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Monthly Newsletter of Vigyan Prasar

DREAM 2047

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VP News

The Last TSE of The Millennium Filmed Successfully

Although the weathermen were not very hopeful, nine enthusiasts aided by a six-member AN-32 Indian Air Force (IAF) crew, took off with high expectations on 11 August 1999 aboard "Godavari"—an AN-32 transport aircraft of IAF — to follow the Total Solar Eclipse and capture it on videotape. This team led by Director, Vigyan Prasar, got airborne at 1700 hrs on 11 August 1999 and rose to a cloud free zone at 24000 ft over Gujarat with the partly eclipsed Sun in full view. After filming the TSE by four sets of video cameras, employed for the purpose, they flew to Ahmedabad and transmitted the footage from Doordarshan Kendra Ahmedabad to Doordarshan Delhi via satellite. These vital shots including those of the Baily's beads, diamond ring and the solar corona were included in the repeat Eclipse telecast during 22:40 - 23:10 hrs by Doordarshan in the national hook-up. The entire exercise was planned very meticulously and was preceded by test flights on 10 August. Besides the Director and a two-member team from Vigyan Prasar, other members of the group were from the Central Institute of Educational Technology of NCERT, Doordarshan, the Electronic Media Production Centre of IGNOU. The IAF pilots and the crew deserve a special mention for their positive and enthusiastic approach which contributed greatly to the success of the mission.

Inside

Vigyan Prasar Planning A National Repository of Popular Science Videos

A great deal of work has been done to produce popular software on science and technology in India. Various organisations and committed individuals have made audio visual programmes on scientific themes, both for specific and general audiences. Unfortunately there is no single source where one can get information on popular science films/videos made in India. Film makers, experts, researchers, science promoters and reporters perennially suffer from the absence of a single-source to provide them with vital inputs on various scientific themes. Vigyan Prasar(VP) is planning to create a National Repository of science videos where collection & cataloguing, preservation, storage and retrieval facilities would be incorporated in phases. Besides acting as a nodal agency for collection of science videos, VP proposes to build up a referral library, organise festivals and disseminate information in various formats.

Vigyan Prasar's stall in the 5th Delhi Book Fair at Pragati Maidan (14-22 August 1999)

... think scientifically, act scientifically ... think scientifically, act scientifically ... think scientifically, act ...

Published and Printed by Dr Subodh Mahanti on behalf of Vigyan Prasar, C-24, Qutab Institutional Area, New Delhi-16 & printed at Rakmo Press Pvt. Ltd. C-95, Okhla Industrial Area, New Delhi - 110 020 Editor: Dr. Narender K. Sehgal

SCIENCE ON TELEVISION : NEED BRIGHT MARKETING MINDS

Want to see good, informative and entertaining Indian science programmes on television? Who would say 'no' to this proposition? Definitely not the viewers! The only ones who may appear unconvinced of the need for such programmes, as of now, are the advertisers and those who run and manage various television channels. Else, how would one explain almost a total lack of effort to build up or develop dedicated viewership and niche slots for science-based programmes by various television channels, including Doordarshan's? 'Reasons' — really excuses, if you ask me — that have often been trotted out by most of the channels go something like this: "Science does not sell", or "there are no takers for science programmes", or that "no advertisers want to sponsor science programmes".

What does one make of these reasons or excuses, in the face of strong evidence to the contrary, i.e. that science sells and that there are takers of all ages for good science programmes and other science materials like books, kits, cassettes, slide sets, charts etc. everywhere and all over the country? We have letters, emails, phone calls from listeners and viewers of our popular science programmes on radio and TV respectively and sales of popular science materials at book fairs and from our sales outlets around the country!

The inescapable conclusion is that convictions or feelings of present-day advertisers and/or television channel managers/ owners against the saleability of science are not based on or backed by any scientific studies or hard evidence. Notwithstanding all this, there is a strong case as it is for promoting good science programmes on radio and television to spread awareness and understanding about scientific aspects of events, natural phenomena and of issues/projects involving technological choices that have to be made by the country in trying to chart a course for its all round development.

Thus, even if there were no takers presently, we would need to consciously and actively make efforts to build and promote a very large listenership and viewership base for popular science programmes on radio and television in the country. To bring this about several new partnerships and collaborations would have to be forged and old ones revived and/or strengthened. The first and foremost requirement for building audiences is the existence of well-made quality programmes on a variety and range of subjects of interests to the listening/ viewing public. Though nuclei for this have already been created, a lot more work would be needed. Different radio and television channels would need to create and build up their own niche slots for science programmes.

But to complete the picture, and to make this all happen on a sustainable basis, we would need a new breed of bright marketing minds who would help design strategies and new and attractive ways of packaging science programmes to create strong demand and a ready and competitive market for them where almost none exists now, at least among the big advertisers. Such marketing efforts have not yet been mounted with any seriousness, even though good science programmes on radio and television in the past have been liked and appreciated by audiences all over the country.

There is no doubt that such a market is there and waiting to be discovered. Why do I say that? It is really very simple! The prosperity, continued well-being and future growth of all business and industrial enterprises depend, one way or another, on the technologies they are able to acquire/develop and deploy for whatever they do — and perhaps even more on the scientific and technical human power that they employ to harness these technologies. Moreover, it is the general public, the common people, who ultimately are the end-users of their products and services. And there can hardly be any doubt that, given a choice, business houses and industries would much rather sell their wares to scientifically aware and informed customers. For this is sure to make life easier for their maintenance and customer relations departments! If that be so, wouldn't it be in their own interest to invest at least a part of their spending on advertisements consciously towards this end — i.e. toward making people scientifically and technologically better informed and better aware, by promoting and sponsoring science-based and scientific programmes on radio and television — and by ensuring that these are heard/viewed by the largest possible audiences.

Such a thing has already been done in the case of sports, especially cricket. It may take a little more doing to achieve something similar for science & technology, but I am sure it can be done.

Any volunteers equal to the challenge from among the marketing professionals, or fresh graduates specialising in advertising & marketing? We would love to hear from you.

❑ NKS

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FISHES AND THE IMPORTANCE OF FISHERIES IN INDIA

For over 400 million years fishes have been swimming in the world's seas. Fossils of bones resembling the armour of fishes like pteraspis and cephalaspis are found in the Ordovician geologic period (360-400 million years ago). The evolution of fish-types was a gradual process. Fishes are among the most colourful of animals, perhaps next only to birds. Like plants and flowers some varieties of fishes are also kept in homes and offices (in aquaria) to add beauty and charm. But then the most feared of all marine creatures is also a fish - the great white shark. Fishes are second only to insects in the largeness of population. Otherwise they outnumber all other vertebrates — mammals, birds, reptiles and amphibians put together.

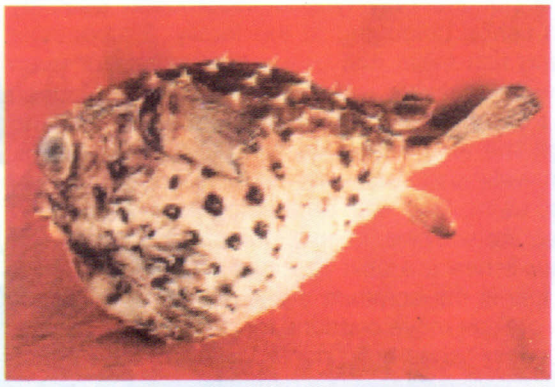
Fishes are among the most widely distributed of all animals. There are about 20,000 to 30,000 species of fishes occurring worldwide in seas and fresh water. In fact, the range of fish that live in rivers, lakes and seas is enormous — from the great whale shark (Rhiniodon typus) to the tiny pygmy goby (Pandaka pygmaea); in between there are thousands of other varieties. Some live in fresh water; others in salt water. The length of adult shark may reach upto 18-20 metres. Pygmy goby is perhaps not only the shortest of all fishes, but also of all vertebrates. When fully matured it measures from 12 to 20 millimeters. Schindleria, an odd transparent fish, is claimed to be the lightest of all fishes. More than 125,000 of these little fish would be required to make up one kilogramme.

The branch of science that deals with fishes, their structure, classification and life history is known as ichthyology. Fishes are exothermic (cold-blooded) — their body temperature changes according to their surroundings. Fishes have streamlined bodies with a covering of bony scales, a fin bearing tail, an anal fin, one or more dorsal fins and paired lateral, pectoral (just behind the head) and pelvic fins. The fins help to balance and steer the body in its movements through water. A majority of fishes are carnivorous, feeding mainly on other fish and invertebrates, although some eat plants. Most fishes lay eggs. Large numbers of small eggs are laid (up to several millions in some cases) and are usually fertilised externally. In some species internal fertilisation occurs and live young ones may be born. Fishes may be broadly divided into three (not very closely related) groups:

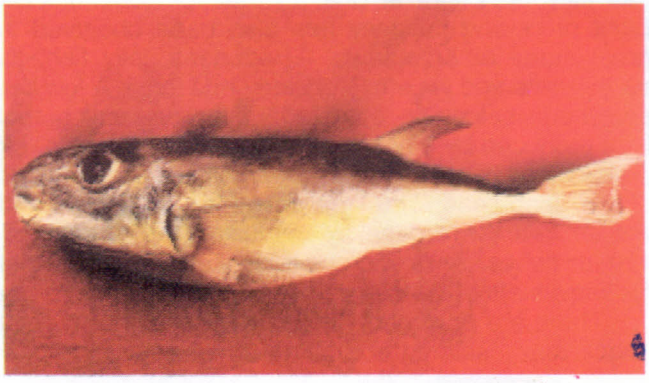
- Bony fishes or osteichthyes, which constitute the majority of living fishes. Some examples of bony fishes are : Carps, catfishes, gold fish, cod and tuna. The skeleton of bony fish is bone, movement is controlled by mobile fins and the body is usually covered with scales. The gills are covered by a single flap.
- The cartilaginous fishes or chondrichthyes. Sharks and rays are members of this group. The cartilaginous fishes are efficient hunters. The skeleton is cartilage (a tough, elastic, whitish animal tissue), the mouth is generally beneath the head, the nose is large and sensitive and there is a series of open gill-slits along the neck region. There are about 600 known species of sharks and rays.
- The Jawless fishes or cyclostomes consisting of hagfishes and lampreys. They are the survivors of a very old and peculiar group. Jawless fishes have a body plan like that of some of the earliest vertebrates that existed before true fishes with jaws evolved. There is no true backbone but a notochord. Hagfishes live in seas only. They are very slimy and feed on carrion and injured fishes. The lamprey attaches itself to the fishes on which it feeds.

There are fishes which possess electric organs. It may be noted here that all living cells produce very minute quantities of electricity because of chemical reactions that are continually taking place inside the cells. Certain kinds of cells like muscle cells produce more electrical activity, though still minute. Many of us know that electro-cardiography which examines the heart uses the electrical discharges within the body. However, certain fishes produce much higher levels of electricity. For example the electric eel, the electric ray and the electric catfish can produce up to 650 volts. Fishes are the only creatures which have electric organs. Electric organs of the fishes are modifications of muscle. Truly electricity producing fishes use their power for one or two of the following reasons: as defence, to locate and obtain prey, or to navigate. The electric eel is very dangerous; it can kill a human adult by electrocution. It can deliver on an average 480 volts per second and maintain it, if necessary, without the 'battery' running down for days on end.

Some fishes living in deep-sea can produce light — a phenomenon known as bioluminescence. In the depth of oceans there are fishes such as the sea dragons which are festooned with lights of different colours — yellow,



Two species of poisonous fish



Central Institute of Fisheries Education

Since its inception in 1961 the Central Institute of Fisheries Education (CIFE) has been playing a pioneering role in human resource development for the fisheries sector in the country. Originally the Institute came into existence as a Government of India set-up at Mumbai with FAO/UNDP assistance. The original objective was to raise qualified and well-trained manpower for handling rapidly expanding fisheries developmental activities in the country. In 1979 CIFE was brought under the Indian Council of Agricultural Research (ICAR). Recognising the pioneering role played by it in fisheries education CIFE was accorded the Deemed University status in 1989.

From time to time the scope of the Institute has expanded and its present mandate is :

- To conduct post-graduate and doctoral degree programmes.
- To conduct post-graduate diploma and certificate courses.
- To conduct short and long-term training courses in different specialised disciplines of fisheries science.
- To conduct research in basic disciplines of fisheries.
- To provide institutional consultancy services.

The Institute which started as a small training organisation with just three divisions and a staff strength of 16 has undergone phenomenal expansion. Today CIFE has ten divisions and five sub-centres/aquafarms as shown below:

CIFE Divisions

- Fisheries Resource Management
- Aquaculture
- Aquatic Environment & Pathology
- Genetics Reproduction & Biotechnology
- Nutrition & Aqua Feed Technology
- Engineering & Harvest Technology
- Post-harvest Technology
- Economics & Marketing
- Communication and Extension
- Planning, Statistics & Computer Applications

CIFE sub-centres/aquafarms

- ☆ Inland Fisheries Training Centre, Barrackpore (W. B.)
- ☆ Aquaculture Research & Training Centre, Kakinada (Andhra Pradesh)

Headquarters of CIFE at Versova, Mumbai

- ☆ Inland Fisheries Operatives Training Centre, Lucknow (Uttar Pradesh)
- ☆ Saline Ecosystem Aquaculture Research Centre, Rohtak (Haryana)
- ☆ Freshwater Fish Farm, Powarkheda, Hoshangabad (Madhya Pradesh)

CIFE has three research-cum-training vessels (M.F.V. Saraswati, M.F.V. Narmada and M.F.V. Sundarbans). It has a small museum and several aquaria.

CIFE will shift from its present location at seven Bungalows, Yari Road Versova, encompassing about 5.5 acres area to a new campus built on a plot of 16.5 acres (the land allotted by the Government of Maharashtra) very close to the present campus.

Post-graduate courses conducted at CIFE include M.F.Sc in Fisheries Resource Management, Inland Aquaculture, Freshwater Aquaculture, Mariculture and Post-harvest Technology and Doctoral (Ph.D.) programmes in Fisheries Resource Management, Inland Aquaculture and Mariculture. Since its inception CIFE has trained more than 4 thousand personnel (which includs over 100 persons from foreign countries) in various aspects of fisheries.

Apart from its academic contributions, CIFE has to its credit notable research achievements. Some of them are :

- Development of hatchery technology for giant freshwater prawn.
- Use of artificial seawater as a substitute for natural seawater in giant freshwater prawn hatchery.
- Development of methods for culture of live food organisms for use in aqua-hatcheries.
- Culture of brackishwater fishes and shrimps in ground

purple or green. Deep-sea angler fish have 'lanterns' of bright light dangling in front of their jaws. Some deep-sea fish flash light at one another for communication. Light producing capacity has also been observed in a great many other animals — sponges, jelly fish, flies, earthworms and in certain bacteria and fungi. A few deep-sea sharks belonging to the order squalidae emit greenish light produced by tiny light organs all over the skin. Light produced by the fishes enable them to see in the darkness of the deep-seas. The light producing organs may also act as defense organs by confusing the enemy as in lantern fishes. They may also act as recognition marks for individuals of the same species, and as lures for prey.

There are poisonous fishes. In fact the poison called "cigua tera", isolated from some marine fishes is one of the most deadly poisons ever isolated.

Some fish can swim at the speed of 80km per hour. Swimming is not the only type of locomotion used by fish. Certain fishes belonging to the family *Exocoetidae* can fly. Flying fish swim just below the surface or even above it in warm oceanic water. If disturbed they launch themselves from the water by rapidly beating the tail and glide through the air using large wing like pectoral fins.

Fish can walk also. Some fishes have completely lost their ability to swim; they walk on the sea floor. Among the walking fishes are sculpins, batfish, gurnards and deep-sea lizards. A few fishes are able to travel on land. The best known example is the common eel. On cool, dewy nights the common eel can move overland for distances of several kilometers.Certain fishes build nests for laying their eggs.

MFV Saraswati: Research-cum-training vessel of CIFE

saline water ponds of inland states.

- Pearl culture using freshwater mussels.
- Culture of mud-crabs in cages.
- Use of ozone for water quality and disease management in aqua-hatcheries.
- Development of a new hormonal formulation 'Ovatide' for fish breeding.
- Development of immuno-diagnostic kits for disease management in aquaculture.
- Improved techniques of chromosome preparation from shrimps and prawns.
- CIFE in collaboration with the National Centre for Cell Science, Pune, has developed a simple and reproducible short-term fish cell culture technique.
- Investigations on certain aspects of culture and breeding of penaeid shrimps.
- Identification of six species of Jelly fishes, three of catfishes, two of sciaenid fishes and one of octopus as potential sources of bioactive substances.
- Establishment of toxicity of carp bile and its possible role in causing chronic renal failure or malfunctioning in human beings.

The institute has brought out a number of useful publications in Hindi. It has successfully offered many consultancy services to government and private organisations.

While covering India's S&T institutions in 'Dream 2047' every effort is made to bring out the salient features, but then selection is made by us and not by the institutions concerned.

- Editor

Fishery in India

For India, fisheries constitute a highly productive sector, a source of nutritious food and employment, and a net contributor to export earnings. More than 6 million fishermen and fish-farmers are totally dependent on fisheries for their livelihood. India's annual fisheries exports are 0.4 million tonnes worth 47 billion rupees.

The total length of rivers in India is about 27,360 kms. The largest rivers are the Ganga, the Indus, the Brahmaputra, the Godavari, the Krishna and the Kaveri. These rivers alongwith their tributaries, canals, and irrigation channels (an estimated area of 1,12,650 Sq.kms) provide a wide variety of habitats to fishes. India has a coastline of about 8100 Kms and the continental shelf bordering the Indian coast has a total area of about 0.5 m sq.kms.

Table 1 : Aquaculture (fish and shellfish only) production (in tonnes) in 1987 and 1996.

Country	1987	1996	%increase
China	4,865,503 (45.7)	17,714,570 (67.1)	(264)
India	788,310 (7.4)	1,768,422 (6.7)	(124)
Japan	739,121 (6.9)	829,354 (3.1)	(12)
Indonesia	376,727 (3.5)	672,130 (2.5)	(78)
Thailand	151,658 (1.4)	509,656 (1.9)	(236)
USA	383,259 (3.6)	393,331 (1.5)	(2.6)
Bangladesh	150,215 (1.4)	390,088 (1.5)	(160)
Korea (RoK)	477,455 (4.5)	358,003 (1.4)	(-0.3)
Phillippines	340,131 (3.2)	342,678 (1.3)	(0.7)
Norway	56,344 (5.3)	324,543 (1.2)	(476)
France	231,778 (2.2)	285,659 (1.1)	(23)
Taiwan	299,897 (2.8)	262,276 (1.0)	(-13)
Spain	270,724 (2.5)	233,833 (0.9)	(-14)
Chile	4,758 (0.4)	217,903 (0.8)	(448)
Other countries	1,499,307 (14.1)	2,082,137 (7.9)	(39)
Total	**10,635,187**	**26,384,583**	

Source : Kutty, M.N., Aquaculture Development in India from a Global Perspective, *Current Science, Vol. 74, pp. 333-341, 1999.*

In 1996 among the top ten aquaculture producers of fish and shellfish China accounted for 67% of the total world production (26.38 million tonnes as estimated by FAO) followed by India (7%), Japan (3%), Indonesia (2.5%), Thailand (1.9%), USA (1.5%); Bangladesh (1.5%), Korea (1.4%), Philippines (1.3%) and Norway (1.2%). Aquaculture (fish and shellfish only) production of different countries is given in Table - 1. The global production of farmed fish and shellfish increased from 10.64 million tonnes in 1987 to 26.38 million tonnes in 1996 indicating an increase of 148%. During the same period the increase in India was 124%.

The production of marine fisheries has progressively increased in the years past. Marine fisheries production increased from 0.5 million tonnes in 1950 to 2.7 million tonnes in 1997. Profile of Indian marine fisheries is given in Table -2. Among the Asian countries India ranks second in culture and third in capture fisheries.

electric eel

The importance of fish as food has been recognised by man from antiquity.

Table 2: Profile of Indian marine Fisheries.

Component Profile		
Physical		
length of coastline		8129 km
Exclusive economic zone (EEZ)		2.02m km^2
Continental shelf		0.50m km^2
Inshore area (<50 mts. depth)		0.18m km^2
Biological		
Potential yield in EEZ		3.9 mt
Potentical yield in inshore area		2.2 mt
Marine fish production (1997)		2.7 mt
Production from inshore area		2.2 mt
Production from coastal aquaculture (1996)		0.07mt
Human component		
Fishing villages		3651
Marine fishers population		5m
Active fishers population		1m
Infrastructure component		
Landings centres		2271
Major fishing harbours		6
Minor fishing harbours		27
Mechanized vessels		47000
Motorized vessels		36500
Artisanal vessels		1,50,000
Economics Component		
Gross investment on fishing component (1996)		Rs. 42 billion
Value of annual production (1997)		Rs. 74 billion
Marine products export (1997-98)		385818 tones
Value of export		Rs. 47 billion
Technology component	**No.**	**Capacity (tonnes/day)**
Freezing plants	372	6600
Canning plants	14	52
Ice plants	148	1800
Fishmeal plants	15	330
Cold Storage	450	80000
Peeling sheds	900	2700

Source : Devaraj, M. & Vivekanandan, E., Marine Capture Fisheries of India: Challenges and Opportunities, *Current Science*, Vol.76, pp.314-332, 1999.

The most important among the food fishes are species of the following families: Clupeidae (herrings, sardines), Engraulidae (anchovies), Salmonidae (salmon, trout and whitefish), Gadidae (cod, haddock, hake), Scombridae (tuna, mackerel) and Heterosomata (flatfishes). The flesh of the fish is rich in proteins and minerals like calcium, phosphorus and iron. Varying quantities of fats and oils are also found in fishes. Fishes also provide many other important by-products like fish oil, fish meal, fish flour, fish protein, fish glue, fish skins etc. Fish is a highly perishable commodity.

Fish oils : There are two types of fish oil - liver oil and body oil.

Fish liver oil is an important natural source of Vitamin A. It also contains small quantities of Vitamin D, C and E. Fishes like cods, halibuts, tunas, sharks and rays are the best liver oil yielders.

Body oils are prepared side by side with the manufacture of fish meal. Fishes like salmon, herrings and sardines having fat are suitable for body oil extraction. Sharks (after liver is removed) are also used for body oil extraction.

Fish meal is a valuable source of material and is used in farms to supplement animal diet. A low-grade variety of fish meal is used as manure in plantations of coffee, tea and tobacco. An average fish meal consists of 55-70% proteins, 2-15% fats, 10-12% minerals and 6-12% water besides small quantities of iron, calcium and phosphorus and traces of vitamins A, D, B & K.

Fish flour, a fine and higher quality of fish meal is chiefly used as a supplement to protein diet.

Fish proteins are extracted after fat is eliminated from fish-meat, with dilute caustic soda solution. Refined fish protein is free from fish odour.

Fish glue, which is prepared from skins, fin-trimmings and bones of fishes, is used as an adhesive in book-binding, furniture-making, etc.

Fish skins of the larger varieties of fish after tanning like any other leather are used in the manufacture of shoes, bags, wallets and tobacco pouches and ornament boxes.

Isinglass, a high grade collagen produced from the air bladders of certain group of fishes are used in clarification of wines, beer and vinegar and in the preparation of plasters and special cements.

❑ **Subodh Mahanti**

Major central government institutes/departments dealing with one or other aspects of fisheries

1. Department of Biotechnology, Govt. of India
2. Central Inland Capture Fisheries Research Institute, Barrackpore, Calcutta
3. Central Institute of Fisheries and Nautical Engineering Training (Ministry of Agriculture), Cochin
4. Central Institute of Fisheries Technology, Cochin (Kerala)
5. Central Institute of Freshwater Aquaculture, Bhubaneswar (Orissa)
6. Central Marine Fisheries Research Institute, Cochin
7. Central Institute of Brackishwater Aquaculture, Chennai (Tamilnadu)
8. Fishery Survey of India, Mumbai
9. Institute of Nautical Engineering and Training, Cochin
10. Integrated Fisheries Project, Cochin
11. Institute of Fisheries Education, Mumbai
12. Marine Products Export Development Authority, Cochin
13. National Bureau of Fish Genetics Resources (ICAR) Lucknow
14. National Institute of Ocean Technology, Department of Ocean Development, Govt. of India
15. National Institute of Oceanography, Goa
16. National Research Centre on Coldwater Fisheries (ICAR), Uttar Pradesh.

In addition there are fisheries colleges, Zoology Departments of various universities and state government institutions.