in construction and total lack of maintenance. Large, dangerous sagging blisters of concrete from ceilings, missing balustrades on the external stairway and stairways of very suspect integrity. In one village a woman recounted how people had been injured by part of one of these balustrades falling. It is not surprising that people were afraid to use these so-called shelters during the cyclone. The newer pattern shelters were structurally in better condition but also suffering from neglected maintenance and lack of creative use and a sense of community ownership.

2.9 The Collector and District Magistrate, JSV Prasad IAS was welcoming and positive towards the project and accepted the invitation to present a paper at the September Workshop and also to inaugurate the Storm Safety Extension Officers Training Course at the Department of Fisheries in April. He also assured full support of his staff in the installation and operation of one of the project VHF sets in his communications control room at the Collector's Residence for communication of cyclone warnings direct to the shore station at Kakinada Fishing Harbour

2.10 The Department of Fisheries supported the visit very positively and welcomed the contribution and cooperation of NGOs proposed by the FAO Team.

2.11 The NGOs CARE, AFPRO, OXFAM, and ACTION all expressed a positive interest in the project and in forming an NGO committee to develop the Storm Safety Extension Officer Training Course and subsequent extension work in close collaboration with DOF.

2.12 The AFPRO report is a most useful and valuable document and is not only of benefit to the project but will also be appreciated by NGOs in the area. It is worthwhile to reiterate some of its findings here:

- The cyclone warning system was set in operation on November 5 itself, but due to various limitations the messages reached very late or were not taken seriously. The message did not reach the fisherfolk villages or the fisherfolk at their fishing grounds at all. Hence the large death toll.
- The report states unequivocally and from various sources that the fishing communities did not receive a warning in advance of the cyclone.
- At least 300 families used to camp on the sandbank (near Bhairavapalem) for six months in temporary huts completely engaged in shrimp seed collection, but after the large loss of life in November 1996, seed collection is now only a daily or short term affair (partly also due to closure of shrimp farms and low prices).
- In Bhairavapalem 60% of lives were lost amongst shrimp seed collectors, 29% at sea. 6% river fishing and only 5% in the village. For Balusutipa the corresponding figures are 88% for shrimp seed collectors, 6% at sea, 6% in the river and one person in the village (0.27%). The obvious observation is that the safest place to take refuge is the village, and specifically in concrete houses (and serviceable cyclone shelters).

2.13. The following were contacted in Kakinada:

- Programme Coordinator OXFAM - This local office is engaged in rehabilitation projects wherein there is a component of disaster preparedness education. This work is funded by HIVOS and DRA (Disaster Research Agency, London). She is keen to actively participate in the training course and field work.

- Field Officer of CASA, Machilipatinam. CASA is the Church's Auxiliary for Social Action. They have done work in that area on mobilising community disaster preparedness activity in coastal villages with good response. They are a potential resource for the project training course.

- Executive Secretary of ACTION based in Rajamundry. He has several years experience in practical disaster preparedness training after training at AIT Bangkok.

2.14. A personal observation of the consultant is that whilst there is much in the CCPA that is commendable, the long intervals between live (or even simulated) testing of the system results in a poor response, especially down the line. For most people in the chain (including the fisherfolk themselves) it may be the first time they are ever taking the prescribed actions. The chain is also clearly too long. Not only that but the fear arising out of such a terrifying experience (remember it was dark, wild, noisy and the water was rising fast. No one had any idea if it was going to stop rising) would be enough to make anyone forget anything other than the basic instincts for survival. A much

more direct warning, and education to believe and heed that warning, is required to save time and lives.

The CCPA has a provision for alerting the military right from the first stage of a cyclone warning. No doubt the military meteorologists are keeping a close watch on the situation anyway. The CCPA calls for military aircraft to be ready for assessment of damage by VIPs immediately **after** the occurrence of a cyclone. It seems a tragedy that these aircraft have been on standby throughout the prelude to the disaster when they could be used with good effect to minimise it. What could be more direct and targetable than flares, smoke and sound signals dropped directly over the threatened villages and fishing fleets? And all this by services that are trained to respond around the clock.

Jeremy Turner had suggested the use of aircraft in his visit of May 1997 and has since found that the Vietnamese use military aircraft to give cyclone warnings to fisherfolk.

3. PROJECT IMPLEMENTATION

3.1 Project Review Meeting

On 12 March, a project review meeting was held, chaired by the Principal Secretary to Government, Agriculture and Fisheries Department, Hyderabad and with participation of all project staff besides OXFAM & AFPRO.

The main conclusions of the review follow:

- In response to the FAO request that the NPD should be nominated by name rather than post, Mr. C Krishnamurthy was appointed as National Project Director (NPD).
- The construction of the radio towers is proceeding on schedule and completion is expected by mid April.
- The provision of additional towers will be considered as the project progresses.
- Though permission for five VHF channels had been requested, only two VHF channels had been granted. Justification for additional channels will be provided by the FAO national consultant (radio communications) and forwarded by NPD to Fisheries Development Commissioner. At least four channels are required as a basic minimum, and the originally requested five channels will greatly facilitate effective communications.
- It was agreed that the target group include the crews of mechanised fishing vessels as well as village fisherfolk.
- It was agreed that the type of engine appropriate for distribution amongst the project villages (with regard to communicating cyclone warnings to remote settlements) should be decided during the forthcoming field visit to those villages

- The findings of the AFPRO report were discussed and generally endorsed with the exception of those recommendations pertaining to the operation of mechanized fishing vessels.
- It was confirmed that the DoF/FAO workshop would be held in Kakinada 15 - 18 September, 1998.
- The FAO national consultant (coastal fisheries) will visit Vishakhapatnam to investigate workshop arrangements.

3.2 Training

Following extensive discussions with DoF officials, it was agreed that training courses/participatory dialogue will be held covering the five distinct subjects of

- (i) disaster preparedness
- (ii) volunteer safety groups
- (iii) VHF radio skills (shore based operators)
- (iv) VHF radio skills (vessel operators)
- (v) mechanised fishing vessel design, construction and maintenance.

Detailed course contents and modus operandi will be developed over the coming month. To take full advantage of the existing links between the fisherfolk communities and NGOs, courses (i) and (ii) will be developed in close cooperation with NGOs who through their chosen coordinator will provide detailed and costed proposals for their participation.

It is foreseen that these two courses will be undertaken in two stages: training to extensionists (DoF and grass roots NGOs) by FAO and NGOs, followed by participatory dialogue between extensionists and fisherfolk on disaster preparedness."

3.3 These Training Courses were subsequently rationalised as:

1. Storm Safety Extension Officer Training Course for 20 extension officers to teach disaster preparedness in up to 50 villages in the project area and build up Storm Safety Action Groups in each village.

2. VHF training for mechanised boat crews

3. VHF training for shore station operators and District Collector's communications staff

4. VHF training for Storm Safety Action Group operators

3.4 The training courses fall into two categories:

- Storm Safety Extension Officer (SSEO) Training Course
- VHF Training Courses

The former category encompasses the many activities which are essential to reduce vulnerability to cyclones. In no way can these be taught in a top down approach or over a short time scale. Thus the aim is to train a team of extension officers with a range of skills and knowledge and with a participative interactive approach to long-term contact with vulnerable communities (actually almost nine months in the course of this pilot project) to develop locally sensitive and effective storm safety action groups.

The latter will essentially deal with effective technical use and maintenance of a VHF set and will address its performance and limitations and protocols in communication, as well as its use in receiving and sending crucial warnings and information regarding cyclones.

3.5 Storm Safety Extension Officer Training Course

The development of the details of this course and coordination of the key resource people are to be undertaken by the NGO Committee described below and presently being formed. The proposed outline is attached as Annex 2. The objective is to develop a competent team of Extension Officers (composed of DoF/NGO) to teach a wide range of locally appropriate disaster preparedness skills. This training course acts as a foundation for the extension team to work from. Their work will be participative and responsive to the needs of the communities and their situations. The array of skills and alternatives they are able to use to stimulate action within the communities will be expanded by the interaction and adaptation that will form a key theme of the process.

3.6 Storm Safety Field Extension Officer Guidance

After the training course the NPD, the team leader and national consultant (coastal fisheries) together with the NGO coordinator, will visit villages with the Extension Officers to observe, advise and demonstrate as required. The extension officers' work will be monitored by the RDD Fisheries and the NGO coordinator together through a monthly feedback meeting and reported on a quarterly basis by the national consultant. By this method shortcomings in skills, training and methodology can be identified and corrected.

3.7 NGO Committee to Develop Storm Safety Extension Officer Training Course

In cooperation with DoF, NGOs with a presence in the project area have been invited to form a committee to develop the Storm Safety Extension Officer Training Course. This committee will be formed from among CARE, AFPRO, OXFAM, CASA, ACTION and others. This is seen as having a variety of benefits within and beyond the duration of the project. There is a variety of skills and experience amongst the NGOs in Andhra Pradesh which can be best brought out by the NGOs having their own committee to coordinate and recruit the key individuals for the Storm Safety Extension

Officer Training Course. The development of this course will be of benefit in the future to both the Department of Fisheries and all the participating NGOs. It will strengthen their position to respond to the need for disaster preparedness training throughout this and neighboring states. It should also improve and strengthen linkages between the NGOs and Government bodies, in particular the Department of Fisheries.

The detailed proposal is to arrive by mid-April 1998 for approval. On finalisation the NGO committee are to provide a costing which on approval by the project management will be forwarded to FAOR Delhi for advancement of funds to the designated NGO account. The Course is scheduled to commence on 29 April.

Since there are many families who spend much of their time in migratory fishing around the estuary and on the sand banks (e.g. 28% of Balusutippa families), the extension officers will have to ensure their programme meets the needs of these groups who may not be at the village at the time of programmed visits.

3.8 VHF Training Courses

The VHF Training Courses will be detailed by the national consultant (radio communications) and will comprise the following: (Indicative costing is given in annex 4)

3.8.1 Storm Safety Extension Officers VHF Appreciation Course

A module within the Storm Safety Extension Officer Training Course (Two Half Days). This will be to appraise these officers of the capabilities and limitations of VHF communications; train them in basic operation and maintenance and make them aware of the project's intended use of this equipment.

3.8.2 Mechanized Boat Crew VHF Operators Course

A series of short courses, initially 4, for mechanized boat crews. These courses will be of two days duration and train groups of 20 trainee VHF operators. The trainees will comprise two members of crew from each boat purchasing a subsidized VHF set. A per diem of Rs. 250 will be paid to each trainee in lieu of lost earnings whilst attending the course and lunch will be provided on both days. The trainees will be responsible for finding their own accommodation over night.

3.8.3 Shore Station Operators Course

This will be a three day course for the full time operators of the two shore stations (Kakinada and Balusutipa). Ten DoF Fieldmen cadre personnel will be trained. An extra half day at the end of the course will be devoted to the District Collector's radio communication operators who will also be receiving one project VHF set.

3.8.4 Storm Safety Action Group VHF Operators Course

After establishment of SSAGs it is anticipated that specific villages should be allocated VHF sets (at least during the cyclone season). Nominees from the SSAGs will receive operator training later in the project. Two nominees from ten key locations for a three day course. Per diem and lunch provided as for Mechanized Boat Operators course.

3.9 VHF Training Follow-up

The mechanized boat VHF operators will be visited within one month of their training and thereafter each month of the remainder of the project, by DoF FDO's. Initially the FDO's will be accompanied by the national consultant (radio communications). These visits will be to check the skills and encourage good practise of VHF operators through some simple practical tests and questions with corrective training being given as required.

3.10 Procurement of VHF Mobile Sets

50 VHF marine sets and 2 VHF shore sets are currently being purchased. Of the 50 marine sets, the majority will be distributed to mechanised fishing vessel owners. Following an assessment of the demand for the radios, they may be distributed on a subsidy basis. It was agreed that if demand is high, the subsidy could be set at 50%, enabling double the number of sets to be procured. The national consultant/team leader will draft a letter to the mechanised boat owner association, to be sent out by the DoF, inviting expressions of interest in this scheme. Proceeds from the scheme will be collected by DoF for the purchase of additional radios. A decision on the purchase of the remaining 100 VHF sets will be taken following the initial reaction from boat owners.

3.11 Allocation of VHF Sets

Mechanised Boats crewed by fishermen of Balusutipa (NB. Actually there are no mechanised boats from Balusutipa but there are many crews from there, i.e. 346 as per AFPRO Report table 4.5, working on mechanized boats out of Kakinada. This intervention is aimed at, amongst others, these crews)

Mechanised Boats of Balusutipa	20 Sets
Mechanised Boats of Bhairavapalem	25 Sets
District Collector's Communications Office	1 Set
Bhairavapalem, Masanitipa, two other locations	4 Sets
Total number of VHF Mobile Sets	50 Sets

There are still some questions concerning the use of VHF sets in the villages by Storm Safety Action Groups. (the two dedicated shore stations are to be operated by DoF staff). This is because apart from the two shore station sets all the other sets are licensed to be on boats. The national consultant (radio communications) is to clarify this situation and explore what options are open for deployment of sets in this way. One suggestion was for these sets to be held by the DoF and installed in key villages only during the cyclone season. Another issue is the potential difficulty of ensuring power supply for such sets. The key to it must be a simple system and permanent installation in a key building or the cyclone shelter in the village, and operation by trained volunteers from the SSAGs is perhaps the most workable and sustainable.

It is hoped that the letter from DoF to the Boat Owners Association regarding VHF Radios at 50% subsidy and free training course will elicit a good response. If so the appropriate training courses will take place from mid-May. However if response is poor, demonstration of the capabilities and uses of the VHF set will be done by trail installation and operation on a boat at Kakinada and Bhairavapalem. Communication and sample messages will be transmitted and received between these vessels and the shore stations at Kakinada and Balusutipa. In this case the training courses for mechanized boat operators would take place in June/July.

As the Shore Stations VHF sets are licensed to the Department of Fisheries they are to be operated by trained DoF staff. However in the longer term it may be more appropriate and sustainable to have all the village based sets operated by the SSAGs.

3.12 VHF Shore Stations

These base stations are being established at Kakinada at the Fisheries Terminal Organisation (FTO) building by the Kakinada fishing harbour and at Balusutipa on the edge of the village in a raised RCC frame shack extending from the water tank bund.. Construction work for both aerial tower foundations and for the radio shack at Balusutipa are under way and are expected to be complete by mid-May. The base station VHF sets will then be installed and commissioned by Phillips with approvals by the national consultant (radio communications).

3.13 Training Workshop on Safety Aspects of the Design Construction and Operation of Mechanised Fishing Vessels and Demonstration of Improved Safety at Sea On Mechanised Vessels

To be developed by the International Consultant Naval Architect. Among his requirements will be :

An able and well equipped mechanised boat building yard with engineering facilities close to Kakinada.

Cooperation from the Boat Owners Association, through DoF, in ensuring participation and attendance at the training workshop and demonstrations of improved sea safety.

It is recommended that the NPD ensures that there are senior representatives from the Coast Guard, MMD, Department of Fisheries and other appropriate authorities available to attend the workshop and demonstrations by the International Consultant Naval Architect and interact with him on safety matters.

The Carley Floats (buoyant apparatus or rigid liferaft) purchased from the safety equipment budget for use on mechanised boats should be installed and tested under the supervision and guidance of the Naval Architect.

Diesel Engines for the Navas. The DoF Kakinada should designate a suitable yard in or very close to Kakinada for installation of the Kirloskar diesel engines in Navas. The International Consultant Naval Architect can give detailed instruction on installation practices there during his visit.

The FAO Naval Architect Consultant will undertake his visit to the project during the month of June.

3.14 Other Equipment

100 lifejackets are currently being purchased. The remainder will be purchased following the advice of the NPD/project leader later in the project.

100 Lifebouys are currently being purchased. It was agreed that the remainder will not be purchased. In their place, Carley floats (rigid liferafts, buoyancy apparatus) for the crews of mechanised fishing vessels will be purchased, the number being dependent on the savings anticipated in item 4, Annex 3 of the project document. The national consultant (radio communications) will obtain quotations and proforma invoices and forward to FAOR Delhi.

The allocation of Carley Floats and other equipment which may be supplied to mechanised boats is to be on 50% subsidy basis as agreed in consultation with DoF and representatives of mechanised fishing vessel operators during Jeremy Turner's visit of 11-22 May 1997. The funds so collected by DoF/Project are to be used to provide more of the same equipment.

3.15 Allocation of Life Jackets and Life Buoys

This safety equipment is envisaged as being donated to volunteers through the SSAGs as is seen most appropriate. The obvious beneficiaries would be the volunteers who take their boats to the sand banks to retrieve the shrimp seed collectors at the time of a cyclone warning. These and others will be identified through active SSAGs during the course of the project.

Following receipt of proforma invoice for the supply of 12 Kirloskar DM20/20HP/1500 rpm inboard diesel engines together with sterngear, 12 units should be purchased. The national consultant (radio communications) will obtain quotations and proforma invoices and forward to FAOR Delhi.

3.16 Selection and Allocation of Engines

The rationale for proposing outboard motors (OBMs) in the project area was not supported by the actual situation in the field. The standard form of motorisation of Navas is by inboard diesel engine 10 -20 HP.

The project proposes to provide 20 HP inboard diesel engines as these are intended for craft that will go to collect shrimp seed collectors. The additional horsepower is favoured since larger Navas would be preferred for capacity and speed and (ideally) seaworthiness. They should not be under-powered as they may have to travel a considerable distance against strong winds, waves and tides.

As such the project will purchase 12 units of Kirloskar 20 HP diesels, and these will be designated for selected beneficiaries who volunteer for Storm Safety Action Groups for Shrimps Seed Collector retrieval from sand banks. The actual purchase and delivery of these engines has been held until September as the preferred method of deciding the actual beneficiaries is by the Storm Safety Action Groups themselves. Until these are formed and somewhat established, the diesel engines would undesirably influence participation in the SSAGs.

The International Consultant Naval Architect was to have supervised the installation of these engines but this will not be possible under the present timetable. It is recommended that he make detailed recommendation s of how this is to be done and leave these with the Project Team for implementation in September when the Team Leader will again be in the project area.

3.17 Overseas study tours

These are to be allocated later in the project as the needs are clarified.

3.18 Workshop "Measures to Reduce Loss of Life Amongst Fisherfolk During Cyclones"

This is to be held at Vishakhapatnam from 15 to 18 September 1998. The proposed programme is given in Annex 3. The National Consultant and Team Leader are responsible for working with the NPD, Commissioner for Relief and DoF to ensure all preparations are in order.

3.19 Improved Cyclone Warning and Dissemination

Improvement of cyclone warning dissemination through National and State TV and radio broadcasting networks will be addressed both during the May-June training courses and at the Workshop in September through a clearer understanding of their present shortcomings elicited from the work of the storm safety extension officers and further field visits by FAO project consultants.

Similarly the short comings of the CCPA will be addressed through the Workshop.

3.20 Heads Indication of Project Spending against Training and Equipment

This is given in Annex 5

3.21 Reporting

The AFPRO report should be reproduced for wide distribution.

Reports required by the FAO team are listed below and shown on the workplan (Annex 1)

A.	Team Leader Mission Report	
B.	National Consultant (Fish)	Report on Training Course
B	National Consultant (Radio)	Report on VHF Training
C.	National Consultants	Mid-Term Report
D.	Team Leader	Review of Mid Term Report
E.	Team Leader	Workshop Report
F	National Consultants	Prep.of all documentation and information for Final Reports
G.	Team Leader	Final Reports

The National Consultants are also required to write a mission report for each period engaged in project work for the team leader to keep him abreast of project progress and developments

3.22 Actions Required:

3.22.1 <u>The national consultant (radio communications)</u>

As per Terms of Reference and specifically:

1. Write a mission report for each period engaged in project work for the team leader to keep him abreast of project progress and developments;

2. Provide justification for additional VHF channels to NPD for forwarding to the fisheries development commissioner for action;

3. Investigate licensing of the VHF sets. If SSAGs are to use mobile sets in selected villages, the implications of licensing and ownership should be clarified both for the project duration and beyond when licenses come up for renewal. (Who will be responsible and who will pay? What happens when new sets are purchased either for village SSAGs or Mechanized Boats?) The national consultant will investigate all aspects of this issue and write a report with proposals and recommendations on how to proceed;

4. Check dimensions of Carley Floats against available space on Mechanized Boat wheelhouse top prior to obtaining pro forma invoices;

5. Investigate supply of quality fireworks of a variety of forms, colours, and sounds to be tested as warning signals by SSAGs and possibly also from lighthouses;

6. Investigate supply of 100% water tight containers for storage of fireworks by village SSAGs.

3.22.2 The national consultant (coastal fisheries)

As per Terms of Reference and specifically:

1. Write a mission report for each period engaged in project work for the team leader to keep him abreast of project progress and developments. This will include the initial and three quarterly reports on Storm Safety Extension Officer fieldwork;

2. Follow up all arrangements for the Workshop in September with NPD and Commissioner of Relief. This will include finalising brochures, list and invitation of participants and special guests and VIPs, ensure key persons will be available, venue has all facilities required for the number of participants, including facilities for 4 working groups to operate, power, secretarial support, photocopying, printing, fax and telephone etc;

3. Note the inclusion of the following in the list of invitees:

- Sebastian Matthew. Executive Secretary, International Collective in Support of Fishworkers, 27 College Road, Madras 600 006;
- Satish Babu, Chief Executive. South Indian Federation of Fishermen Societies, Karamana, Trivandrum, Kerala. (This is a strong NGO with extensive links with the fishing communities throughout south India. They have had notable success with the introduction of appropriate technology and training. They will shortly be opening an office in Kakinada.)

Other suggestions include: PREPARE in Madras, The National Fishworkers Forum representative in East Godaveri

4. Contact leading animation and video producers to identify suitable companies to undertake the production of the video outlined in this report. Liaise with Team Leader.

5. Produce course material for the modules of his competence in the Storm Safety Extension Officers Training Course.

6. Meet Director General of Light Houses and Light Ships in Delhi to explore the possibility of using light houses and their crews as a possible link in cyclone warning dissemination. Could the lighthouse crews hold a project VHF set and activate pyrotechnical devices or other signals to alert inshore fishing craft (principally Navas) and shrimp seed collectors on the sand banks on receipt of a VHF message?

7. Liaise with NPD as required to ensure timely commencement and completion of all project activities as per the workplan.

3.22.3 Team Leader

1. Liaise with National Consultants as required re courses, equipment, shore station completion and commissioning and workshop preparations.

2. Liaise with NGO Committee Coordinator to approve SSEO course details and costs.

3. Prepare materials for SSEO course modules.

4. The Team Leader will plan to visit the project again from 24 April for approximately six weeks to supervise final preparations and conduct of the SSEO Course and subsequent field trials of the trained extension officers. Participate in early fieldwork with extension officers and actively participate in and guide work with Storm Safety Committees in the use of flares/fireworks/pyrotechnics etc. to extend warning signal to nava fishermen to retrieve seed collectors He will also see that the preparations for the International Consultant Naval Architect are in place. He will inspect and appraise VHF installations and courses. He will also meet key members of the SLHPSC, Military, AIR, IMD and Doordashan.

5. Oversee arrangements for workshop, also participation, presentation and workshop report preparation.

3.22.4 NPD

1. Liaise with the NGO Committee to ensure all preparations for the SSEO course in April are completed on time.

2. Keep the State Commissioner of Relief and the Collector and District Magistrate closely informed of project activities through regular meetings with project staff and concerned officers at State and District level. Coordinate actions and disseminate information regarding project activities.

3. Liaise with the GOI State Commissioner of Relief and national consultant (coastal fisheries)_to ensure effective and timely conduct of the workshop in Vishakhapatnam 15 -18 September.

4. Ensure in conjunction with the national consultant (coastal fisheries) that the reporting required of the DoF is fulfilled.

5. The NPD agreed in Hyderabad to provide the following staff at DoF Kakinada:

   - 2 FDO's To provide direct assistance and support to the FAO Team commencing with supervision of the VHF shore station construction, erection and commissioning works. Also to ensure mechanised boat VHF trainee operators come for the training. Support installation of marine sets and coordination and organisation of Mechanized Boats/Owners to facilitate this. Support all VHF courses and Storm Safety Extensionist Courses.

   - 2 AD'sPart-time To coordinate and supervise the work of the trained extensionists.

   - 10 Fieldmen For receiving training in shore station operation (3 on duty at Kakinada, 3 at Balasutipa and 4 to return to their normal duties but to be available as reserves.

   - 10 FDO/AIF Full time for 8 months for training as extension officers and subsequent field work. They must be fully available and committed to the idea of spending their working time in the villages for the purpose of developing storm safety committees and action groups for the duration of the project. Ideally 50 % should be women. For these 10 the FAO project will cover their TA/DA for the period of field work.

Annex I Project Workplan I	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb
Completion and Commissioning of Shore Stations	XXXX	XXXX	XXXX	XX									
Procurement Radios L.Jkts/Buoys		XXXX											
Procure Diesel Engines							XXX						
Procure Curley Floats		XX	X										
Culvert		XX	X	XXXX	X			XXX					XX
Radha Krishna		XX	X	XXX	XX	X	XX	XXX			X	X	XX
Raghu Ram		XX	XX X	XXX	XXX			XXX				X	XX
Guildtrandsen					XXXX								
Project Area Survey with NGOs		X											
Video Cyclones+Disaster Prep.		X	X	X	X								
Formulation Storm Safety Extensionist Course, NGOs		X	XXXX										
Training Extensionists + Trials			X	XXXX	X								
Extension Work Training SSAGs					XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Select Moth. Boats for VHF+Inst			XXX	XX	XXX								
Train VHF Shore Station Ops													
Train Moth. Boat VHF Ops				XX		X							
Select Benefic. Engines + L.Jkts								XX					
Install Engines										XXXX			
Overseas Visit Selection				X									
Reporting		A			B			CDE	*				FG

Annex 2

Storm Safety Extension Officers Training Course

To: NGO Committee formed at request of FAO to develop and run a Training Course for NGO and DoF Disaster Preparedness Extension Officers within TCP/IND/6712

From: Paul Calvert, FAO Team Leader.
Pulari, TC42/937(11), Asan Nagar, Vallakadavu, Trivandrum, 695008.
Tel 0471 502622 Fax 450541 email paulc@md2.vsnl.net.in

Date: 20 March 1998

Subject: Training Course for NGO and DoF Disaster Preparedness Extension Officers and Video.

Further to Jeremy Turner's (FAO) visit to AFPRO earlier this week I would like to confirm that we invite you to form a committee to propose, develop and ultimately deliver a training course for disaster preparedness extension officers. The guidelines attached are indicative and are to be developed in conjunction with the FAO Team Leader. On agreement of content and methodology the NGO committee should provide a quotation to the FAO Team Leader. Additionally the idea of an Awareness Raising Video is proposed. The NGO committee is invited to develop this also and provide a quotation as above.

Training for DoF/NGO Extension Workers in Developing Storm Safety Committees in the Fishing Communities in and around Balusutipa and Bhairavapalem

To be followed by development of Storm Safety Committees/Action Groups in 50-60 villages in this area by the so trained extension workers.

Venue: DoF Fisheries Training Institute (FTI) Kakinada

Date: 29 April 1998 for approx. 3 weeks

An indicative outline is provided below:

Content of Module	Resource Person	Duration (hours)
1. Introduction and background to TCP/IND/6712	FAO	0.3
2. Presentation of AFPRO report and its findings.	AFPRO	2
3. Cyclones; their nature, behavior, effects, tracking, prediction of surge height, wind strength, rain and the effect	IMD	4

of tides etc.		
4. The Cyclone Contingency Plan of Action (CCPA). How it works and its strengths and weaknesses	FAO/RK	4
5. AIR and Doordashan cyclone warnings and information bulletins. Strengths and weaknesses and interpretation for local use.	NGO	2
6. Indigenous knowledge about cyclones and storm indicators.	NGO	2
7. Communication skills and participative training methods.	NGO	4
8. Radio Communications; use, capabilities limitations and maintenance including power supplies and weather effects	FAO/RR	4+4
9. Alerting of shrimp seed collectors, small fishing craft etc. e.g. by flares, fireworks, lights, smoke, sound, etc. focus on what is affordable and reliable.	FAO/PC	4
10. Rescue of shrimp seed collectors and others from outlying areas	FAO/PC	4
11. Disaster Preparedness in the community. The formation of Storm Safety Committees, Disaster Task Force teams; maintenance of cyclone shelters, preparation with food grains, drinking water, cooking fuel, assistance to aged/infirm/pregnant women and unattended children, first aid, etc.	NGOs	24
12. Cyclone Shelters; design and construction, the good and the bad and the ugly. Multiple uses and a sense of pride and ownership.	DRDA NGO FAO/PC	6
13. Particular issues affecting women.	NGO	8
14. Organisation of Annual Remembrance Day incorporating commemoration of those lost in earlier cyclones (Nov 96) and preparedness exercises where skills are practiced and demonstrated. (e.g. trial evacuation of a shrimp seed collection site). Possibly Best Maintained and Prepared cyclone shelter awards and prizes.	FAO/PC	3
15. Safety equipment use and care. e.g. life jackets and life buoys, radios and telephones, TV's and their aerials, etc.	FAO/RK/ RR	8
16. Craft Safety and Stability, essential equipment e.g. bailers, ropes, paddles, life jackets and improvised buoyancy aids, tarpaulins to keep out heavy spray, additional buoyancy, etc.	FAO/PC	4
17. Insurance of life and property.	NGO/	2
18. Land Use Patterns and Environmental Degradation as factors in increased vulnerability.	NGO	3
19. Government's responsibilities and Government Schemes for development, aid, assistance, loans, insurance etc. and how to access them.	DRDA/ DoF/ NGO	2

Together with field visits the total duration of the course would probably be about three weeks.

Resource persons would include: FAO Team National Consultants (Dr. Radha Krishna and Raghu Ram), FAO Team Leader Paul Calvert, National Institute of Oceanography (?), Indian Meteorological Department, etc. Where NGO is tabled the Committee should find the best resource person from NGO , public or private sector etc. as appropriate.

DoF to nominate 10 staff (of which ideally half would be women) who will be able to fully participate in the course and subsequent fieldwork.

Similarly NGOs to nominate or recruit 10 participants (at least half of which are to be women) who will be able to fully participate in the course and subsequent fieldwork. (Up to Feb. 1999)

Methodology for extension work in the villages themselves is to be further developed by the NGO committee. However it must be borne in mind that regular interaction over a longer period say 6 months is far more valuable than a few intensive short courses. Weekly visits over six months may be the preferred scheduling. Since the communities are busy throughout most days in their primary activities the fieldwork has to be adjusted to fit with their preferred timings(e.g. early mornings, evenings)

The extension teams would identify a key community organiser in each village to continue the work during the week. The community organiser and the extension team would develop a Storm Safety Committee/Action Group in each village. Actual practise of, and participation in, the skills and actions developed would form a key component of the village training interactions.

Possibly the 10 DoF and 10 NGO extensionists could be paired thus giving ten extension teams. They could then each be assigned five to six villages for a period of six months. This way 50 to 60 villages would be reached with disaster preparedness training. (In larger villages there may be several groups to work with rather than one).

One day per week the extension teams (and community organisers?) would meet to share and review progress and solve problems. On a monthly basis this would be a review with DoF and NGO coordinator where, additionally, methodology may be refined.

Training and Awareness Raising Video:

Cyclones and Community Disaster Preparedness.

Audience	Primarily coastal and esturine fishing communities of Andhra Pradesh Secondly other communities and audiences e.g. September Workshop) for which the video may be dubbed in English, Tamil, etc.
Purpose:	To raise awareness about: The causes, nature and behavior of cyclones and the effects they induce and why their track is hard to predict. What communities themselves can do to be better prepared.
Language:	Colloquial Telegu
Duration:	15-20 minutes
Content:	Include:

- Cyclones / Hurricanes in Action
- IMD tracking and reporting
- What is a cyclone, how and why they form. *Animation*
- Cyclone growth, approach and crossing coast, erratic unpredictable behavior, storm surge/wind and pressure and sea bed and coastal features. *Animation and Archive footage.*
- Effects (because audiences who have never been in a cyclone often have a rather indifferent attitude towards them compared with those who have survived them) *Archive footage Doordashan, BBC, etc.*
- Disaster Preparedness in the community (examples from NGO work e.g. CASA, ACTION, FAO/DoF etc.

Annex 3

Workshop on Measures to Reduce Loss of Life amongst Fisherfolk during Cyclones 15 - 18 September 1998

Proposed programme:

Day 1		
Registration		0830 - 0930
Welcome Address	Commissioner. of Fisheries AP	0930 - 0945/ 1000
Keynote Address		1000 - 1030
message from FAOR Representative, Delhi	FAOR Delhi	1030 - 1040
Chief Guest's Address		1040 -
Coffee Break		
Cyclones and Cyclone Forecasting at National and State Level	IMD	1130 - 1200
Storm Surges	NIO	1200 - 1215
Cyclone Contingency Plans and Procedures at the National And State Levels	Commissioner of Relief	1215 - 1230
Cyclone Contingency Plans and Procedures at the National And State Levels	District Collector East Godaveri	1230 - 1245
Discussion		1245 - 1315
Lunch		1315 - 1400
A Description of the events occurring at sea and on land on 6 and 7 November 1996 in East Godaveri District	National Consult. FAO and Fishermen and women reps	1400 - 1430
Discussion		1430 - 1500
Cyclone Warning and Dissemination Systems in Bangladesh	TCDC Consult.	1500 - 1515
A description of the events occurring on 17-20 May 1997 in Chittagong area	TCDC Consult.	1515 - 1530
Cyclones in Vietnam	TCDC Consult.	1530 - 1550
Cyclones in Philippines	TCDC Consult.	1550 - 1610
Discussion		1610 - 1640
DAY 2		
Loss of Mechanised Vessels from Kakinada	Fishermen's Assoc.	0930 - 1000
Search and Rescue	Coast Guard / Military	1000 - 1015
Discussion		1015 - 1040
The Fisherfolk of East Godaveri - Demography and Fishing Operations	FAO Consultant	1040 - 1100
Analysis of the events occurring on 6 and 7 Nov 1996 in the affected villages	FAO Consultant	1100 - 1130
Awareness Programmes for Disaster Preparedness	FAO Consultant	1130 - 1200
Discussion		1200 - 1220
Improvements of Mechanised Fishing Vessels and their equipment	FAO	1220 - 1245
Lunch		
Cyclone Shelters: Design Construction Maintenance and Use	DRDA	1400 - 1415
Discussion		1415 --1430
The Use of Radio Transceivers at sea and on land for Cyclone Warnings	National Consultant FAO	1430 - 1500
Discussion		1500 - 1515

Introduction to Working groups: 1. Cyclone Warning Dissemination Systems and Co-ordination from State to Fisherfolk 2. Evacuation and Protection 3. Use of Radio, Safety Equipment and SAR 4. Fisherfolk Storm safety action Groups / Disaster Preparedness		1530 - 1700
DAY 3		
Brief Presentation of Working Group Progress (Max 5 min each group)		0930 - 1000
Interaction		1000 - 1015
Resumption of Working Groups and drafting of reports		1015 - 1300
Lunch		1300 - 1400
Presentation of Working Group papers (20 min each) followed by 30 min Discussion and Finalisation, typing and distribution of		1500 - 1630
DAY 4		
Presentation of the Main Findings, Conclusions and Recommendations	FAO	1000 - 1100
Valedictory and Closing session		1100 - 1300
LUNCH		1300 - 1430

Annex 4

Cost of VHF Training Courses:

1. Storm Safety Extension Officers VHF Appreciation Course.
   Comes within the Storm safety Extension Officer Training Course

2. Mechanized Boat Crew VHF Operators Course.

Rp250pd x 4 courses x 20 people x 2 days	= 40,000
Rp50 per lunch x 160	= 8,000
Total	= 48,000

3. Shore Station Operators Course.
   These are all DoF staff. Only lunches to be provided

Rs50 x 4 days x 10 people	= 2,000

4. Storm Safety Action Group VHF Operators Course

Rs250pd x 1 course x 20 people x 3 days	= 15,000
Rs50 per lunch x 60	= 3,000
Total	= 18,000

Total VHF Training Costs: Rps = 68,000
(Approximately $2000)

Annex 5

Budget Projections

1. Training: Estimates of Costs:	**US$**
VHF Training Courses	2,000
SSEO Training Course including NGO Fees and Supervision	?6,000
Mech. Boat Sea Safety Course	?1,000
Contingency	1,000
TA/DA for 20 Extension Officers for 6 months@100Rs x 20 officers x 6days x 40 weeks = 480,000Rs	13,000
NGO Extensionist Salaries 10 x 4000Rs? x 9mnths=360,000	9,500
Overseas Study Tours upto	20,000
Towards September Workshop in Vishakapatanam	6,000
Video with Animation of Cyclone	?15,000
Total Estimated Spend	73,500
Total Budget	70,000
Estimated Overspend	3,500

2. **Equipment: Estimate of Costs:**	
Kirloskar Diesel Engines for Navas (12@1700)	20,400
Carley Float Buoyant Apparatus (12 @ 700)	8,400
Lifejackets (100@75)	7,500
Lifebouys (100@75)	7,500
Shore Station Sets (2@7,750)	15,000
Bhairavapalem Set with Battery etc.	1,325
More like this = village SSAG sets x5?	6,625
Mech. Boat VHF Sets (?150@ 370)	55,500
Returned from 50% contribution to VHF Sets from MechBoatOwners	(27,750)
Misc. Equipment for Mech. Boat Sea Safety Course	1,000
Total Estimated Spend	95,500
Total Budget	130,000
Estimated Underspend	34,500

Net Estimated Balance from training and equipment budgets = $31,000

Alternative uses of remainder of training and equipment budget: i.e. $31,000

Village SSAG VHF Sets (5 @1325)	6,625
VHF Sets for mech. boats upto 150 at 50% subsidy = 150@370)	27,750
Shore Station Sets (2@7,750) with towers. (to extend network.)	15,500
Carley Floats (should they be at 50% subsidy after first 12 or for all?) (? @700)	?
Training Course for New Extension Officers at project end?	?

Waterproof Firework Packs for SSAGs 50@?30	1,500
Cyclone Shelter Micro Maintenance Grants to SSAGs to be matched 50-50???? (for painting for e.g.)	?
Annual Day Celebration Grants for Bhai and Balu	?

Annex 6

Itinerary

Trivandrum		11 3.98
Hyderabad	11.3.98	12.3.98
Kakinada	13.3.98	
Balusutipa, Masanitipa	14.3.98	14.3.98
Bhairavapalem, Teerthalamundi	17.3.98	17.3.98
Kakinada		19.3.98
Hyderabad	20.3.98	22.3.98
Trivandrum	22.3.98	

Schedule

11.3 Travel to Hyderabad. Meet Jeremy Turner
12.3 Meeting at Dept. of Fisheries Hbad. Catch night train to Kakinada
13.3 Visit Project office at Kakinada Port. Inspect foundations for aerial tower. Discussions with JT and Project consultants
14.3 To Balusutipa with Consultants JT, Dept. of Fish, AFPRO
15.3 Project Office, discussions and Project and Workshop Planning with JT and Consultants
16.3 Discussions with DFID, OXFAM, CASA and DoF. Develop Project workplan and training Course.
17.3 To Bhairavapalem and Teerthalamundi with Consultants, DoF and ACTION
18.3 Meeting with District Collector, visit to Fisheries Training Institute and DoF offices, discussions
19.3 Project Office. Detailing training course workplan and workshop. Catch night train to Hyderabad
20.3 Prepare training course outline, meeting with DoF NPD, OXFAM and AFPRO
21.3 Meetings: Centre for Development Communications; CARE and AFPRO
22.3 Travel to Trivandrum

Annex 7

Persons met:

Hyderabad

T Gopalrao	Principal Secretary to Govt., Agr and Fisheries Dept., Hyderabad
N Ramarao	Jt Secretary (Fisheries) Ministry of Agriculture, GOI
P Dayachari	Commissioner, Fisheries, Hyderabad
C Krishnamurthy	Jt Director of Fisheries, Hyderabad
B V Raghavulu	Regional Deputy Director of Fisheries, Kakinada
Ms C Mohana (Ms.)	Oxfam (Programme Coordinator)
C M Muralidharan	AFPRO
J M Turner	Senior Fishery Industry Officer, FAO, Rome
K Radhakrishna	FAO National Consultant (Fisheries)
P Raghu Ram	FAO National Consultant (Radio communications)
Roy D'Silva	OXFAM Regional Representative
C.S.Reddy	Director, CARE Andhra Pradesh
Rajendra Shaw	Director, Centre for Development Communication

Kakinada

J.S.V.Prasad	Collector and District Magistrate, East Godavari Dist.
Y.S.Prasad	Project Director, District Rural Development Agency
B.V.Raghavulu	Regional Deputy Director of Fisheries Kakinada
C.Mohana (Ms.)	Programme Coordinator, OXFAM
Venkatesh Salagrama	Field Liaison and Extension Officer, DFID (ODA)
M.Gurudutt Prasad	Exec. Secretary, ACTION, Rajamundry
T.Yesupadam	Field Officer, CASA, Machilipatnam
KSN Murthy	Asst Dir of Fisheries Kakinada
V.Rama Mohana Rao	Fisheries Development Officer (asst to RDD)

Annex 8

Clips from the Web

13) Tropical cyclone myths: 13a) Doesn't the low pressure in the tropical cyclone center cause the storm surge?

No. Many people assume that the partial vacuum at the center of a tropical cyclone allows the ocean so rise up in response, thus causing the destructive storm surges as the cyclone makes landfall. However, this effect would be, for example, with a 900 mb central pressure tropical cyclone, only 1.0 m (3 ft). The total storm surge for a tropical cyclone of this intensity can be from 6 to 10 m (19 to 33 ft), or more. Most (>85%) of the storm surge is caused by winds pushing the ocean surface ahead of the storm on the right side of the track (left side of the track in the Southern Hemisphere).

Since the surface pressure gradient (from the tropical cyclone center to the environmental conditions) determines the wind strength, the central pressure indirectly does indicate the height of the storm surge, but not directly. Note also that individual storm surges are dependent upon the coastal topography, angle of incidence of landfall, speed of tropical cyclone motion as well as the wind strength.

18) How does El Nino-Southern Oscillation affect tropical cyclone activity around the globe?

The effect of El Nino-Southern Oscillation (ENSO) on Atlantic tropical cyclones is described in subject 32).

The Australian/Southwest Pacific shows a pronounced shift back and forth of tropical cyclone activity with fewer tropical cyclones between 145 and 165E and more from 165E eastward across the South Pacific during El Nino (warm ENSO) events. There is also a smaller tendency to have the tropical cyclones originate a bit closer to the equator. The opposite would be true in La Nina (cold ENSO) events. See papers by Nicholls (1979), Revell and Goulter (1986), Dong (1988), and Nicholls (1992).

The western portion of the Northeast Pacific basin (140W to the dateline) has been suggested to experience more tropical cyclone genesis during the El Nino year and more tropical cyclones tracking into the sub-region in the year following an El Nino (Schroeder and Yu 1995), but this has not been completely documented yet.

The Northwest Pacific basin, similar to the Australian/Southwest Pacific basin, experiences a change in location of tropical cyclones without a total change in frequency. Pan (1981), Chan (1985), and Lander (1994) detailed that west of 160E there were reduced numbers of tropical cyclone genesis with increased formations from 160E to the dateline during El Nino events. The opposite occurred during La Nina events. Again there is also the tendency for the tropical cyclones to also form closer to the equator during El Nino events than average.

The eastern portion of the Northeast Pacific, the Southwest Indian, the Southeast Indian/Australian, and the North Indian basins have either shown little or a conflicting ENSO relationship and/or have not been looked at yet in sufficient detail.

THE KILLER CYCLONES

V. P. SUBRAHMANYAM

The recent devastating cyclone that hit the Andhra coast was not an unusual phenomenon. These killer storms occur quite frequently over warm oceanic areas in the tropics

THE term 'Cyclone' derived from a Greek word meaning 'coil of a snake' was first used by Captain Henry Piddington about the middle of the last century for denoting revolving storms occurring in the Bay of Bengal and the Arabian Sea. A cyclone is essentially a huge rotating mass of air spiralling inward into the centre of the storm in the tropical oceans; when fully developed, it is a vast whirl-wind of extraordinary violence. Temperate zone storms—the extra-tropical cyclones—are larger than the tropical cyclones which again cannot match the concentrated fury of the 'Tornado'—the funnel cloud. But, because of their considerable size and intensity, they are the most dangerous and destructive of all storms and in total damage excel any other natural catastrophe.

Historical records show that tropical cyclones have been known from very early times in almost all the tropical countries of the world. In the Atlantic and the eastern Pacific region they are known as 'Hurricanes', in the western Pacific as 'Typhoons', as 'Willy-Willies' in the Australian seas, as 'Bagiuos' around the Philippines, 'Repus' over Japan and 'Asifat' along the Arabian coastal region.

Wrath of gods ?

The haunted days of early man were filled with many terrors which developed out of vagaries in the natural world. Since no mortal means of protection from these phenomena were available to him, he created immortal ones in the form of holy images which he worshipped and to which he offered sacrificial gifts for propitiation of their wrath and crave for mercy. And as fierce winds lashed and deadly storms glued him to his cave dwellings, he maintained his courage only by his faith in these gods of his creation. One such deity was 'Hurican' (which in Spanish meant 'God of Evil'), established by a tribe of aborigines—the Tainos—who developed a vast culture and civilization in the central American region. The Tainos are now extinct but their word with the suggestion of dread in the term 'Hurricane' still lingers on.

Half-a-world away, in the Pacific Ocean where the same storms are called 'Typhoons', the fear is just as real. On the great coral islands which dot the Pacific storm-belt east of the Australian continent, panic-stricken natives offer sacrifices—formerly even human sacrifices—so that they may be spared destruction.

Cyclone months

None of the tropical regions in either hemisphere is entirely free from cyclones but there is no record of a storm of hurricane intensity having occurred in the south Atlantic Ocean or in the south-west Pacific. Tracks normally followed by tropical storms over the Indian region reveal that cyclonic disturbances of varying intensities and extent originate in the Bay of Bengal and the Arabian Sea, mainly during the period from April to December. The number of storms occurring in

Dr. Subrahmanyam is Prof. of Meteorology at Andhra University, Waltair (AP)

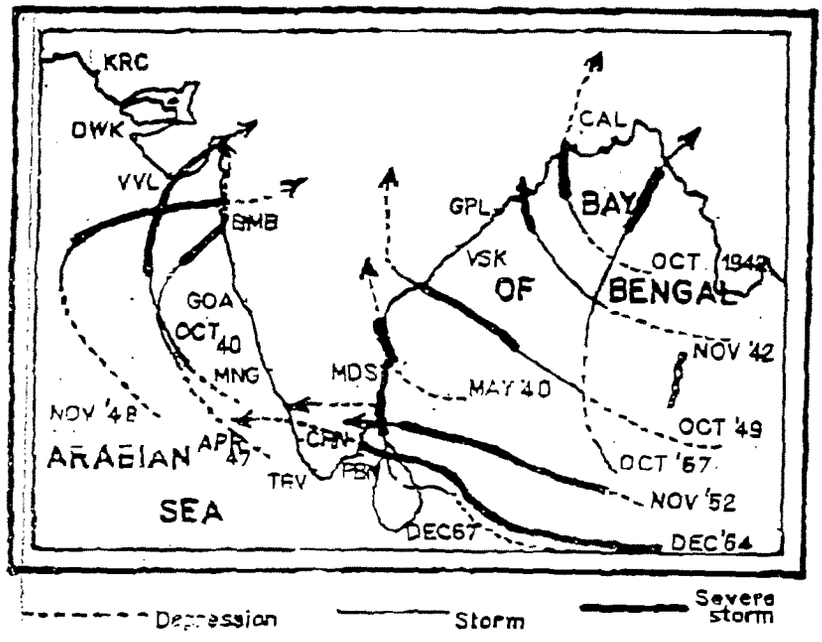


Fig. 1. Track of major cyclones in the Indian regions

the Bay of Bengal is, on an average, 4 to 5 times more than those occurring over the Arabian Sea. The storms which form in this region during the transition month—April to May and October to November—are of great intensity having an inner core of fierce winds. The cyclonic disturbances of the monsoon season—June to September—known as the 'monsoon depressions' are as a rule of smaller intensity; they form at the head of the Bay and follow a west-north-westerly course and the damage caused by them is mainly due to heavy rain rather than by strong winds.

The cyclonic storms of the transition months usually form in the middle of the Bay, move in a north-westerly direction and sometimes curve again towards north or north-east. Some, however, are known to trespass from the China Sea as weak pressure systems to start with, and later intensify into very severe storms on entering the Bay of Bengal. It is not unusual for a Bay of Bengal cyclone to cross the east coast of India, cause havoc around the point of entry, become subdued during its passage over land and later become easy on entering the Arabian Sea. Some of these, however, have enough energy left in them to revive into severe cyclonic storms and move off towards Arabia or, in very rare cases, (as, for instance, it has happened in the recent November 1977 storm) change direction and hit the western coast of south India. October and November are the two months to be dreaded most as regards cyclones originating both in the Bay of Bengal and the Arabian Sea.

Though not followed in our country for some unknown reason, it has been the practice in other parts of the world to give names to these weather monsters. For several hundred years, hurricanes over the Spanish islands of the Caribbean region were named after the Saints. Early in this century, forecasters in Australia were sarcastically naming their storms after political figures they disliked. Today, hurricanes of the Atlantic and typhoons of the Pacific are called by girls' names—like Alice, Betty, Carol, Dorothy, etc.—a practice that has gained popularity during the Second World War. It is claimed that this method is written as well as spoken communications is shorter, elegant, quicker and less confusing than any other type of nomenclature.

How they form

Tropical cyclones form in much the same way and in the same

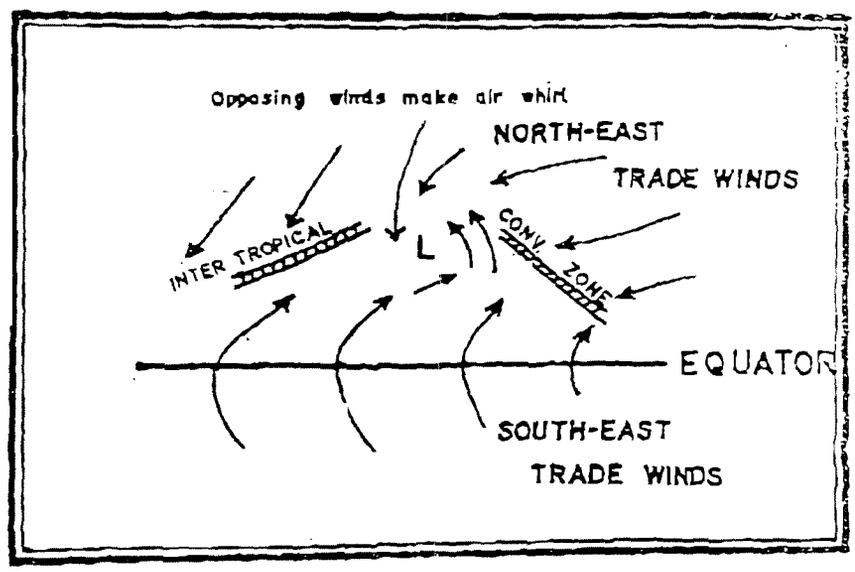


Fig. 2. Origin of a tropical storm

seasons all over the world; they originate over comparatively warmer oceans fairly close to but not at the equator. In the tropics, the prevailing winds called the 'trades' blow from the north-east in the northern hemisphere and from the south-east in the southern hemisphere. Between these wind systems is a belt of calms—known as the Doldrums—which swings northward and southward with the advance and retreat of summer. In certain weak sections of this otherwise continuous belt of calms, technically referred to as the 'Inter-Tropical Convergence Zone', moist stagnant air becomes warmer and more moist and begins to rise on a large scale. This rising air is instantly replaced by air flowing in from all sides, but because of the earth's rotation the inflowing air is prevented from directly reaching the centre and, therefore, a whirling system with spirally ascending component of air is formed. All feeble circulations do not develop into intense systems and the circumstances responsible for such intensification are not yet fully understood.

The evolution of an average cyclone can be broadly divided into four phases, namely, (a) formative, (b) developing, (c) mature, and (d) dissipating phases. In the formative phase, prevailing winds over an extensive oceanic region become variable and scattered showers of rain occur accompanied usually by thunder. Atmospheric pressure in the area gradually falls and isobars on the synoptic weather map take on closed shapes. Meteorological services then describe the weather over the region as 'unsettled'.

During the developing phase, the pressure fall continues and winds increase in speed taking up a definite anti-clockwise direction of motion around the centre in the northern hemisphere (it is clockwise in the southern hemisphere). Skies become thickly overcast and rainfall

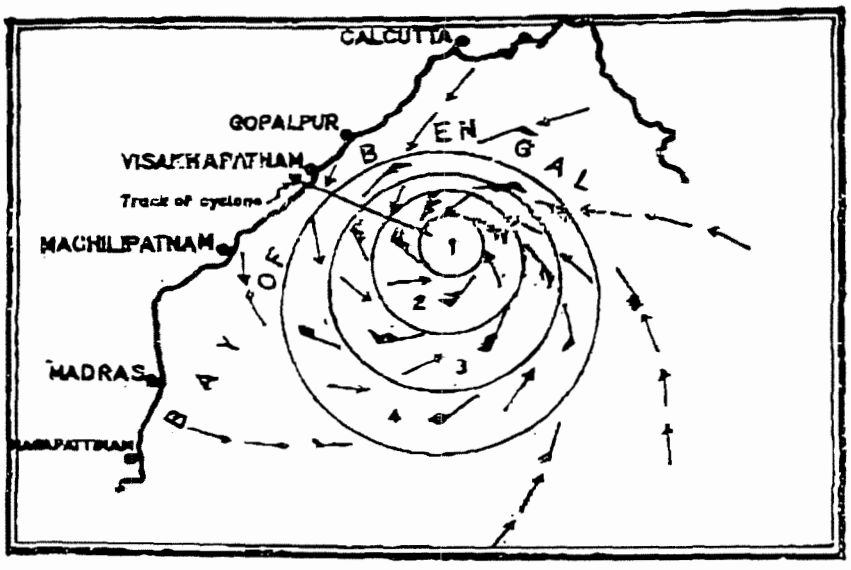


Fig. 3. The four parts of a mature tropical cyclone

becomes heavier; winds spiral inward with speeds around 25 to 35 km per hour. This condition is described as a 'depression' by the Weather Bureau. From this stage onwards, the area of low pressure and the associated weather begin to move at a rate of 350 to 500 km per day. Many of these depressions do not develop any further; some only pass beyond into the mature phase while very few become severe cyclones. The India Meteorological Department uses the term 'cyclonic storm' when the wind speed exceeds 64 km per hour and 'severe cyclonic storm' when the wind-speed is in excess of 80 km per hour.

In the mature phase, the tropical cyclone consists of four distinct parts as detailed below :

(1) A calm central area, known as the 'eye' of the storm, varying in diameter between 10 km and 30 km in which absolute calm or very light winds prevail with clear or partly clouded skies.

(2) An inner ring of hurricane winds (90 km per hour or more), 50 km to 150 km in width within which the pressure fall is excessively steep and fierce squalls and torrential rains occur.

(3) An outer storm area in which winds reach strong gale force, 50 km to 80 km per hour, and which is generally asymmetrically situated with respect to the pressure centre.

(4) The outermost area of weak cyclonic circulation.

Anatomy of a cyclone

If we look at the vertical section of a fully developed tropical cyclone, we find that the motion of air in the lower levels is along a rapidly contracting spiral with relatively gentle ascent. In the upper levels, it is along a gradually expanding spiral. At the core of the storm, i.e., in the eye, the air experiences a significant descent without much horizontal motion. The eye has all around its sides thick vertical clouds known as 'wall clouds' from which incessant downpours of heavy rain are a common feature. The rain is often accompanied by severe electrical activity in the form of lightning and thunder.

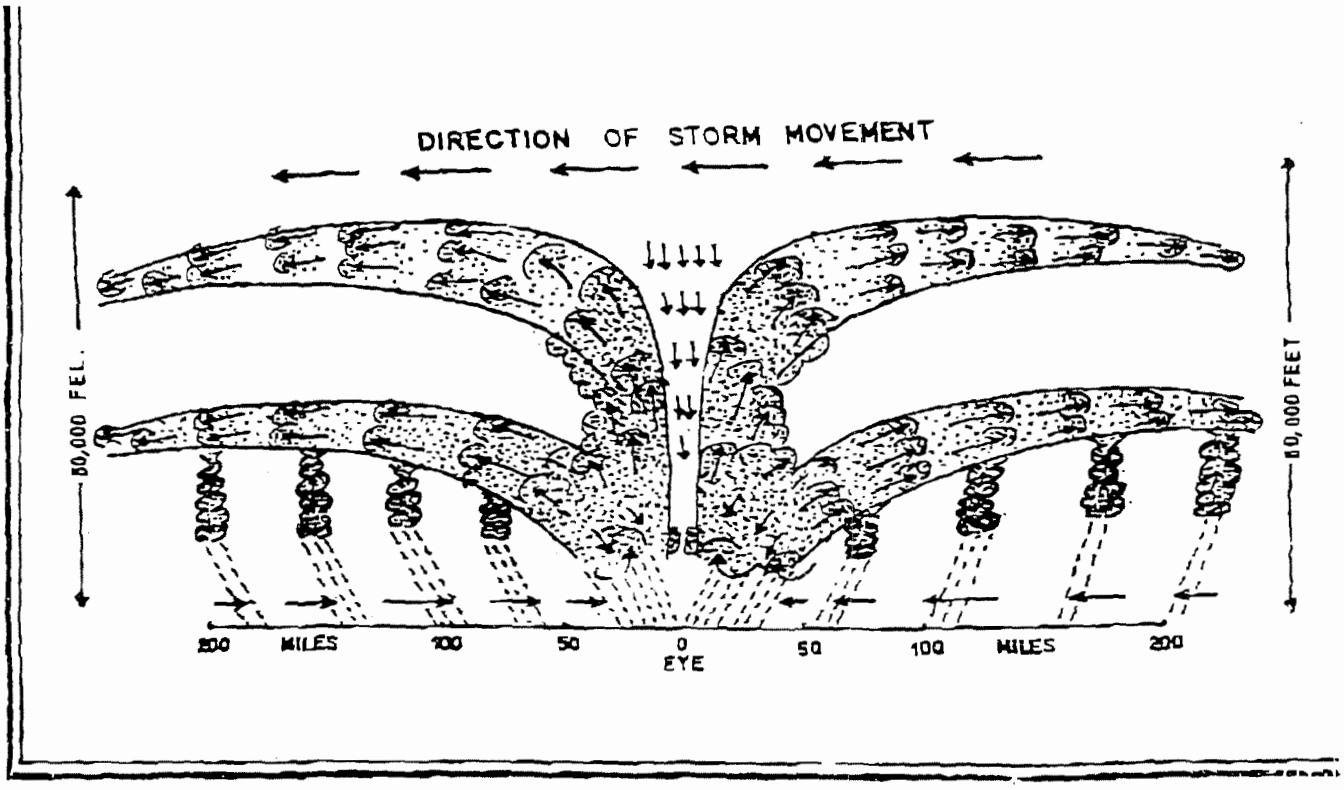


Fig. 4. Vertical section of a tropical cyclone

Cyclonic storms, as already mentioned, are formed characteristically over warm oceanic surfaces. The intensity of the storm increases when the water vapour in the rising air condenses as rain during which process the latent heat is released as sensible heat and is utilized for warming the air around. When this warm air rises rapidly, a sort of a vacuum results and to fill this void winds rush from all sides towards the centre in a spiralling fashion due to the earth's rotation. It is this set of circumstances that maintains the storm for a considerable period of time without dissipation which would otherwise be the case (if the inflowing air rushed directly to the centre and filled up the low pressure area there).

Table 1. cyclonic storms over the Indian region (1891 to 1969)

Month	Bay of Bengal		Arabian Sea	
	All Cyclones	Severe Cyclones	All Cyclones	Severe Cyclones
January	6	2	1	—
February	1	—	—	—
March	4	1	—	—
April	19	8	5	3
May	42	24	15	10
June	43	5	16	8
July	58	8	2	—
August	42	—	2	—
September	51	9	5	—
October	79	24	19	5
November	72	28	25	18
December	36	5	5	1
Total	453	114	95	45

The violent winds in the second zone (hurricane ring) whip up mountainous waves over the sea surface, around 15 to 20 meters from crest to trough. A vast whirl-wind of enormous power, the cyclonic storm communicates its whirling movement to the sea waters and since the storm itself moves comparatively slowly, the winds act for a long time on the water surface producing strong currents of water up to depths of 20 to 25 meters. When the storm approaches a coastal belt, the sea level rises rather suddenly to an overwhelming extent causing dangerous inundations over the coastal areas. The sudden rise in the sea level associated with cyclonic storms is called 'storm tides' or 'tidal waves' which strike the vulnerable zones within a matter of a few minutes producing large-scale devastation.

Soon after crossing the coast, the storm begins to dissipate, for the increased frictional effects of land and lack of moisture supply from the warm oceanic surface rapidly reduce the energy supply to the system. The winds consequently weaken and the atmospheric pressure at the centre rapidly rises, although rainfall may continue in intermittent showers for another day or two.

The average life-span of a tropical cyclone in the Indian region is about 6 days from the time of its formation until dissipation; some die within a few hours while others may last as long as two weeks. The normal rate of travel of the storm is about 450 km per day, but it varies from cyclone to cyclone and for the same cyclone. Some have been found to travel as much as 1000 km in a single day while others may remain stationary for a few days at the same spot. It is not uncommon for the October and November storms of the Bay of Bengal to hug to the coast for days together producing continuous and heavy rains and causing wide-spread inundations.

Table 2. Some major cyclonic storms that affected the Andhra coast

Date	*Area affected*	*Nature of damage caused*
13 October 1679	Machilipatnam and the neighbourhood	Storm surge of sea water was 6 metres deep. Number of ships and boats as also roofs of all houses blown away.
1706 (According to Mr. M. Toppings'—Astronomer to Madras Govt.—testimony in 1789) (Date not mentioned)	Port of Coringa in the East Godavary District	Storm surge and cyclone; large number of people killed, innumerable trees uprooted and paddy fields ruined
15 April 1752	Visakhapatnam and the surroundings	Number of villages ruined and the fort and its buildings suffered great damage.
20 May 1787	Ingeram region in the East Godavary District	Storm surge inundated the whole country all around and destroyed almost everything. The whole town of Coringa and all the little villages around with the inhabitants carried away. Dead cattle and fallen trees strewn all over the countryside and a number of vessels were broken to pieces. Death toll was estimated 'with moderation' at 10 to 12 thousand.
December 1789	Coringa town and environs (East Godavary District)	Tidal wave swept the area; 20,000 people perished and vessels at the mouth of Godavary carried away to Yanam also greatly damaged.
11 October 1795	Srikakulam and around (in the present Srikakulam District)	Cyclone and flood of a calamitous nature; 1000 people lost their lives. Srikakulam town was a mass of ruin and not one house belonging to the inhabitants had escaped. Of the two weaving villages, nothing but the wells remained.
28 October 1800	Guntur District in Central Andhra.	Under the tremendous cyclone which brought untold devastation in its trail, several coastal villages were swept away and many lives lost; many people and cattle in the salt-pan village of Chinna Ganjam perished; sea water came upto a pagoda situated on high ground but flowed back itself.
10 May 1832	East Godavary District	Sea broke in at Coringa and the water rose so high as to break open the Sea Customs House and destroyed all the records. Houses, trees, boats etc. were destroyed. It appeared to have also extended upto Rajahmundry town which too was greatly damaged. Large numbers of cattle were destroyed and the loss of life in the villages near the sea was extensive.

Table 2 (*Cond.*)

Date	*Area affected*	*Nature of damage*
1839 (Date not mentioned)	Coringa in the East Godavary District	Cyclone and storm surge killed about 30,000 people. 'The number of vessels from 100 to 200 tons that were high and dry, miles inland, some bottom up gave the country the appearance of having been visited by a party of gigantic demons who had been throwing the huge hulls at one another.'
19 November 1879	Krishna District	Disastrous cyclone and storm surge caused immense destruction of life and property in Bapatla, Repalle and Vijayawada taluks. The country was inundated for miles, the Commamur canal breached in every direction and wet crops were entirely destroyed.
6-8 December 1879	Visakhapatnam and Godavary Districts	Cyclone and floods; 414 human lives were lost, 500 cattle perished and 9,000 houses destroyed. Damage to roads and irrigation works was very heavy.
1 November 1864	Machilipatnam in Krishna District	One of the worst cyclones in history; the associated storm surge rose 4 metres high, affected 130 km of coast and penetrated 28 km inland. 20,000 people fell victim to the catastrophe. Innumerable cattle were destroyed and damage to roads, buildings and trees indescribable.
1 November 1927	Nellore region	The cyclone was most severe 40 to 50 km north and south of Nellore. Almost all buildings suffered damage. 629 people were killed and 50,000 heads of cattle were destroyed. Cuddapah district was also badly damaged.
28 October 1936	Guntur District	Bapatla taluk was worst affected by the cyclonic storm; 233 lives were lost and 32,[illegible] families were rendered homeless.
27 October 1949	Machilipatnam of Krishna District	Cyclonic storm and storm surge 4 mts. high went 15 kms. inland; 800 people died and million acres of paddy were ruined.
17 May 1969	Guntur, Krishna and West Godavary Districts	Severe cyclone and heavy rain. Death toll was 608. Five coastal villages of Divi island were wiped out by a storm surge. Loss of paddy crops in Krishna and East Godavary Districts was estimated at Rs. 20 crores.
7-8 November 1969	East Godavary, West Godavary, Krishna and Visakhapatnam Districts	Devastating cyclone and surge that rose to 3 metres affected the entire coastal region; water spout occurred in the Kolleru Lake; 250 people were killed, 35,000 livestock lost and 400,000 houses damaged. 18 lakhs acres of paddy land ruined causing loss of Rs. 65 crores.

Every year, on an average one severe cyclonic storm may be expected to form in the Indian seas in the pre-monsoon season and one or two in the post-monsoon period; severe cyclones do not generally form in this region during the winter months. In the 79 year period from 1891 to 1969, 453 storms formed in the Bay of Bengal and 95 in the Arabian Sea; nearly one-fourth the total number in the Bay of Bengal and one half in the Arabian Sea were severe cyclones.

The killer storms

It has been estimated that it would take the continuous explosion of one thousand atomic bombs per minute to catch up with the energy output of a moderate tropical storm. And the damage wrought by these storms is truly incredible; in 1900 the edge of an Atlantic hurricane struck Galveston (Texas) and in the brief encounter that followed, 6000 people were killed, the city was completely ruined and damage to property was estimated at more than 20 million dollars. This havoc—the greatest encountered in the United States of America pales into insignificance when compared with the Calcutta cyclonic storm which roared through the Bay of Bengal on the 17th of October, 1737. When the fury subsided, 30,000 people were dead, over 20,000 boats sunk and every structure was razed to the ground. The Bangladesh storm and tidal wave disaster of 1970 was of even greater magnitude as some heavily populated islands of the region were literally wiped out. The number of dead was estimated at about 3 lakh.

The recent cyclonic storm that battered the Andhra coast was neither unique nor extraordinary. May be, the devastation and damage caused by the storm were accentuated on account of the

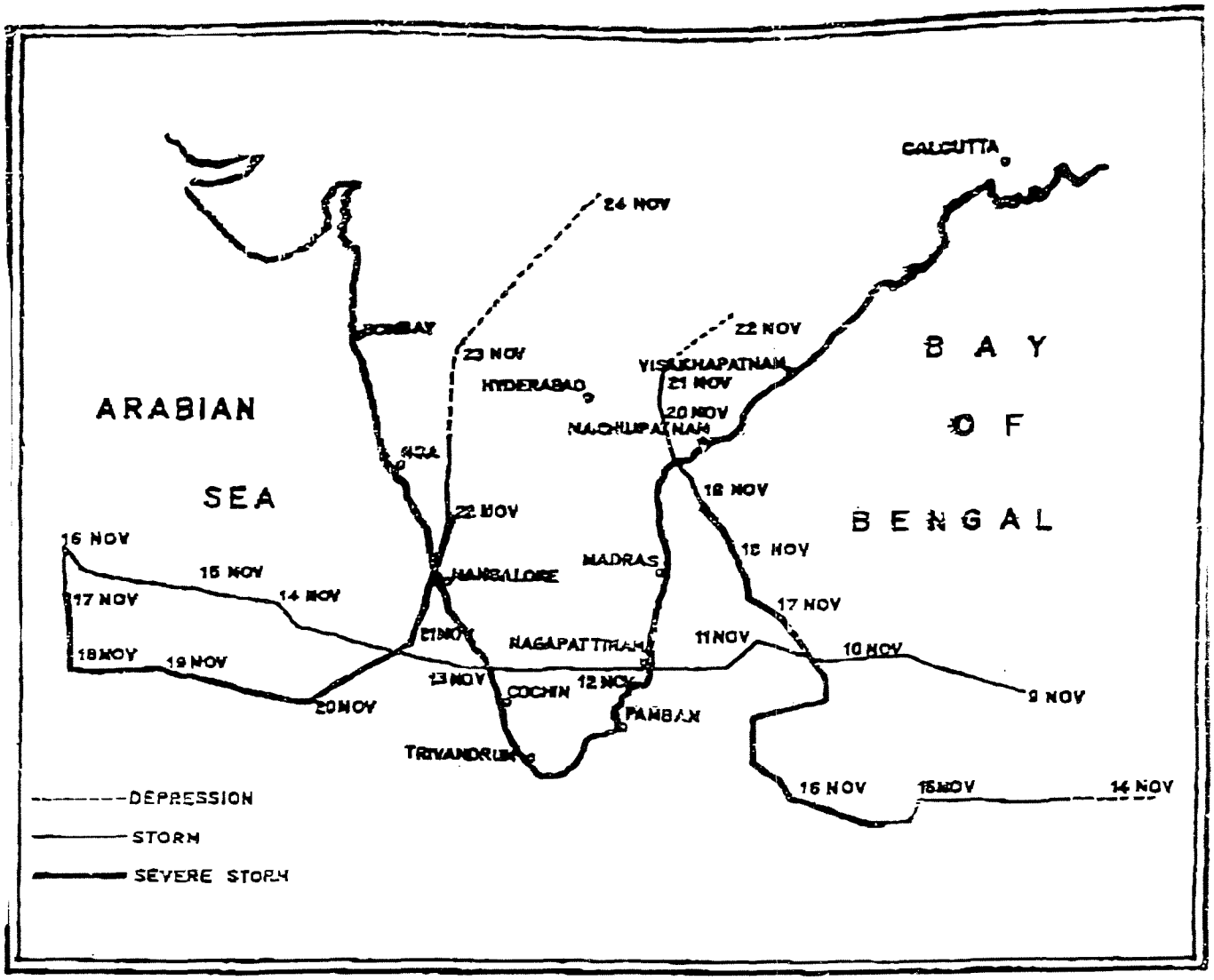


Fig. 5. Tracks of the November 1977 storms

Nagapattinam cyclone which ravaged Tamilnadu region a few days earlier. The simultaneous presence and movement of these two storms in the Bay of Bengal and the Arabian Sea, coupled with another tropical cyclone in the southern hemisphere almost equidistant from the two are regarded as responsible for the severe and widespread devastations caused in the coastal areas of the peninsular region.

It is significant to recall that this was not the first time that the Andhra coast around the Godavary and Krishna River mouths was hit by such a severe cyclonic storm and storm-tide. On May 20, 1787, a dreadful cyclone raged in the coastal region of Ingeram in the East Godavary District and a storm surge inundated vast areas and destroyed almost everything the town of Coringa. All the little villages around were carried away along with the inhabitants. Dead cattle and fallen trees were strewn all over the country-side and a number of boats and vessels were broken to pieces. The death toll was estimated by the then Acting Resident Sir Archibald Campbell at 10 to 12 thousand. Again, in December 1789 a tidal wave swept the same town during which, according to the Manual Administration of the Madras Presidency, some 20,000 people perished.

One of the worst cyclones in history struck the Bandar Taluk around Machilipatnam on 1st November 1864 with a storm surge 4 metres in height which affected 130 km of the coastline and penetrated 30 km inland. 30,000 people lost their lives.

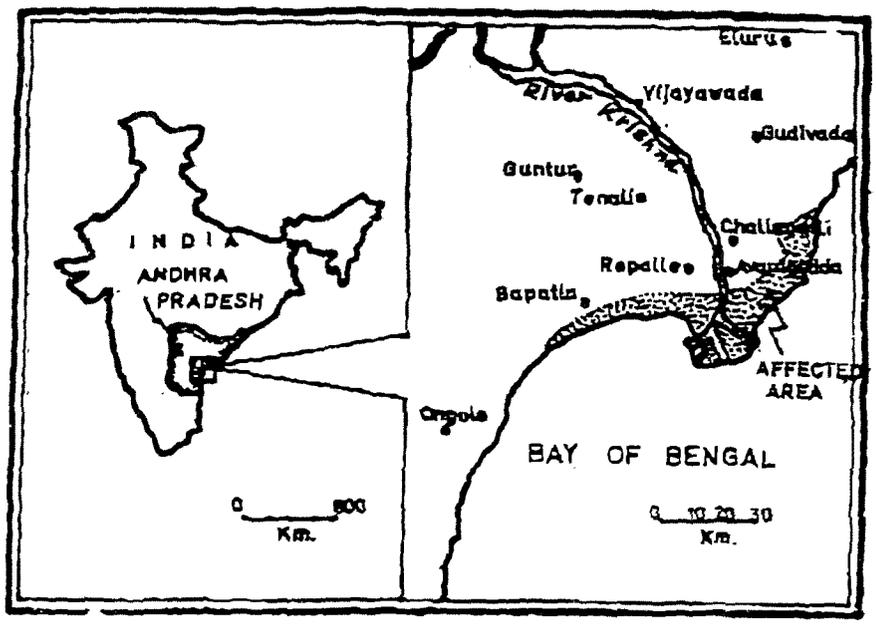
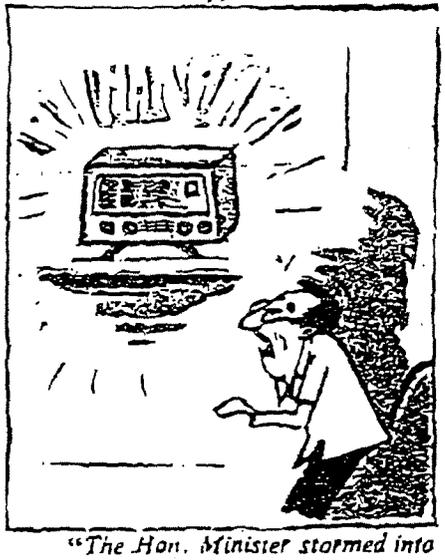


Fig. 6. Area affected by the cyclone and storm tide of November 1977 in Andhra Pradesh

On May 17, 1969, the coastal districts of Andhra Pradesh were ravaged by a severe cyclone and heavy rain. Again on 7th and 8th of November 1969, another devastating cyclone struck extensive areas in the districts of East Godavary, West Godavary, Krishna and Visakhapatnam. A storm surge which reached a height of 3 metres affected the entire coastal region.

But the havoc caused by the previous Andhra cyclones in living memory cannot be compared with the gruesome tragedy enacted by the November 19 cyclone of 1977, for the storm surge that developed was almost 6 metres in height, and affected an area 80 km in length and 16 km wide; 60 villages were completely washed away, 70 were severely crippled. Some 10,000 people are estimated to have lost their lives and about a lakh of of live-stock perished.

Yet the cyclone, from the meteorological point of view, was neither extra-ordinary nor unexpected. Whether we could have saved the entire loss of life and destruction of property if we had any prior knowledge about the



"The Hon. Minister stormed into the cyclone affected area, made a hurricane tour of it with the energy of a tornado, and now, a blizzard of aid has followed."

Preventive measures

FOLLOWING the Andhra disaster, an Expert Committee headed by Dr. K.L. Rao, former Union Minister of Irrigation and Power, made a study of the causes of large scale devastations, and has made several suggestions for preventive measures. Among the recommendations made by the Committee, those of meteorological importance are : (1) development of casuarina and other plantations upto 3 km wide along the sea coast to check the ferocity of winds and consequently reduce the effect of the tides, and (2) establishment of a research laboratory at Andhra University, Waltair to supply timely information and general literature to the coastal people regarding the formation, movement and other significant features of cyclones so that steps can be taken promptly to mitigate distress. In its recommendations for protective measures, the Committee has accorded primary importance to collection and dissemination of cyclone data and has suggested the immediate establishment of an 'S'-Band radar station at Machilipatnam. It has suggested setting up of self-recording rain gauges and anemometers at selected places along the Andhra coast for the measurement of rainfall and velocity of winds, communication of this data at different times should also be arranged. The Committee has also suggested the setting up of two special organizations, one based at Machilipatnam and the other at Visakhapatnam, for taking systematic action against cyclone havoc and for the provision of special aircraft with necessary meteorological instruments for reconnaissance flights at the centre of cyclonic storms to report the direction and speed of winds and related features.

V. P. S.

impending disaster is a question which is still being debated in several circles. The India Meteorological Department and its Cyclone Warning Centres did a commendable job in not only tracking the two November storms almost continuously but also in issuing weather warnings every hour about two days in advance through all available means like radio, telephone, telegraph and wireless.

A study of the reports and warnings by the India Meteorological Department that appeared in various media will make it amply clear that alerts about the impending disaster had gone to all the concerned authorities almost 48 hours in advance. Yet even 24 hours after the storm-tide hit the Andhra coast on November, 19, there was no idea of either the nature or the extent of the havoc caused because of the total breakdown of communications. It was only on the morning of 21st that the Government learnt about the large-scale deaths and devastation due to the tidal wave.

The occurrence of cyclones cannot be prevented but precautionary measures taken in time can eliminate practically all loss of life and significantly reduce damage to property. With the developments in meteorology, techniques of detection of cyclonic storms and forecasting of their intensity and movement have been steadily improved along scientific lines. The Storm Warning Service of the India Meteorological Department now covers almost every part of our country giving timely warnings about cyclonic storms and also suggesting precautionary steps in the event of the storm invading any area. In recent years, the most spectacular development in meteorology has been the use of artificial earth satellites for weather studies. Capable of photographing the cloud patterns associated with various weather disturbances, these weather satellites are a valuable aid for observations over tropical oceans where conventional stations are either insufficient or non-existent. The first of the TIROS family of weather satellites launched by the United States in April 1960 was able to detect a severe tropical storm in the southern Pacific east of Australia when no evidence of any sort was available on routine weather charts. Presently, the NOAA series of weather satellites are providing valuable pictures of cloud formations associated with the cyclonic storms over the Indian region almost four times a day.

Man is thus no longer a moronic brute and he no more worships hurricanes as unchained goddesses. By probing into these storms through

(*Continued on page* 210)

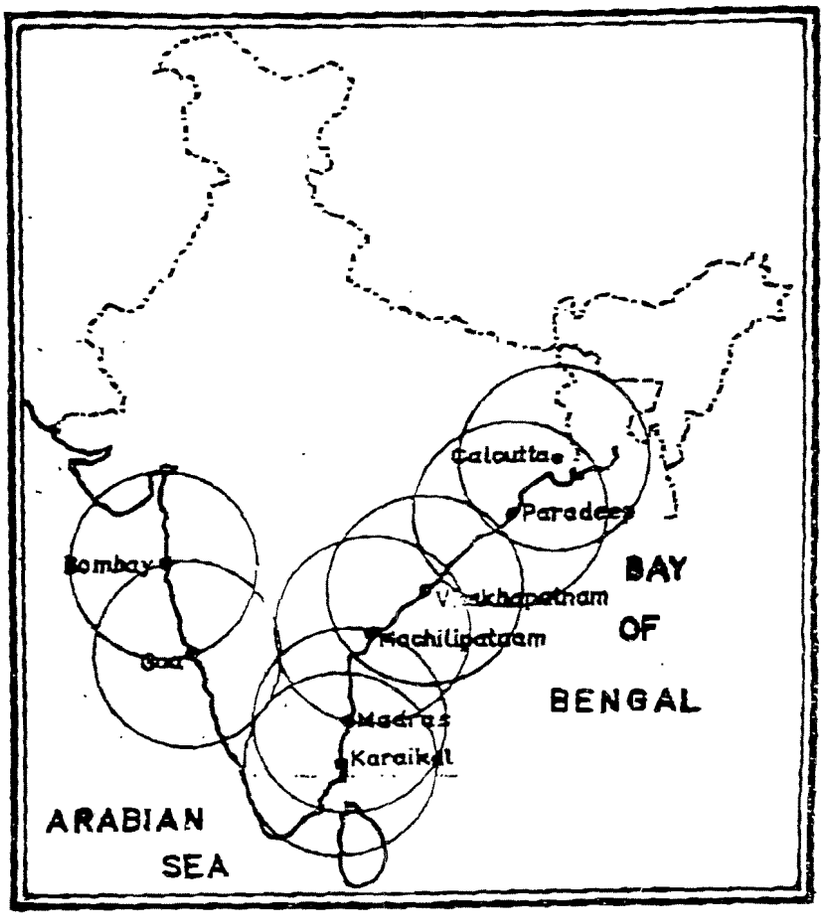


Fig. 7. Network of cyclone warning radars

been scientifically established that noise, provided it is loud enough (180 to 200 decibels), can cause the death of a human being. Less loud noises have been known to cause a variety of illnesses—from headaches, ulcers, blurred vision, deafness, high blood pressure and increased heart rate to nervous tension and mental disturbances. The loss to a nation by noise pollution can be colossal, not only because industrial output decreases due to lack of concentration and illness of workers, but even agricultural production may be affected. It has been observed that on farms that use noisy machinery, the milk yield of cows becomes less, pigs do not get as fat as they should, and some plants actually wither away!

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SPARK MACHINING (*Continued from page* 181)

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CYCLONES (*Continued from page* 162)

his instruments and equipment, he is able to plot their tracks well in advance and issue timely notices of their visitations. But nothing that man has developed so far is able to check their terrible fury and power; our efforts are successful in only one aspect — in providing a suitable warning.

With the tremendous potentialities of the energy of the atom, fantastic suggestions have been made for dissipating or diverting these weather monsters of the tropical lands. Though eventually some method of hurricane control may be found, environmentalists opine that its application may not be wise. First, because storms bring many benefits, mainly in the form of rains and they may more than compensate for the overall economic loss wrought by floods, winds and tidal waves. Secondly, and this is more important than any other, the hurricane may be a rather indispensable cog in the general circulation of the atmosphere, for it serves as an essential means by which the energy balance between the tropical and polar regions is maintained. If hurricane control were successful and no storm were allowed to go through its full life-cycle nature would undoubtedly find some other method of restoring this balance, and who say that the new means may not be even more disastrous than the hurricane?

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