PARTICIPATION REPORT

ON

THE FIRST WORLD CONFERENCE ON TRADE IN FROGLEGS VIS-A-VIS ENVIRONMENTAL CONSIDERATIONS

(Held at Calcutta 10-11 April , 1986)

By

B.C.Choudhury
Assistant Director,CRC,WII.

REPORT ON THE FIRST WORLD CONFERENCE ON TRADE IN FROG LEGS VIS-A-VIS ENVIRONMENTAL CONSIDERATION, HELD IN CALCUTTA DURING 10 AND 11, 1986.

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The first World Conference on trade in frog legs co-sponsored by Marine Product Export Development Authority & Central Inland Fisheries Research Institute was held at the Grand Hotel, in Calcutta on 10th and 11th April 86. Participant in this Conference included a large number of frog leg exporters, research scientists from Universities and from the Central Inland Fisheries Research Institute, as well as representatives from various central/state governments Conservation agencies. With representatives from organisations like Beauty without cruelty, SPCA, World Wildlife Fund etc, a total of about 200 participants and observers attended the conference.

The objectives of the conference was to come to a general concensus on the mounting contraversy of trade in frog legs. The conference intended to bring out a resultion and recommend to the Government of India guidelines to formulate a long term policy on this trade, based on the findings of delegates who have been involved with frogleg trade, frog culture, killing, processing and handling of frogs and to a limited extent on the aboundance, status and ecology of frogs.

In the introductory address Dr.A.V.Natarajan, Director CIFRI reviewed the present situation of frog leg export trade all over the world in general and in India in particular. He also highlighted the growing concern of conservationists, on the dwindling status of frogs and its impact on the environment - particularly the role of frogs in the Agricultural pest control.

The role of animal welfare organisations in mounting pressure on the frogleg trade highlighting the inhuman mode of killing of frogs was also mentioned. A reference was also made by him on the breeding season of the commercially harvested frogs and the need of a realistic close season for harvesting.

The present state-of-art of frog culture and the role of research organisations in this was also proposed to be a topic of discussion as also the use of exotic species of frogs for culture.

To discuss the above mentioned points the conference was devided into 4 Technical sessions and a total of above 40 papers were presented in them. The 4 sessions were as follows:

1) Status of frog leg trade
2) Handling processing and quality control in frog leg Industry.
3) Commercially exported species of frogs and environmental impacts.
4) Breeding and culture of frogs.

(IMPORTANT OUTCOME IN EACH TECHNICAL SESSION)

1. Trade in Frog legs: (a) The conservation measures in India since 1981, such as including the frogs in Schedule IV of the wild life (protection) Act and ceiling on the export quota as well as a size restriction on the exploitable frogs has resulted in a decrease on the quantity of frogs that were being harvested in India. The 1985 export quality is reported to be 1785 tons compared to 4368 tons in 1981. Additionally, Rana tigerina & Rana hexadactyla have now been included in the Appendix II of the CITES at the 5th meeting of the convention held in Buenos Aires in May 1985 and now needs a CITES clearance before being exported.

To quote Dr.K.P.P.Nambiar of the Marine Products Exports Development Authority " The frog-leg trade has been dwindling lately not because of any apparent depletion of resources, but due to other factors like conservation measures including concerted protests against consumption".

India is no longer the leading exporter in frog legs, Indonesia and Bangladesh now export more than India, perhaps because of no stringent control on the trade as it is in India. However, Marine Products Exports Development Authority who are the promotors of export of this resource are concernd of the decreasing trade in frog legs and are advocating to find means and ways of increasing this trade without disturbing the environmental factors. They are also advocating to find out an optimum exploitable level for longterm rational utilization of this resource.

2. Handling, Processing and quality control

With increasing concern by inposters and Animal Welfare Organisations about the inhuman means of killing of frogs and certain guidelines on this subject such as 'electrical stunning' of frogs before they are slaughtered has made several research organisations to develop techniques in this line. Leading amongst them are the College of Fisheries, Mangalore, Central Institute of Fisheries Technology, Cochin, Zoological Survey of India and Jadhavpur University. All these organisations have carried out research on developing new techniques for painless killing of frogs.

Since a large quantity of frogs have been rejected by exporters alleging that the frogs exported from India are bacteriologically contaminated, research organisations have now shifted their attention to proper processing technology and quality control. This has now brought down the rejection of processed froglegs by importers to a minimal quantity. Recently some work is also being carried out on nutritive values of frogs as well as utilisation of frog wastes. The Central Institute of Fisheries Technology, Cochin is leading in this field.

3. Commercially exploited species of frogs and environmental impacts.

While most of the presentation in this section was on the distribution and exploitation of frogs in various regions of the country and for purposes as diverse as export and laboratory utilization, there was no presentation on as such, on the environmental impact of such exploitation. Shri Humayun Abdulali of BNHS, Bombay and Shri Baldev Prasad of Indian Agriculture Research Institute were the leaders on presenting the frogs as the major controllers of agricultural pests, Dr.T.J.Pandian

and his group from the Madurai Kamaraj University were at the other end refuting the views of Abdulali and Baldev Prasad. However, both these groups had no hard core data to support their views and agreed that a more realistic data based report in this field is required.

While many delegates presented papers on the various use of frogs in India, everyone was surprised that there is no inventory on the frog resources in India as yet. There is, it was felt an urgent need for a systematic and authentic survey of the frog population in India in general andthe edible and exported frogs in particular. Most of them felt that this work can either be taken up by organisations like Zoological Survey of India or State Wildlife Wings or through leading Universities of each region. This was felt to be an urgent need since this could provide the guideline for any future policy decisions on the frog-leg trade in India.

4. Breeding and culture of frogs

The Central Inland Fisheries Research Institute who were the co-sponsors of this Conference were the leaders in this field. They presented their progress in frog culture. In fact, the Central Inland Fisheries Research Institute has already started a frog culture farm at Kalyani, Calcutta and claims to have achieved a break through in evolving suitable hatchery model for Rana tigerina and Rana hexadactyla. They also claimed to have achieved a fair amount of success in culture of frogs upto a marketable size. Other than CIFRI, Madurai Kamaraj University have also presented papers on a model for developing commercial frog culture baded on the work carried out in that laboratory since the last several years. They claim that exploitable size frogs can be produced at economically viable costs in frog forms using their technique.

The CIFRI frog culture unit have been restocking wild habitats with laboratory culture tadpoles. However, they have no records as to their survival after being liberated into the wild. An optimum size for restocking has not been established by them as yet. There was a general agreement that research in this line should be supported and perhaps the cultured frogs can be a substitute to the presently wide harvested amphibians. Dr.D.P.Bakshi, Jt.Secretary, Union Ministry of Commerce even disclosed that their Ministry was planning a strategy for developing and encouraging frog culture.

Demonstration of 'Electrical stunning' method of Killing.

The foreign delegates particularly from the Animal Welfare groups as well as some importers wanted to see the new methodology that are being adopted in India in killing frogs. The delegates were taken to a processing centre in South Calcutta where the newly developed electrical stunning box was demonstrated. Some 200 frogs were stunned in a few second to the satisfaction of most delegates but there were still doubts on how painless this methodology is. The Marine Products Export Development Authority and and other controlling agencies of frog-legs have made it compulsory for all frog-leg processors to use this new methodology og stunning the frogs before they are cut and processed.

One doubt on this methodology is that most of the frogs collected in the field are cut and brought to packaging units and such equipments are not practically possible to be used in the field ; the limitations being its size and erratic electicity in most rural areas from where most of the frogs are obtained. However this development has been a welcome step towards mitigating the objections of Animal Welfare Groups.

The conference brought out to the fore the following:

that

a) There is no systematic and scientific survey of the edible frog resource that have been utilised for so long without any consideration for its long-term survival.

b) Quite a high percentage of frogs that are captured go to the education sector and export is not the only cause of depletion.

c) While the role of frogs as agricultural pest controller can not be ruled out, it needs to be studied very objectively.

d) Painless killing of frogs by methods such as ' electrical stunning method' are only paper methods as most of the actual killing is done in the field immediately after collection.

e) The projected argument that the ban on the trade may deprive many of employment in the rural sector is true to some extent but, this should not be at the cost of an ecologically important resource.

f) the conservation measures like size restriction, fixation of ceiling on export quota, restricted collection season and enlisting of two species of edible frogs in CITES Appendix are justified.

g) There is a need to promote frog culture as a possible means of replacing pressure from the wild population.

h) there is a need to initiate field oriented research to study the basic biology and ecology of the edible frogs; based on which a rational policy of frog-harvesting can be initiated.

i) the proposal of utilising exotic species of frogs in commercial frog culture be studied carefully before taking a final decision keeping in view introduction of exotics may prove disastrous in the long run.

j) the argument that increasing irrigation facilities produce more habitat for frogs and in the last few years the habitat for frogs has increased is not based on any scientific research and can not be considered true.

k) eventhough some of these irrigated fields serve as habitat for frogs after considerable time of ecological succession, the use of excessive quantity of pesticides may be adversely affecting the tadpoles and negating the population growth. The effect of pesticides on tadpoles particularly on metamorphosis and growth has been well documented in laboratory based research.

General comments:

1. There was virtually no discussion or conclusion on the environmental role of the commercially exploited freshwater frogs or on the impact on ecosystem as a result of large-scale off-take of frogs.

2. The conference, it was felt was organised as if to sort out the bottlenecks of the frogleg trade rather than to consider and find ways and means to treat and use frogs as a long-term sustainable resource.

3. The conference emphasised and advocated rather at length on the employment potentiality in the frogleg trade and the main issue of "ecological impact of frog removal from ecosystem" was completely ignored.

4. There was no consensus or agreement on any recommendations by the conference nor was there any action plans to be followed up.

5. With so many agencies participating in the conference it would have been better if each major organisation was given the responsibility for some particular aspect of the problems in this field.

6. Though the conference was named as the First World Conference, there were no delegates from Indonesia, Malayesia and other south-east Asian frogleg exporting countries. There was also no deliberations on the present state of affairs in these frogleg exporting nations to compare them with the Indian situation.

7. The conference would have helped everyone concerned if they had reviewed the problem of frofleg trade and its allied problems in all frogleg exporting countries and the policies of the concerned governmental agencies.

The enclosed recommendations being supplied by the MPEDA is one which was not agreed to by most of the delegates. ANNEXTURE I

ORGANISATIONS/LABORATORIES WORKING ON VARIOUS ASPECTS OF FROGS.

(In India)

Taxonomy,Status,Biology and Ecology:

Bombay Natural History Society.

Wildlife Institute of India.

Utkal University.

Zoological Survey of India, Calcutta and Madras.

University of Calcutta.

Madurai Kamraj University.

College of Fisheries,Mangalore.

Science college,Kohima,Nagaland.

Indian Agricultural Research Institute,New Delhi.

Trade and Socio-economic studies.

Marine Products Export Development Authority,Cochin.

Post-graduate Research Centre,Dept. of Zoology,Modern College,Pune.

World Wildlife Fund - India and International.

Wildlife Preservation Organisation,Krishi Bhavan,New Delhi.

Handling,Killing,Preserving and Quality Control.

Central Institute of Fisheries Technology,Cochin.

College of Fisheries,Mangalore.

Export Inspection Council,Ministry of Commerce,Pragati Bhavan
Rajendra Palace,New Delhi.

Beauty Without Cruelity - India, Pune.

Society for Prevention of Cruelity to Animals.

Frog Culture:

Dr. A.K.Mondal
Central Inland Fisheries Research Institute,Barrackpore,West Bengal.

Sambalpur University,Dept. of Life Science,Burla,Orissa.

Dept. of Zoology,Utkal University,Orissa.

Madurai Kamaraj University,Madurai. Tamil Nadu.

S.V.University,Dept. of Zoology.Tirupathi.

Utkal University,Orissa.

ANNEXTURE I

FIRST WORLD CONFERENCE ON TRADE IN FROGLEGS VIS-A-VIS ENVIRONMENTAL CONSIDERATIONS HELD AT CALCUTTA ON 10 & 11 APRIL, 1986

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RECOMMENDATIONS

The First World Conference on Trade in Froglegs Vis-a-Vis Environmental Considerations held at Calcutta on 10th and 11th April, 1986 takes note of the various viewpoints of the national and international delegates on the ecological role of frogs, impact of exploitation on frog populations, impact of industrial effluents, pesticides, urbanisation etc upon frogs in natural habitats, mode of killing, conservation, catching and transport, processing technology, frog farming and the socio-economic aspects of the trade in froglegs and makes the following recommendations :

1. While recognising the importance of frog in the ecosystem, it was noted that available evidence of gut contents of exported frog species does not show any major role of frogs in the control of insect pests associated with agriculture. The Conference strongly recommends, that the frog exporting countries should take up suitable research projects to elucidate this aspect not only with reference to commercially exploited frog species but also others common in paddy fields.

2. Taking into consideration the fact that the total volume of frogleg trade in the world is only 10,000 tonnes - with India contributing about 25% and finding it difficult to conclude that the frog species are over-exploited in the absence of specific information on geographical distribution within the country of the population units

..2.

of exploited frog species, age structure, relative abundance, age composition, annual mean length etc., the Conference recommends that these aspects be taken up for detailed studies through research projects in frog exporting countries.

3. The Conference, taking note of the adverse impact of the irrigation projects upon the morphometry of flood plains, swamps and ox-bow lakes, which form some of the major natural breeding habitats of frogs and noting the impact of pesticides especially chlorinated organics and organophosphates upon the breeding and the habitat including paddy fields and their possible impact upon recruitment, recommends detailed studies to assess the magnitude of these developmental activities upon frog species.

4. The Conference after taking note of certain inadequacies of the indigenous methods used at present for killing of frogs, recommends that both the exporting and importing countries take up suitable research projects for perfecting a technology of painless killing of frogs.

5. The Conference taking into consideration the variations in the arrival and action of the South West monsoon from May to August and North East monsoon from October to November in the country favours a detailed study for determining the closed season for frog trapping region-wise.

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6. The Conference taking into consideration the international demand covering a wide range of frogleg sizes varying from 8-80 counts per kg. in the continent and USA and the difficulty in enforcing diverse counts for different species, recommends a size limit of 50 counts and below paired legs/kg as part of conservation.

7. The Conference also recommends that region-wise catch quota may be considered to avoid possible over-exploitation in certain regions.

8. The Conference taking note of the inadequacy of the existing methods of capture and transportation recommends a training programme for frog catchers.

9. The Conference takes into consideration the existing practices of handling and pre-processing of frogs and recommends that suitable measures be evolved to avoid possibility of Salmonella infection in the processed froglegs.

10. The Conference taking into consideration the overwhelming view of the delegates recommends setting up of hatcheries in different States of the country with a view to replenishing and augmenting the natural stock of the commercial species of frogs.

11. The Conference also recommends that CIFRI intensify its efforts of development of frog culture programmes to sustain and improve upon the existing frogleg trade.

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12. The Conference is of the opinion that introduction of any exotic frog species be done with great care after proper studies.

13. Taking into consideration the fact that a sizable section of the poor people in rural areas earn their livelihood though frog catching and related activities, the Conference recommends that the existing ~~practice~~ level of frog ~~capture~~ exploitation be continued.

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LIST OF PAPERS

Crocodile Breeding & Management Training Institute Madras LIBRARY
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1. The first World Conference on Trade in Froglegs-Vis-aVis Environmental Considerations - Calcutta April 10th & 11th 86 PROGRAMME.
2. Presidential Address by Dr.S.Z.Qasim
3. Introductory Address by Dr.A.V.Natarajan,Director,Central Inland Fisheries Res.Instt.,Barrackpore,W.B,India.
4. Keynote Address by Prof.N.Balakrishnan Nair,Head of Dept.of Aquatic Biology & Fishereies,Univ.of Kerala,Trivandrum
5. World Trade in Froglegs - An overview by Dr.K.P.P.Nambiar, Marine Products Export Development Authority,Cochin.
6. Trade in Froglegs - Seen from a Conservationist's point of View by Manfred Niekisch, Director of Traffic WWF-Germany.
7. Ecology and Conservation of Frogs by Kalyan Chakrabarti,IFS Wildlife Preservation,Eastern Region,Calcutta.
8. Survival of pathogens salmonella and vibrio parahaemolyticus in processed froglegs by M.A. James & Mr.M.R.Nair,Central Institute of Fisheries Technology, Cochin-682029.
9. Programme Utilization by P.V.Prabhu, A.Lekshmy Nair & K.G. Ramachandran Nair,C.I.FT,Cochin-682029.
10. Edible Frog Ecology by B.N.Choudhary,IFS,C.F,WL Circle,Ranchi
11. Biology, Conservation and culture of Indian frog species by M.K.Khare,Deptoof Zoology,School of life sciences,North-eastern Hill University,Shillong-793014 - Abstract.
12. Pithing: A Procedure for painless killing of frogs prior to processing by P.Dhandapani,Zoological Survey of India,Marine Biological Station,III,Santhome High Road,Madras-600028.
13. Progressing of Froglegs by Mr.Yoshiji Okane,Japan.
14. Quality control of Froglegs in India for export by Dr.K.P. Shrivastava,Jt.Director,Export Inspection Council (Ministry of Commerce ,Govt.of India)Pragati Tower (11th Floor)26 Rajendra Place,New Delhi-110008.
15. Larval Energitics of Rana Tigrina by M.C.Dash and S.N.Mohanty School of Life Sciences,Sambalpur University,Jyotivihar,Burla 768017,Sambalpur,Orissa - Abstract.
16. Effects of some of the size regulators on the timing of Metomorphosis by Dr.P.N.Misra,Deptof Zoology,Larambha College Sambalpur,Orissa,Abstract.
17. Addendum to "Diagnosis, distribution and bionomics of the edible frogs of India" by R.S.Pillai,Zoological Survey of India,Madras-28.
18. A model for developing commercial frog culture by M.Peter Marian,School of Biological Sciences,Madurai Kamaraj University,Madurai-625021 - Abstract.
19. Beauty without Cruelty - Paper presented at the International conference on trade in froglegs vis-a-vis environmentalconsiderations held in Calcutta: CAPTURE,HANDLING AND TRANSPORTATION OF FROGS by Nalini Z.Mehta,vice president,Beauty without cruelty(India Br.)

20. Recommendations

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20. Paper presented at the International Conference on trade in Froglegs Vis-A-Vis Environmental Considerations held in Calcutta: PAINLESS KILLING OF FROGS by Diana Ratnagar, Chairperson,Beauty without cruelty (India Br.)

21. FUTURE OF INTERNATIONAL TRADE IN FROGLEGS by Diana Ratnagar.

22. Ecology and Conservation of Frogs by Kalyan Chakrabarti,IFS Wildlife Preservation,Eastern Region,Calcutta.

23. ON THE EXPORT OF FROG LEGS FROM INDIA By Humayun Abdulali.

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The First World Conference on Trade in Froglegs

Vis-a-Vis

Enviornmental Considerations

Calcutta April 10th & 11th 1986

PROGRAMME

Organised by

Marine Products Export Development Authority

(Ministry of Commerce, Govt. of India)

In Association with

Central Inland Fisheries Research Institute

(ICAR Govt. of India)

First World Conference on Trade in Froglegs
Vis-a-Vis Environmental Considerations

PROGARMME

10-4-1986

9.30 - 11.00 a. m.	-	Inaugural Session
PRESIDENTIAL ADDRESS	-	DR. S Z QASIM SECRETARY TO GOVERNMENT OF INDIA, DEPARTMENT OF OCEAN DEVELOPMENT NEW DELHI
KEYNOTE ADDRESS	-	PROF. N BALAKRISHNAN NAIR HEAD, DEPT. OF AQUATIC BIOLOGY AND FISHERIES, UNIVERSITY OF KERALA TRIVANDRUM
COFFEE BREAK	-	11.00 - 11.15 a. m.
Technical Session I	-	11.15 a. m.-1.15 p m.

PRESENT STATUS OF INTERNATIONAL TRADE IN FROGLEGS

CHAIRMAN	-	SHRI. T. M. JOSEPH Vice-Chairman, MPEDA
1. World Trade in Froglegs - An Overview	-	Dr. K P P Nambiar, MPEDA
2. Frogleg Trade - An Importer's Point of view	-	Mr. Van Der Wielen — Eurotraco, Belgium
3. Frogleg Trade - A Scientist's Point of view	-	Dr. George W Nace Professor Emeritus of Biology University of Michigan U S A
4. Frogleg Trade - A Consumer's Point of view	-	Prof. Stephen Subtelny, Dept.of Biology, Weiss School of Natural Sciences, Houston, Texas, U S A

5.	Frogleg Trade - A Conservator's Point of View in a Consuming country	- Mr. Manfred Niekisch, World Wild Life Fund Traffic, WWF GERMANY
6.	Frogleg Export from Eastern India - Present Status & Future Strategies	- Shri. Prasun K Dutta Shri. Pankaj K Manna Shri. Ashish K Ghosh
7.	Problems of Frogleg Export in India	- Shri. Ranjith Bhattacharya Triveni Food Products, Calcutta
	Lunch Break	- 1.15 - 2.15 p. m.
	Technical Session II	- 2.15 - 5.15 p. m.

HANDLING, PROCESSING & QUALITY CONTROL IN THE FROGLEG INDUSTRY

	CHAIRMAN	- DR A N BOSE, Advisor Indian Institute of Technology Kharagpur
1.	A New Technique for Painless killing of Frogs	- Shri. G G Hiremath Shri. K A Narayana Bhat & Shri. H P C Shetty College of Fisheries, Mangalore
2.	Development of an Electrocution box for Stunning as Humane Method of killing Frogs for Frogleg processing Industry	- Shri. S Ayyappan Pillai CIFT Cochin
3.	Pithing - A Procedure for Painless Killing of Frogs prior to processing	- Shri. P Dhandapani Zoological Survey of India Madras
4.	a) Capture, Handling and Transportation of frogs b) Painless killing of frogs	- Beauty without Cruelty, An International Charitable Trust Branch (India) Poona
5.	An Improved Method of Cutting Frogleg without damaging the Intestine	- Prof. Sunit Mukherjee Jadavpur University Calcutta

Inhuman killing either by stunning or by chemical would not be accepted by EEC

3 6th April 1986 Hindusthan Times

Processing

6.	Processing of Bacteriologically sound frozen Froglegs	- Shri. T S Gopalakrishna Iyer CIFT Cochin & Shri. M R Nair CIFT Cochin
7.	Survival of pathogens Salmonella & Vibrio Parahaemolyticus in processed froglegs	- Dr M. Arul James CIFT Bombay & Shri. M. R. Nair CIFT Cochin
8.	Canning of froglegs in different styles	- Shri. K K Balachandran CIFT, Cochin & Shri P R G Varma CIFT, Cochin
9.	Utilisation of frog waste	- Shri. P V Prabhu et. al CIFT, Cochin
10.	Nutritive value of frog	- Dr A.G. Gopakumar
11.	Quality Control of Froglegs for export in India	- Dr. K P Shrivastava Export Inspection Council NEW DELHI
12.	Code of practice International Standard for Froglegs brought out by FAO	- Shri. Om P Dhamija Export Inspection Agency Calcutta
13.	Code of practice International Standards for froglegs	- Mr. Limpus FAO, Rome

Presented by

11-4-1986

Technical Session III - 9.00 - 11.15 a. m.

Commercially exploited species of Frogs in the world & Environmental impact due to exploitation

CHAIRMAN - PROF. S KRISHNASWAMY
Vice Chancellor
Madurai Kamaraj University
Madurai

1. Frogs & Man - Their Mutual Welfare - Dr. George W Nace
Professor Emeritus of Biology
University of Michigan U S A

2. Production and export of frogs - An Ecological view - Dr. T J Pandian and
Dr. Peter Marian
Madurai Kamaraj University
Madurai

3. Diagnosis, Distribution and Biolonics of the Edible Frogs in India - Dr. R S. Pillai
Zoological Survey of India
Southern Regional Station
Madras

4. Edible frogs of Nagaland - Mr. Kiyasetuo
Dept. of Zoology,
Science College, Kohima

5. Edible Tadpoles - Mr. Meren A O, Dept. of Zoology, Science College Kohima

6. Frog & Froglegs Socio-Economic & Ecological Perspective - Dr. S Y Paranjape and
Shri. H V Ghate Post Graduate Research Centre Dept. of Zoology, Modern College Poona

7. Some aspects of frog population and Utilisation in various Districts in Gujarat State - Dr. V C Shah, School of Sciences, Gujarat University
- Ahmedabad

8.	Animal Welfare and Conservation Issue	- Mr Victor Watkins, WSPA, U. K.
9.	Ecology & conservation of Rana Species of Frogs	- Shri Kalyan Chakkrabarti Wild Life Preservation, Calcutta.
10.	On the Export of Froglegs from India	- Shri Humayun Abdulali - Bombay
11	Catching of Wild Frogs vis-a-vis Ecological Imbalance - Some Considerations	- Shri I. G. Hiremath and Shri G G. Hiremath College of Fisheries, Mangalore
12.	Role of Frogs & Toads in Environment with Special reference to Agriculture	- Shri Baldev Prasad Indian Agricultural Research Institute New Delhi.
13	Do Frogs constitute an Exploitable Resource?	- Prof. S. Dutt, Department of - Marine Living Resources, Andhra University
14.	On the Ecology & Exploitation of Commercial Species of Frogleg Export	- Dr. A. K. Mondal Frog Culture Division of CIFRI, Kalyani, Calcutta
	Tea Break	- 11.15—11.30 a. m.
	Technical Session IV	- 11.30 a. m. — 1.30 p. m.

BREEDING & CULTURE OF FROGS

	CHAIRMAN	- PROF. STEPHEN SUBTELNY U S A
1.	Frog culture in India	- Dr. A. K. Mondal, Frog Culture Division of CIFRI, Kalyani, Calcutta.
2.	Current Status of Amphibian in Indian context and the Need for Frog Culture	- Dr P. Mohanty Hejmadi Prof. & Head of Department of Zoology, Utkal University Bhubaneswar
3.	a) Bull frog culture in Philippines	- Mr. Charlito Rivera Juico Central Luzan State University - Philippines.
	b) Bull frog production technology	

4.	Growth Responses of Indian Bull Frog under Captivity Fed with various live diets	- Dr. A. K Mondal, Shri M. K. Bose & Shri S C Mondal, Frog Culture Division of CIFRI, Kalyani, Calcutta
5.	Biology, Conservation and Culture of Indian Frog Species	- Prof. Mahendra Kumar Khare Dept. of Zoology, School of Life Sciences, North Eastern Hill University, Shillong
6.	A model for Developing Commercial Frog Culture	- Dr. M. Peter Marian Madurai Kamaraj University Madurai
7.	Culture of Rana hexadactyla under Electropolarity Treatment with Reference to Protein Enrichment	- Dr. K S Swami, Shri K. Ravindran and Shri P V S Prakash - Dept. of of Zoology Shri Venketeswara University Tirupathi
8.	Effects of some of size regulators on the Timings of Metamorphosis	- Dr. P. K. Misra, Dept of Zoology, Larambha College Sambalpur, Orissa.
9.	Energy Accumulation & Metamorphosis of Rana tigrina larvae	- Dr. A K Hota G M College Sambalpur
	Lunch Break	1.35 — 2.15 p. m.
	Concluding Session	- 2.30 - 4.00 p. m.
	CHAIRMAN	- Dr. R M ACHARYA Deputy Director General ICAR, New Delhi
	Presentation of Summing up Paper	- Dr. T J Pandian, Professor Madurai Kamaraj University Madurai
	5.00 - 6.00 p. m.	- Demonstration of painless killing of frogs (Processing Plant of M/s. George Maijo Ganga Nagar Near, Dum Dum Air Port, Calcutta)

What is the survival % of larvae?

50,000 tons of pesticide

Frog seed centre like fish seed centre not only for economic reasons but also for environmental reasons

Tumor R. tigrina is more susceptible to disease than R. cyanophlyctis

(6) Marian – optimal limnological & other conditions for commercial production of frog also a cost-benefit ratio

David Whiting -

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FIRST WORLD CONFERENCE ON TRADE IN FROGLEGS VIS-A-VIS ENVIRONMENTAL CONSIDERATIONS

— Venue : Hotel Oberoi Grand, Calcutta, 10 April 1986

INTRODUCTORY ADDRESS

Dr A.V. Natarajan
Director
Central Inland Fisheries
Research Institute
Barrackpore
West Bengal
INDIA

With the advent of frogleg trade in the country and its steady growth over the past two and a half decades came very many issues like conservation of frog genetic resources; impact of exploitation of frogs on ecology especially in the context of their role as destroyer of insects and hence as an ally in agricultural production; problems in handling and processing; and above all, the mode of killing that received wide publicity in mass media all the world over. The trade in froglegs has, therefore, become a contentious issue with commercial and socio-economic considerations on one side, and the interests of environment, conservation and cruelty to animals arrayed on the other side. Many of these aspects have assumed both national and international overtones. Many of the frogleg-exporting countries like Bangladesh, Indonesia, Thailand, Philippines, Brazil and Mexico, share many of the above problems. This explains the genesis of the present first World Conference on frogleg trade vis-à-vis environmental considerations sponsored by Marine Products Export Development Authority of India (MPEDA) in association with Central Inland Fisheries Research Institute (CIFRI) which handles not only all aspects of Inland Fisheries research but also amphibian research with particular reference to ranidae, the family of true frogs.

Froglegs are fast becoming an important item of export in processed animal food in many developing countries in South and South-East Asia and Central and South America. The product has a growing market in U.S.A., Netherlands, Belgium, France, U.K. and Italy, where it is considered a table delicacy.

India made a modest begining of frogleg export in 1960. The level of export was about 600 tonnes during 1960-70; 1,800 tonnes during 1971-75; and 3,300 tonnes during 1976-84. A record export of 4,368 tonnes of this commodity was achieved in 1981 valued at Rs.12 crores. The commodity which was initially under Open General Licence has now come within the purview of Wildlife Preservation Act which lays down stringent conditions on exploitation, processing etc. This perhaps explains the downswing in trade since 1982.

The exploited populations of frog species in this country are the Indian Bull frog Rana tigrina and the Indian green frog Rana hexadactyla; the former has a wider distribution covering both north and south India while the latter is by and large restricted to Peninsular India. The migratory range of these species from the rivers, lakes, flood plains, swamps, marshes, sloughs and ponds are not known. Rana hexadactyla being more aquatic has probably a more restricted migratory range than R. tigrina. R. crassa which makes comparatively a a smaller contribution in the export has also a wide distribution in the country.

We are at present killing in this country about 20,000,000 frogs a year for the purpose of frogleg export. We were exploiting about 1/6th this number some 20 years ago. In the absence of precise information on

geographic population units of the frog species and population parameters (age, relative abundance of age composition, annual mean length in exploited populations etc.), there are difficulties in pronouncing if the commercial species of frogs in this country are over-exploited. The experiences of participating countries in this regard would come for discussion under technical session devoted for 'Commercially exploited species of frogs in the world'.

Frogs have been identified as farmers' friend. It is apprehended that removal of large number of frogs from the wild would eliminate an important destroyer of insects and increase the damage to agricultural crop. According to one estimate the frogs that are killed each year would have destroyed insects of the order of 1,20,000 t in a season; and perhaps twice or thrice as much during the whole year especially under irrigated production system. It is further contended that we are replacing a natural bio-agent with pesticides at great cost to environment, economy and public health. Rana tigrina's food is largely made of crabs, insects and insect larvae, earth worms and gastropods besides casual occurrence of arachnids, fish, frogs, snakes, birds and mice; while the food range of R. hexadactyla, besides algae and aquatic weeds includes as major food item, aquatic insects : dragflies and larvae, water scorpion, giant waterbug, pigmy back swimmer, water boatman, pond skaters, water beetles; and a small proportion of terrestireal insects. Perhaps the conference will like to critically examine if these elements have any share in the destruction of crops and if they have anything to do with the known major crop pests or their relevance is only peripheral. Since agricultural scientists are participating in this conference their opinion and their

observations on this aspect would be valuable. Similarly views of other countries would help give correct focus to this crucial issue. These aspects will be examined under technical session on commercially exploited species of frogs and environmental impact.

Aside from mortality caused by exploitation on commercial species of frogs, various other measures like impact of pesticides on egg masses, cleaving eggs and pre-limb tad-poles need to be looked into and their possible effect upon recruitment. Similarly the impact of irrigation projects creating new water resources like canals, extensive shallow irrigation impoundments especially those obtaining in south India need to be examined in the context of favouring augmentation of natural frog populations.

The handling and processing is another issue of importance for importing countries which would naturally expect a Salmonella - free product. The mode of killing of frogs causing avoidable cruelty to animal has been subject of lively debate all the world over. The World Society for Protection of Animal has also added its voice of concern to the matter. This is also listed as one of the major topics for discussion at this conference. There will also be a few demonstrations on painless killing of frogs.

The breeding of the frogs in this country is influenced both by south-west monsoon and north-east monsoon. In some areas in south India double breeding has been reported. While R. tigrina has a brief breeding period around break of monsoon, R. hexadactyla has gametogenetic activity all the year round with breeding reported both in spring and monsoon. In Indonesia local

frog species respond to north-east monsoon and breed in November; in temperate Europe from March to June coinciding with spring in northern hemisphere; and in South Africa and South America during July to November coinciding with spring in southern hemisphere. Various eco-climatic parameters like temperature, humidity, length of photoperiod and rainfall need to be considered in evolving guidelines for closed season, a subject matter of crucial importance and would be discussed in one of the sessions on conservation.

The aspects of frog reproduction relating to hormone — induced breeding, the effect of administration of PMSG, HCG, mammalian pituitary hormones and corticosteroids would receive due consideration in the session devoted to breeding and culture of frogs.

The Central Inland Fisheries Research Institute has achieved a break-through in evolving suitable hatchery model (at present Lab-based) for R. tigrina and R. hexadactyla and millions of newly transformed frogs are released into swamps near Kalyani each year even within the limited facilities available to the Institute. Similarly CIFRI has also achieved a major break-through in culture of R. tigrina to marketable size. Various live feeds have been experimented for culture and the potential of many more are under screening. These studies are presently laboratory-based. Going by successes of these experiments CIFRI has procured a 17-acre land near Kalyani in West Bengal for frog farm, which would be the first ever major effort in this direction in south and south-east Asia. Indonesia and Philippines have also been experimenting on culture experiments in R. catesbeiana, the American Bull frog. These experimental efforts would be discussed in the session on breeding and culture.

The introduction of exotic frogs especially R. catesbeiana needs proper evaluation especially in the context of conservation of indigenous frog resources. This has not been listed as a subject matter for discussion but a theme on which an international opinion is desirable. This matter could be examined in a general way in the session on conservation of frog resources.

The deliberations and outcome during the next two days of this World Conference are keenly looked forward by the Governments, trade circles, environmentalists and conservationists the world over. Let me wish the conference all success.

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First World Conference on Trade in Froglegs

VIS-A-VIS

Environmental Considerations

CALCUTTA

APRIL 10-11, 1986

PRESIDENTIAL ADDRESS

by

Dr. S. Z. QASIM

Secretary, Department of Ocean Development
Government of India
New Delhi

PRESIDENTIAL ADDRESS

by

Dr. S. Z. QASIM

Mr. President, Mr. Chairman, MPEDA, Distinguished Guests, Ladies and Gentlemen,

It is indeed a privilege for me to be associated with this World Conference on Trade in Froglegs vis-a-vis Environmental Consideration organised by the MPEDA in association with the Central Inland Fisheries Research Institute, Calcutta. I understand that it is for the first time that a World Conference of this nature to discuss several aspects of the international trade in froglegs and its relation to environmental considerations is being held. I congratulate the MPEDA and the CIFRI for taking the initiative in organising this unique meeting.

It is indeed a pleasure to see such a large number of distinguished participants both from India and abroad who are specialists in different aspects of the subject and that the theme of the Conference has attracted such a wide attention.

International trade in froglegs has been growing steadily over a decade now. The current level of the trade in froglegs is of the order of about 11,000 tonnes. The supplying countries are India, Indonesia and Bangladesh while the major importing countries are the USA, Japan, France and other European countries.

The importing countries have stringent quality regulations to be adhered to by the supplying countries. Some of them have requirements more stringent than even the Codex Standards. Supplying countries have been and are taking measures to comply with these quality controls.

Apart from this, the supplying countries have to take care to ensure that the level of exploitation is such that it does not endanger the wild stocks and does not lead to resource depletion. India, in particular, has been quite conscious of this aspect and regulatory measures have been instituted long back, which include banning catching and processing of frogs during their breeding seasons, restriction on the size of froglegs to be exported and to ensure that young ones are not caught and slaughtered. Recently, the export quantity, I understand, is regulated through a quota system.

Environmentalists strongly advocate putting a ban on catching of frogs and the export of froglegs on ecological considerations. They also question the wisdom of developing countries trying to earn foreign exchange through the export of froglegs, on the one hand and spending enormous sums on pesticides on the other hand, to kill insects which would otherwise have been destroyed by the frogs if the eco-system is not deprived of the frog population. These are arguments which are being at present debated upon at various levels.

Another subject of considerable interest is the protest made by the animal welfare groups from different parts of the world about the alleged inhuman ways adopted in the killing of frogs. Codex guidelines on the subject require that frogs should be subjected to electrical stunning before they are slaughtered. Countries like Ind have taken measures to comply with the Codex Guidelines. The method adopted in India, I understand, will be demonstrated to the participants.

To prevent the over-exploitation of frogs in the supplying countries, CITES Regulations, as I understand, have been made applicable recently for the export of froglegs.

Interest in frog rearing on a commercial scale is also gathering momentum. Reports from other countries indicate that commercial-scale frog rearing is a feasible proposition. To what extent the

supplying countries could derive benefits from the work in this direction, reported to have been done, is a matter to be further examined.

The programme of this Conference is wide enough to cover all these subjects and also the other related fields. I am sure the deliberations of this Conference and the conclusions to be arrived at will be helpful in establishing the short-term and long-term goals for substaining and developing this resource and its utilisation □

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FIRST WORLD CONFERENCE ON TRADE IN FROGLEGS VIS-A-VIS ENVIRONMENTAL CONSIDERATIONS :

K E Y N O T E A D D R E S S

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T R I V A N D R U M

Conservation and management of amphibians

Problems and Prospects

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Introduction

These has never been a period in the history of developing countries when they have to face so many crises. These situations have arisen on account of an unprecedented increase in the population more especially in Latin America, Africa and S.E. Asia. From a mere 1 billion in 1830 the human species would reach a staggering 6 billion by the turn of the century. A child is being born every 2.5 seconds and we in India are increasing one Australia population - wise every year. Naturally we have serious problems concerning raw materials, food, population, environment health and so on.

Habitat disturbance and destruction

From the point of view of amphibians, more especially frogs, there have been very specific problems in regard to habitat disturbances on account of anthropogenic changes. Thus, the new agricultural technologies introduced during the past 50 years have had noticeable adverse effects on the amphibian fauna. The use of hybridised varieties of cereals which needed massive inputs of artificial fertilisers, the indiscriminate use of pesticides, crop rotation multiple cropping etc. all have their specific roles to play in the

significant changes brought about in the quality of water which is the medium in which frogs spend the sensitive part of their life history. It has been estimated that 25% of all pesticides and fertilisers used in agriculture ultimately leach out into the neighbouring body of water. Ever since the advent of DDT during the Second World War, a series of chemicals belonging to the tribe of organohalogens have been synthesised and used in pest control. Phosphatic insecticides and carbomates have also found extensive application in various areas such as agriculture, food, health and sanitation. The indiscriminate use of these deadly chemicals has caused serious problems of pollution of the environment. Of the more than 55 well known pesticides, forms such as DDT, BHC, Carboryl etc. are extensively used and these pose a serious threat to non target organisms such as frogs. The breeding places of frogs get contaminated by these poisonous biocides and they adversely affect the eggs and early stages causing at times total destruction. The exact nature of the damage done by insecticides is still incompletely known. However, it should be borne in mind that the effect of these deadly poisonous substances on all aquatic biota must indeed be deleterious and ways and means should be found to save the natural breeding areas of amphibians from the detrimental accumulation of these poisons inadvertently introduced by man.

As a result of urbanisation, spectacular expansion of cities and towns and the rapid development of industries, the natural habitats available for normal activities of amphibians which are by

far the most sensitive of living vertebrates have been drastically reduced.

Ponds, tanks and lakes are either filled in or silted up and all these eventually dry up to become parched, unsightly depressions unsuitable for any aquatic life.

Similarly extensive deforestation along the Western and Easte Ghats and the Himalayan slopes has caused irreparable damage to the habitat of amphibians in general and the frogs in particular. The unprecidented drought to which certain parts of Africa and S.E. Asia are subjected to recent times has also been most detrimental for the life and activity of frogs.

Thus, habitat destruction, over exploitation, pollution more especially biocide contamination have thus severely reduced the frog population of this country affecting the collection and sale of frogs. The public in general complain that noxious insects such as mosquitoes and midges have increased alarmingly in recent times and attribute this to the depletion of frogs which are supposed to feed on these insects. Ecologists are disturbed since they feel that the balance in nature which has been maintained through years of selection and stabilisation has been upset throug a break in the food chain at the predator level of the trophic pyramid. The process of capture and transport and the way the legs are chopped off leaving the frogs to die a slow and painful death all acts of cruelty which disturbs the peaceful citizen. The enti

operation is no doubt barbaric, harsh and brutal and some countries have been ~~tried~~ trying to introduce an embargo on the import of frog legs from India.

Present status of captive and export

The arrival of the monsoon over the Malabar coast is indeed one of the most spectacular phenomena. It represents one of the eventful crises in the meteorological drama during the cycle of the seasons. A major component of this yearly event was the characteristic, ear-shattering vocal orchestrations by the countless bull-frogs announcing the death of summer and the arrival of the life-giving life-sustaining heavenly waters of the monsoon. Alas, along the entire west coast this amphibian serenade which has been passed down to us as a natural heritage through the past millions of years, now remains as a sad nostalgic memory of the 1960's, depriving the fascinating meteorological event of its sonorous biological component!

.There is no doubt of the fact that the frog population in the country has significantly declined at least in the neighbourhood of human habitations. Ecologists have warned that the reckless and unscientific capture of frogs would lead not only to their extinction but also to the disturbance of ecological balance resulting in the multiplication of such insect vectors as mosquitoes and other noxious creatures (Mondel, 1975).

India is the biggest frog-leg exporting country in the world at present accounting for nearly 3000 tonnes, earning foreign exchange to the value of 8-10 million U.S. $ per annum.

We have a very rich fauna of frogs and toads, more than 112 species of which edible ones belong to the genus Rana. The Indian ballfrog R. tigrina, the green frog R. hexadactyle and R. crassa are the ones caught at present for frog-leg export. R. tigrina is a robust species, yellowish green or olive above with dark spots all over the back and occurs in India from Nepal Valley and the base of the Himalayas, Burma, Ceylon and S. Yunan. R. hexadactyla though commonly known as the green frog could be recognised by its leaf green or dark brown colour, primrose-yellow vertebral line and granulated lower parts with more or less distinct porous warts. This species occurs chiefly in S. India, Ceylon, Bengal and Rajasthan. R. crassa is the third species which is edible.

Frog utilisation Sectors

Frog is the standard laboratory animal both for the pre-degree and degree classes for the Physics, Chemistry, Nat. Science (II Group); B.Sc. Zoology and B.Sc. ancellary zoology groups in virtually all the nearly 130 Universities in India. According to Pandian (1985) the syllabus demands the dissection of at least 10 frogs by a Biology student prior to his graduation. Thus in 1980 nearly 20 million frogs were used in the 4500 colleges for educational purposes alone. Much of the biomolecular and other sectors of medical research also uses frog as a standard animal. Three times this number was exported by the MPEDA in 1980.

According to Pandian the increasing cumulative frog harvest made by the educational sector and the export sector during 1970-1980 was far higher than the rate at which the frog's habitat (*) area and its frog production capacity. Pandian concludes that this is perhaps the reason for the decline in frog export since 1981. According to his estimates the number of frogs harvested - lagarithmetically increased from 0.2/ha in 1960 to 2/ha in 1978; subsequently the harvesting rate stabilised at that level showing that the maximum possible annual harvest of frog is only about 2/ha. Mondal (1975) reported that the average size of a frog used for export is 100 gms. From careful observations and experimental studies, Marian (1982) estimated that the home range of a 100 g. R. tigrina is around 0.0357 ha. Thus one ha. of irrigated land could support as many as 28 frogs. Therefore, since the sustainable harvesting rate is of the order of 2 frogs/ha/annum, it would appear that a harvest of 7% of the population from the habitat per year would be the reasonable optimum yield that could be harvested and exported. The habitat of these frogs is not just irrigated areas. On the other hand they have very characteristic preferences. There are specific qualities in regard to type and amount of water that must exist to meet the amphibians requirements. The water must be fresh, should have hiding places such as aquatic macrophytes or stones and are generally found in pools and ponds of different kinds, stream-fed, spring-fed, shallow, deep, large, small, wood-land and meadow ponds, we are yet to know the exact requirements of these frogs. In the case of R. hexadactyle

(*) ie. the irrigation area has increased and he argues that the frog harvesting rate in 1981 has exceeded the limit set by the habitat.

they occur more frequently in ponds and tanks with dense aquatic vegetation. They feed voraciously on a variety of animals, insects of various kinds, chiefly beetles and larger worms, miscellaneous crustaceans, fishes, tadpoles, small frogs and even small water snakes!

Role of frogs in vector control

The role played by the frog in controlling vectors of diseases such as mosquitoes and pests like Hieroglyphus banian, Oxya velox was assessed by analysing the stomach contents. Suguraman (1979) found that the food of Rana tigrina collected around agricultural field in Sholavandan for one year was mainly insects and crabs, the former constituting 80% in which surprisingly there were no mosquitoes, not even a representative of a dipteran for that matter. Pandian and Vivekanandan (1985) explained it on the basis of the cost-benefit ratio of feeding and concluded that a prey weighing 0.1% of the predators body weight alone could offer additional energy to the predator than the energy cost of foraging, subduing and handling the prey. No wonder the mosquito (2 mg. wet weight) does not form an item of the frog's food. They seriously doubt the possibility of using frog as a vector controlling agent. Nevertheless, their studies do indicate that agricultural pests belonging to a wide assortment of insect orders such as Orthoptera, Isoptera, Lepidoptera, and Coleoptera ~~and thus~~ contribute a major bulk of the frog's food. Likewise, crabs which damage the bunds in agricultural fields are also consumed in fair numbers by frogs.

The myth of habitat expansion

Frogs inhabit wells, ponds, tanks, lakes and other Swampy and low lying areas. It has been indicated that of the more than 300 million ha. land available in India nearly 7.3% (i.e. 23 million ha.) was under irrigation in 1951. During the period 1950-1980, 1500 dams were built to control flooding and to expand irrigated agricultural land area (Agarwal, et al., 1982) resulting in an expansion of irrigated land area to 51 million ha. This is probably a substantial increase in the habitat of frog which in turn should enhance frog production. The above mentioned statement appear to be very impressive from the point of view of irrigated area. The problem arises when we try to examine closely whether all irrigated areas are ideal habitats of frogs. Assumptions and generalisations are exciting from the point of view of arm-chair dialogue but one should examine the realities especially in problems concerning ecology where several factors work together to produce specific effects conducive for the existence and maintenance of particular populations and communities. The habitats of animals are not transformed overnight, but are the result of years of growth, stabilisation and evolution resulting through natural selection a characteristic and diagnostic biocoenosis.

This explanation at this point is deliberate with a view to showing that general estimates and assumptions on the basis of statistical computations need not necessarily indicate real situations.

Non availability of basic data

In any consideration of frog resources, their conservation, exploitation and management one should bear in mind certain basic prerequisites. No estimate has ever been made of the available resources at any time in this country. An inventory on frog resources was neither contemplated nor carried out and the export which started as a minor fancy item in 1955 spectacularly developed into an important component to consumers in U.S.A., France, Australia, Belgium, Italy West Germany and Netherlands.

To undertake a reliable inventory on frog resources is not an easy task. The only reliable data on which one could depend are the quantity of frog-legs exported and the probable number that are used for educational and scientific purposes. A substantial quantity of frogs are smuggled out of this country into Bangladesh and other neighbouring countries from where they are exported. A major portion of U.S. imports from Japan are, in fact, frogs of Indian Origin. Pandian (1985) has recently "collected some information from scientific areas of overlapping interest and drawn certain inferences from ecological point of view and has presented an objective view on the present status and prospects of production and utilisation of frogs in India". While no population census of frogs is available some reliable data on frog harvest by the export and educational sectors furnish circumstantial evidence on frog production.

Capture

Frogs are extraordinarily active during the monsoon which is their breeding season, when the loud resonant mating calls of the

males could be heard as a disturbing concert all through the rainy nights. They are collected usually at night with the aid of strong lights which stunn and dazzle them. Using scoop nets, sweeping cast nets, seine nets or by hooks with baits, they are caught and transported in wet gunny bags. Their hind legs with the base of the vertebral column are chopped off after narcotising them in 10% salt solutions. From the legs the skin is peeled off, claws are trimmed, the blood vessels pulled out and thoroughly cleaned before packing them in polythene paper to be quick frozen to a temperature of - 40°C. Frog legs frozen in 2 kg blocks as in the case of shrimps are also available. Unlike most edible animals, frogs as a whole are not eaten except the fleshy hind legs. Fully grown specimens measuring 70-165 mm or above from snout to vent are normally slaughtered. The number of forzen frog legs contained in each Kg is based on their size. Export of frog-leg counts 80 and above/Kg is banned owing to conservation measures since these small legs are from immature frogs. Processing of frog-legs is also banned during the breeding period ie. June-August. Export of live frogs has also been brought under control by the Govt. of India.

Frogs are mainly collected from Tamil Nadu, Kerala, Andhra, West Bengal and Maharashtra chiefly during the monsoon and post monsoon periods. The harvesting rate is about 50 frogs/collector/night thereby providing employment for a large number of people (Pandian, 1985).

From the discarded protions of the frog's body, other valuable products could be obtained such as an odourless frog oil, and frog-meal, the former for medicinal purposes and in leather curing and the latter as a fertiliser or additive or poultry and cattle feed. The skin can be tanned into leather and fancy articles as they do in China and Japan. Frog Culture Stearns (1939) demonstrated that bullfrogs can be reared successfully in large numbers. Nace (1977) and Cully and Gravois (1971) have shown that it is possible to maintain colonies of frogs and they have developed culture techniques for large-scale rearing. Japan also has developed many successful frog-culture techniques. Despite the fact that these techniques have been developed for species other than those that occur in India many practices they employ are applicable to our species of frogs. Extensive studies by experts suggest that since careful environmental control is an essential requesite, outdoor rearing is not considered desirable. The basic rearing technique involves confinement and concentrated feeding with suitable live feed such as fly-larvae, silkworm pupae, crustaceans and aquatic oligochaetes.

Frog culture is not so easy as fish culture. Even in the United States and Japan culture is still in its infancy. Attempts have not been very successful mainly on account of problems of disease, cannibalism, predation and slow growth. Artificial feeds have been used for tadpoles and adult frogs. Food pellets, potatoes meat scraps, chicken viscera have been tried with some success.

Likewise, frogs have been fed with floating feeds such as rabbit pellets, chicken feed, trout chow with suitable binders such as alginate gelatinised starch and gelatin.

The American experience suggests that the cost of culture is still quite high and the market for such cultured frogs will have to be research institutions rather than for food. It does not appear to be economical to compete against the cost of frogs which grow as by-product with fish culturists or caught in the wild. Until such time as some of the above mentioned problems are overcome, it will be impossible to culture the bullfrog for the food market. By far the most important need is the discovery of a commercial feed. Both in Japan and the U.S.A new types of feeds and feeding techniques are being developed. The results are incomplete at this time. If an economical commercial feed could be utilised, the expensive food chain could be eliminated and suitable medication could be administered for disease control. Similarly to ensure the production of genetically defined strains of frogs for research market, laboratory breeding techniques need to be improved. At present only limited success is enjoyed by induced breeding. Selection for such characteristics as rapid growth, identifying markings, blood characteristics disease resistance etc. are necessary if the frog is to become a standard animal for the research market.

Likewise, our information is fragmentary regarding the diseases of frog both in the tadpole and the adult stages. Methods of disease control are virtually unsatisfactory. The administration of medications is also inadequate. Until modifications are developed and techniques for administering them are found, perhaps the only method of disease control would be extreme sanitation.

Work in these directions are in full swing (Preddy and Culley, 1971) both in the U.S.A. and in Japan and it is hoped that suitable solutions for these problems would soon be forthcoming so that frog culture would emerge out as a profitable proposition from its present position of uncertainty.

A careful consideration of all the above mentioned factors suggest that extensive culture is perhaps the most practical solution for the large scale production of frogs in our country. Techniques which have been developed and perfected in U.S.A. and Japan could be profitably employed here with effective modifications to suit local conditions. Large-scale controlled production of eggs and their care in well conceived hatcheries will have to be carried out. Nurseries have to be established on a large scale in suitable areas and the early vulnerable stages of frog's life cycle be suitably protected and the metamorphosed juveniles be released in large numbers in ideal localities. This is perhaps the only way to compensate for the indiscriminate exploitation of frogs from natural sources and the replenishment of their population.

Elsewhere it has been found that when bullfrogs are reared under sanitary conditions and are provided with adequate nutrition, little mortality occurs after they are 2 months past metamorphosis. Mortality over two months of age is normally less than 10 per cent. The critical period is in the late stages of metamorphosis and loss of over 90% of a population has been recorded. The cause of this is not yet clear. This indicates the need for careful scrutiny of the stages in the life history and recording the most sensitive periods for their care in culture systems.

The breeding period of the Indian frogs coincides with the monsoons, the South-west and the north-east. The S.W. monsoon breaks over the Malbar coast in June and the North east brings copious precipitation along the east-coast during September-December. Naturally there is some overlap in the breeding season among the frog species. The brief duration of the monsoons and the evanescent nature of the habitat lead to severe competition both for food and for space. Being highly specialised suspension feeders, the amount of food available is a reflection of the quantum of primary productivity in these seasonal ponds and tanks. The food available being a temporary and more often undependable source, the tadpoles are subjected to considerable stress and strain in regard to food. Furthermore, the steady shrinking of the ponds and pools imposes on the inhabitants other physical stresses in terms of available space per specimen, a natural increase in temperature and change in the quality of the medium. At times the habitat may dry up completely leading to total destruction of the inhabitants. The breeding

success of the anurans is thus a virtual gamble depending on the arrival and action of the monsoons. The most vulnerable period of its life history is also geared to the most critical part of the seasonal rains. The clutch size of anurans ranges from 1280 to 1680 eggs/spawning, the average being 1474. The percentage hatchability of Rana tigrina is 60± 6 per cent. Mortality of taspoles is severe and 75-100% death has been recorded during development as a result of infection and sudden drying up of the puddles (Marian & Christopher, 1985).

The brief account presented above indicates the nature of the vicissitudes, the natural pit falls, the environmental stresses and strains to which the developmental stages of frogs are subjected to in their natural habitats. The failing nature of the medium and the constant anthropogenic disturbances also are additional constraints. Under these circumstances, an ~~are~~ effective solution to these problems is undoubtedly scientific culture of frogs. Pandian and Marian (1985) in small laboratory systems could rear 98% of the tadpoles to metamorphosis. This result suggests that it is feasible to develop frog culture in a big way using the expertise available. Only by this way it would be possible to replenish the rapidly declining frog population in nature and to augment the production of frogs. There is the imperative need for the judicious adoption of such techniques as hypophysation, dry fertilisation, mass rearing in high density cultures using appropriate types of food in adequate quantity. Pandian and his group found Tubifex tubifex to be an ideal food and R. tigrina attained a body weight of 40 gms

in 90 days wit 200 gm of Tubifex.

In areas such as the Kuttanad where extensive paddy cultivation is in practice, large froggeries will have to be commissioned with suitable protective fencing and netting and be provided with suitable light traps for attracting insects from the paddy fields. Thus the food for the frogs could be supplimented and at the same time paddy pests could be checked simultaneously.

The initiative taken by the Central Inland Fisheries Research Institute sometime back towards the introduction of the big American frog R. catesbeiana will have to be resumed more seriously since it has been found that they can breed naturally under Indian conditions and since such efforts have proved successful in Japan and in Cuba. An important suggestion I would like to place on record is my constant plea to stop forthwith the use of frogs for teaching biology courses. Nearly 20 million frogs as has already been stated are yearly sacrificed for this purpose. This is indeed a colossal, avoidable waste. Since 1971 I had been suggesting to replace frog with rat as a laboratory animal. The advantages are twofold in that we can divert the large number of frogs for export purposes at the same time help to reduce the number of the undesirable and destructive rodents.

Unless serious considerations are given as expeditiously as possible to conserve and manage our amphibian resources, with the present rate of exploitation and habitat destruction a situation would soon arise when the wild frog population would rapidly dwindle, a trend which is already discernible since 1980.

We should bear in mind that large-scale culture and steady replenishment of the natural population of frogs by artificial breeding are, therefore, the only ways to develop and stabilise our frog-leg inductory. We have some basic expertise in inducing the frogs to spawn in captivity by pituitary hormone injection and rearing the tadpoles to table size. But the economic viability of frog farming is still to be experimented on a commercial scale. Considerable information is available on the biology of frogs representing the results of research work carried out in the Universities on the food, feeding habits, conversion efficiency growth and reproduction. The scattered information should be collected, collated and used for evolving an effective, economic technique for the development of frog culture. If we could succeed in these objectives our frog-leg industry would no doubt, develop and stabilise as a viable industry.

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WORLD TRADE IN FROGLEGS - AN OVERVIEW

- DR K P P NAMBIAR,
MARINE PRODUCTS EXPORT
DEVELOPMENT AUTHORITY,
COCHIN.

INTRODUCTION

Edible frogs of several species under the genus Rana are being traded as an expensive exotic delicacy in frozen form or as canned, in many countries, especially in the continent and the USA. USA is the single largest market for this item while the EEC as a block accounts for about 60% of the world trade with France as the leading market. Based on 1984 statistics, it is estimated that the total world trade in froglegs involves about 9,000 to 9,500 M/T valued at US $ 36 to 38 Million.

As per the Brussels Tariff Nomenclature (BTN) and the Standard International Trade Classification (SITC), froglegs are treated under three different groups as follows:

1) SITC 01169, BTN 0204 - Other meat and edible offals, n.e.s., fresh, chilled or frozen.

2) SITC 0129, BTN 0206 B - Meat and edible meat offals, n.e.s., salted, in brine, dried or smoked.

3) SITC 014.9 BTN 1602, Other prepared and preserved meat or meat offals.

....2/-

Imports from Lome Convention Countries and other developing countries are normally eligible for duty exemption or G.S.P. concessional tariff in most of the importing countries.

MARKET PREFERENCES

Froglegs are usually consumed as exotic delicacies or entrees in both medium priced and expensive restaurants. While the preference is for big size or Jumbo size legs in the US, in the EEC countries gourmet prefer smaller grades. According to the findings of a survey conducted by the MPEDA and the ITC in the EEC countries during the year 1980, the consumption is about 150-200 gms per person per meal. The size generally marketed in western Europe are from 16/20 to 81/100 pairs of legs per kg. However, in the northern part of FRG, there is a limited demand for large size 6/8 to 9/12 pairs per kg.

Grading used for froglegs destined to the US and EEC are done differently. While for the US, the grades are usually called jumbo, large, medium, small, extra small (A, B, C) and above 40 , in the case of EEC markets, the grading starts from 16-20 upto 61-80. There are two colour grades, viz: (1) white or ivory white that includes a light pink or light brown colour and (2) bluish white.

PACKAGING

Froglegs after proper cutting, skinning and cleaning etc., are either individually quick frozen or block frozen, canned

...3/-

or processed otherwise as per buyers' requirements. When made into IQF product, each pair is either wrapped in polyethelene film and secured with a rubber band or encased in plastic film tubes. In the case of block frozen products, standard 5 pound or two kg. blocks are produced by plate freezing in block form.

MAJOR SUPPLIERS

1) India

Till the year 1981 when India started taking serious measures for frog conservation, she had been the world's largest producer and exporter of froglegs for several years. During the 10 year period from 1972 to 1981 exchange earnings from exports of froglegs had increased almost 5.5 times together with 2.4 fold increase in the quantity exported. In real terms, the quantity and value at 1822 tonnes and Rs.21.7 Million in 1972 had increased to 4368 tonnes valued at Rs.119.6 Million by 1981.

India started exporting froglegs back in 1959 with a meagre quantity of 94 tonnes valued at Rs.0.47 Million. However, after reaching a peak in 1981 as mentioned earlier, various restrictions and conservation measures have resulted in a much less quantity of 1785 tonnes valued at Rs.63.65 Million in the year 1985. The primary reason for this fall in exports from India is the inclusion of frogs under Schedule 4 of the Wild Life (Protection) Act of 1972. USA, EEC countries, Japan, Australia and UAE are our leading markets for froglegs. Lately Mexico and Algeria have also started lifting froglegs from India in small quantities.

....4/-

2) Indonasia

Presently Indonasia is the leading supplier of froglegs to the EEC. But her quantity and value of annual exports of froglegs have been flectuating widely. In the year 1979 Indonesia's export was to the tune of 2067 tonnes valued at US $ 7.18 Million with the corresponding figures for 1980 at 1612 and 4.75. Exports after reaching a peak at 2775 tonnes valued at US $ 9.83 Million in 1981, went down drastically in the following year to 1516 tonnes valued at US $ 3.99 Million. Again in 1983, the figures went up to 3295 tonnes and value realisation of US $ 8.75 Million.

Indonesian froglegs are marketed mainly in such a way that individual pairs of frozen froglegs are put in plastic film tubes which in turn are packed in plastic bags usually of one kg capacity. This is found to be quitc convenient for the importers to straightaway distribute the imported product through retail outlets without undertaking any re-processing at the destination. As per 1983 figures, Indonesia's exports are mostly to France that accounts for 1827 tonnes followed by Netherlands at 292 tonnes and Belgium-Luxumberg as the third at 107 tonnes. Some 40 to 50 tons are also shipped to Switzerland.

3) Bengladesh

Bengladesh is another leading supplier of froglegs. She is the third biggest supplier of froglegs to the EEC next to Indonesia and India. Of late, she has also emerged as the principal supplier of froglegs to USA relegating India to the 2nd place. Bengladesh is a major supplier to EEC countries too. Her total export to the EEC in 1983 was 1545 tonnes against 1296 tonnes to the US in the same year. Bengladesh has increased her

.... 5/-

exports of froglegs to the EEC and US considerably during the last 5 to 6 years. Against a total quantity of 585 tonnes exported to US in 1981, the corresponding figure in 1985 is 1917 tonnes, while in the case of EEC countries the export that stood at 622 tonnes in 1979 has had gone upto 1545 tonnes in 1983. Among the EEC countries, France is the major importer of froglegs from Bengladesh at 526 tonnes followed by 475 tonnes imported into Netherlands, 285 tonnes to Belgium and Luxumberg and 239 tonnes into FRG as per the figures available for 1983. Apart from this, Bengladesh has been exporting small quantities of froglegs to Switzerland also - at 11.7 tonnes in 1983 and 28 tonnes in 1984.

Other exporters of froglegs including re-exporters are Turky, Rumania, France, Mexico, Spain, Italy etc.

IMPORTERS

US has been the single largest market for froglegs for all these years. Next comes the EEC as a group where France occupies the top position followed by Belgium-Luxumberg and Netherlands. Apart from this, Switzerland, Japan, Australia, Canada, The Middle East countries, Mexico and Algeria have also been importing froglegs from several sources including India. Some of these like Japan, Netherlands and Mexico etc., are reported to be re-exporting froglegs after reprocessing and packing.

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EEC COUNTRIES

EEC as a whole is the largest market for froglegs in the world. Among EEC countries, France that imported 4178 tonnes in the year 1981 has not shown any increase in her off-take during the following years. While her imports were only 2240 tonnes in 1982, there was some increase in the following year reaching 3686 tonnes again followed by a fall at 2636 tonnes in 1984. Among the seven EEC countries, viz., Netherlands, France, Belgium-Luxumberg, Italy, FRG, Denmark and the UK, there has been a gradual decrease in froglegs imports during the past few years - falling from 6954 tonnes in 1981 to 5287 tonnes in 1984.

CONCLUSION

After witnessing a steep increase in both exports and consumption of froglegs during the 70s, a reverse trend has been evident in the 80s, especially in the case of the EEC countries that used to consume almost 60% of the world exports of froglegs. There has been a gradual fall or even stagnation varying from country to country among the EEC members during the years 1979 to 1983. Back in 1980 when the MPEDA and the ITC had carried out a market survey in the EEC countries, it was seen that the French imports of froglegs had increased by about 180% during the 5 year period from 1974 to 1978. It was envisaged at that time that there would be a further growth of from 50 to 100% in froglegs consumption in France during the next 5 years. Similarly, in the case of FRG the increase in consumption during 1974-'78 was 520% with expectation of further growth. So, there were projections and estimates to suggest considerable growth in consumption and imports by these countries.

However, contrary to all such expectations, froglegs imports into the EEC have come down considerably from 5587 tonnes

....7/-

in 1980 to 5287 tonnes in 1984. In fact, in the case of the Netherlands, it is said that during the year 1985 her total imports of froglegs have been drastically reduced by almost 1/10th both in quantity and value compared to the year 1984. Even in the case of the USA, the import figures for this item have not been showing any marked rise during the first half of the 1980s.

Frogleg trade has been dwindling lately, not because of any aparant depletion of resources, but due to other factors like conservation measures including concerted protests against consumption. Such steps also include the inclusion of two species of common edible frogs in Appendix II of CITES at the fifth meeting of the convention held in Buenos Aires from 22nd April to 3rd May '85. Therefore, it is time opportune for all concerned to consider whether based on the past performance as well as the present ~~dem~~ market mood especially in Europe and also the proven resources in the wild, it would be feasible for fixing an optimum exploitable level of this produce without disturbing the environmental factors and ecological balance. This is all the more important due to the fact that froglegs trade has been supporting a large number of poor rural folk in several developing countries.

FROGLEGS EXTRA EEC IMPORTS, IMPORTS FROM INDIA & ITS COMPETITORS

VALUE IN 000 ECUS
1 ECU = 0.9 US$

		EEc	FRG	FRANCE	ITALY	NETHER-LANDS	BELGIUM LUX	U.K	IRELAND	DENMARK	GREECE
EXTRA EEC	1979	18,020	1089	10733	964	3317	1820	46	-	51	-
	1980	15,481	790	11000	338	1888	1392	33	-	40	-
	1981	25,307	1575	15808	561	4427	2823	58	-	55	-
	1982	16,380	1243	8018	1137	3357	2491	80	-	54	-
	1983	24,465	1251	15891	434	3610	3101	102	-	76	-
	1984	20707	652	10095	1542	3747	4583	107	-	61	-
	1985	6,655	176	3911	732	401	1390	34	-	11	-
INDIA	1979	7392	424	4593	401	1596	337	39	-	2	-
	1980	6418	328	4847	78	713	429	23	-	-	-
	1981	9399	785	5648	185	1904	817	58	-	2	-
	1982	6285	412	3376	591	1137	689	80	-	-	-
	1983	4793	266	3807	30	464	282	44	-	-	-
INDONESIA	1979	7076	130	4950	-	638	1358	-	-	-	-
	1980	5910	64	4491	-	518	837	-	-	-	-
	1981	9644	127	7234	-	798	1485	-	-	-	-
	1982	4762	99	2834	-	374	1455	-	-	-	-
	1983	10800	30	8072	-	1132	1566	-	-	-	-
BANGLADESH	1979	1531	491	249	-	666	125	-	-	-	-
	1980	1476	394	911	32	580	119	10	-	-	-

ctd. . . .

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FROGLEGS EXTRA EEC IMPORTS, IMPORTS FROM INDIA & ITS COMPETITORS

Value In 000ECUS

I ECU = US $

		EEC	FRG	FRANCE	ITALY	NETHER-LANDS	BELGIUM LUX	U.K.	IRELAND	DENMARK	GREECE
BANGLADESH	1981	2676	614	395	-	1457	210	-	-	-	-
	1982	2935	726	343	82	1700	84	-	-	-	-
	1983	6357	931	2392	-	1822	1154	58	-	-	-

FROGLEG — EXTRA EEC IMPORTS IMPORTS FROM INDIA & ITS COMPETITORS — Quantity in M.T.

		EEC	FRG	FRANCE	ITALY	NETHER-LANDS	BELGIUM LUX	U.K.	IRELAND	DENMARK	GREECE
EXTRA EEC	1979	6700	418	3859	282	1439	647	19	-	36	-
	1980	5597	327	3767	115	885	470	14	-	19	-
	1981	6954	449	4178	158	1339	786	16	-	28	-
	1982	4612	339	2240	306	990	688	23	-	24	-
	1983	5954	325	3686	102	976	799	38	-	28	-
	1984	5287	158	2636	378	908	1137	41	-	29	-
	1985	1765	46	1100	181	91	336	8	-	3	-
INDIA	1979	2853	155	1679	132	753	118	15	-	1	-
	1980	2336	133	1631	32	385	135	10	-	-	-
	1981	2602	224	1473	61	589	238	16	-	1	-
	1982	1841	109	990	170	343	204	25	-	-	-
	1983	1253	76	911	10	157	82	17	-	-	-
INDONESIA	1979	2547	42	1792	-	234	479	-	-	-	-
	1980	2048	21	1551	-	191	285	-	-	-	-
	1981	2471	28	1869	-	199	375	-	-	-	-
	1982	1260	20	759	-	98	383	-	-	-	-
	1983	2532	6	1827	-	292	107	-	-	-	-
BANGLADESH	1979	622	202	90	-	280	50	-	-	-	-
	1980	643	172	129	15	278	45	4	-	-	-
	1981	808	185	110	-	460	53	-	-	-	-
	1982	855	210	95	21	502	27	-	-	-	-
	1983	1545	238	526	-	474	285	21	-	-	-

IMPORT OF FROGLEGS FRESH & FROZEN QUONTITY IN TONNES

BY USA

SOURCE	1981	1982	1983	1984	1985
INDIA	933	1935	897	1865	1681
BANGLADESH	585	999	1296	1367	1917
OTHERS	240	411	246	475	400
TOTAL	1758	3215	2439	3707	3998

BY SWITZERLAND

SOURCE	1983	1984	1985
INDIA	20.7	4.5	6.5
Indonesia	41.7	54.7	51.9
BANGLADESH	11.7	28.0	-
TURKEY	54.3	28.3	19.1
Rumania	-	12.8	15.4
FRANCE	-	28.7	40.0
TOTAL	128.4	157.0	132.9

FROGLEG EXPORT FROM INDIA

Q : Quantity in Kg
V : Value in Rs.

COUNTRY		1980	1981	1982	1983	1984
AUSTRALIA	Q:	20,666	36,616	22,242	-	-
	V:	3,21,344	12,50,450	5,43,868	-	-
ALGERIA	Q:	-	-	-	-	31,053
	V:	-	-	-	-	80,400
BELGIUM	Q:	5,47,634	3,62,517	1,63,355	1,42,333	5,19,359
	V:	1,47,70,313	1,09,39,661	43,01,711	43,23,233	1,58,14,932
BEHARIN	Q:	-	-	-	-	-
	V:	-	-	-	-	-
CANADA	Q:	3,335	62,552	-	12,577	-
	V:	65,261	21,59,332	-	2,15,281	-
DENMARK	Q:	-	3,565	-	-	-
	V:	-	1,24,689	-	-	-
FRANCE	Q:	9,21,492	6,46,541	3,61,831	1,43,809	4,69,694
	V:	2,41,65,946	1,92,31,629	93,41,669	44,29,269	1,35,92,522
ITALY	Q:	12,105	90,940	10,112	-	93,377
	V:	3,76,998	5,13,758	2,62,222	-	21,22,251
JAPAN	Q:	44,159	37,597	45,862	1,55,005	8,448
	V:	11,11,479	19,57,564	10,84,244	42,62,203	2,51,548
QATAR	Q:	-	-	613	-	-
	V:	-	-	22,282	-	-
MEXICO	Q:	-	-	-	3,437	11,471
	V:	-	-	-	1,18,818	3,40,382
MAURITHUS	Q:	-	24,400	-	-	-
	V:	-	7,37,197	-	-	-
OMAN	Q:	-	-	-	-	13,112
	V:	-	-	-	-	3,55,700
NETHERLANDS	Q:	8,45,576	17,02,240	7,04,102	6,99,611	6,61,341
	V:	1,92,21,784	4,53,09,698	1,70,17,249	1,90,28,458	1,78,91,813

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COUNTRY		1980	1981	1982	1983	1984
S.ARABIA	Q:	61,960	16,511	-	12,500	-
	V:	9,07,000	1,89,312	-	1,15,685	-
SWITZERLAND	Q:	2,100	8,000	-	-	-
	V:	44,394	2,38,000	-	-	-
U.K.	Q:	32,480	3,081	42,455	1,85,860	92,254
	V:	10,39,753	51,535	9,80,161	49,31,612	28,74,590
USA	Q:	5,42,811	12,96,201	8,22,111	4,48,205	8,99,408
	V:	98,35,476	3,38,79,305	1,94,37,558	1,14,81,987	2,49,40,437
UAE	Q:	781	50,267	7,855	50,400	22,008
	V:	19,749	7,08,476	1,92,469	4,28,629	2,27,421
FED.REB.OF GERMANY	Q:	59,310	87,861	90,834	17,399	9,003
	V:	13,20,293	22,79,162	22,69,973	2,55,160	2,34,999
TOTAL	Q:	30,94,909	43,67,889	22,71,372	18,71,236	28,33,528
	V:	7,31,99,790	11,95,69,798	5,54,54,406	4,95,90,335	7,95,26,995

FROGLEG EXPORT FROM INDONESIA

Q:Quantity in Tonnes
V:Value in million US$

	1979	1980	1981	1982	1983
Q:	2,657	1512	2775	1516	3295
V:	7.18	4.75	9.83	3.99	8.75

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TRADE IN FROGLEGS - SEEN FROM A CONSERVATIONIST'S POINT OF VIEW

BY MANFRED NIEKISCH, Director of Traffic
WWF - Germany

The trade in frogs legs has increased substantially in the last years. This is well documented by the export-statistics of India, Bangladesh and Indonesia. The number of kg exported from India in 1983 was seven times higher than it was in 1963. Bangladesh exported in 1983 six times as many frogs legs as it did in 1977 and exports from Indonesia had doubled in weight from 1980 to 1983.

The volume of trade

Bangladesh, India and Indonesia alone have exported - according to the export statistics - about 10,000,000 kg of frogs legs in 1983. The average weight of a pair of frogs legs is certainly not more than 50 g and may be well below that; in other words at least 20 frogs are needed for 1 kg, so the minimum number of frogs exported from these 3 countries in 1983 was 200,000,000.

The real amount of frogs killed is much higher: many frogs arrived dead at the processing implants and cannot be exported. According to WHITING (1984) 20% of the frogs caught may be dead when they arrive at the processing station, and WHITAKER (1982) considers the "wastage" account "conservatively" for 10%. In Indonesia, according to Anonymus (1985) 40 - 50% more frogs are killed than exported - because of "lack of export quality". So the number of frogs caught every year in India, Bangladesh and Indonesia is certainly higher than 250 million.

Effects of collecting of frogs on the wild populations in Asia

While much information is available on the status of

amphibians in Europe, only few research has been done in Asian countries. For Bangladesh and India, however, there are data which show that collecting frogs is having effects on the populations of Rana tigerina, the species mainly in trade. KHAN (in litt. 1984) writes: "The situation of frogs in Bangladesh is in no way good. The population of Rana tigerina is declining at an alarming rate. Consumption of this bullfrog in Europe and western countries is solely responsible for the population decline of Bangladesh frogs."

FUGLER (1983) has undertaken field-studies in Bangladesh and analysed diverse populational samples. These analyses indicate that wild stock of Rana tigerina is seriously stressed by over-exploitation and that population densities have decreased significantly. Studies of snout-vent lengths led FUGLER to the conclusion that wild populations are seriously depleted and that relatively few individuals survive three reproductive cycles.

ABDULALI (1985) has made an inquiry among farmers, sending questionaires to 1650 "police patils" in India in the districts of Thane and Kulaba, asking if the number of frogs had reduced in that places over the last five years. From 588 replies he received, 582 stated that "there was a considerable depletion in the number of frogs. Some said that it had disappeared from their area while others reported decreases of 50 to 90%."

Decrease in number of frogs must of course not necesarily be due to over-collecting, pesticides surely play an important role too. Alteration of habitat, the main factor for the general decline of Amphibians in Europe is certainly not of big importance in Asia, where the frogs live e.g. in rice-fields.

The results of the research done by ABDULALI (1985) for India and by FUGLER (1983) for Bangladesh leave no doubt that over-exploitation is a very important - if not the most important - factor for the decline of R. tigerina in these countries.

Indonesia has started recently a national program of re-stocking with some frogs species to help survive over-exploited populations, but frogs are quicker collected than they can be "replaced" (SUGIRI 1984).

Effects on rice crops

Rice-fields are a typical habitat of R. tigerina. Analysis of stomachs of this species was published last by ABDULALI (1985), AHSAN (1983), FUGLER (1983), ISAAC and REGE (1975), KHAN (1973).

The food of R. tigerina consists in a large variety of invertebrates and small vertebrates. Here is not the place to give the complete list of animals found in the stomachs of R. tigerina, just the conclusions are given : "The analysis of the food .... shows that at least 90% is made up of crabs, insects and insect larvae, all of which are undoubtedly detrimental to agriculture" (ABDULALI 1985).

Based on the work of ISSAC and REGE (1975), KHAN (1973), and his own research, FUGLER (1983) states: "In Bangladesh as well as in India, Rana tigerina is a significant agent of biological control. In those areas in which the populations are overly stressed, observations indicate that noxious insects and agricultural pests have rapidly increased."

Having analysed stomachs of R. tigerina AHSAN (1983) has found "thirtyone families .... of insects belonging to different orders ..... Of the insects consumed by the frogs 7 families are agricultural pests, 4 are injurious to trees and 2 are household pests. Beside these some harmless or even useful (directly or indirectly) insects were also consumed by the frogs but this does not nullify their role in biological control of insect pests .....

..... In conclusion it can be said that R. tigerina plays a significant role in controlling the various pests in their natural habitats and thus plays a very important role

in maintaining the natural balance in the ecosystems."

At least in India larger frogs subsist almost entirely on 3 species of crabs, which live in rice-fields and damage bunds and seeding rice (ABDULALI 1985). It is understood that R. tigerina does not feed selectively on animals harmfull to rice-fields, but unselectively on every live prey of a certain size. But the frogs certainly do take advantage of every concentration of a species, which also according to ABDULALI is a good index of the efficacy of their control on the number of individuals of this species.

The role of R. tigerina in the rice-fields is confirmed by Indian farmers which had answered to the inquiry of ABDULALI (1985) : "577 (out of 588) complained of agricultural losses due to .... removal (of frogs), while 361 specifically stated that this was because of the fact that they used to feed on paddy pests i.e. insects, insect larvae and crabs. 158 said that the pests had increased due to the decrease in frogs. 80 referred to the increased menace of crabs. To this extent our findings are fully substantiated by local opinion."

The inquiry of ABDULALI among farmers regarding the consequences of frogs catching evidenced another interesting aspect of problems caused by frog removal. Frogs are caught during the night, and frog-hunters cause serious damage to rice by walking through the cultivations.

Considering the economic benefit of export of frogs legs for the villagers who catch the frogs, it must be taken into account also the damage caused by the catchers to rice-fields directly as well as the long-term effect of over-exploitation of frogs such as increase of crop pests.

Bangladesh has imported in 1983 3000 tons of pesticides - approximately 500 tons more than in 1982, to combat insects causing danger in rice crops (FAZL 1984). According to ABDULALI the value of pesticides used every year in India "is said to be rupees 200 crores and it is anybody's guess

as to how much of this is needed to bill the pests which have escaped the frogs."

Conclusions

- Trade in frog legs causes severe environmental problems - there's no doubt on that.
- Trade in frog legs is at least locally - endangering the species by the present way frogs are collected.
- Trade in frog legs does affect - as a consequence of depletion of frogs - [illegible] quantity and quality of rice harvest.
- Frog legs are exported to countries where they are completely superfluous as a source of food for human nutrition.
- Catching of frogs provides income for poor villagers and tribals, which may depend at least for some months of the year on this source of income.
- Frog legs play a certain role in the foreign exchange of some countries e.g. India, Bangladesh, Indonesia.
- There's a certain need - if any - of trade in frog legs for the countries of export, but certainly not for the importing countries.

What is the position of World Wildlife Fund ?

It is the task of nature conservation organisations like WWF to create public awareness for environmental problems, to preserve species of animals and plants from threat of extinction and - last not least - to develop and propone solutions for such problems.

UNEP, IUCN (International Union for Conservation of Nature and Natural Resources) and WWF have prepared the World Conservation Strategy. It was launched internationally in 1980 and provides a more focussed approach to management of living resources for the sustainable benefit of mankind.

WWF is convinced that living resources are renewable if properly managed. And we are convinced that mankind has the right to exploit these living resources for the benefit of man. But we are also convinced that man has the duty to preserve any living resource from exhaustion, to preserve fauna and flora from extinction. If correctly managed, the capital value of living resources can be retained and only the yearly dividend exploited.

It is in the direct interest of mankind itself not to exploit the "capital value" of living resources, because this may be exhausted soon and man has lost then - by his own fault - a source of food, income.

This is what is happening at the moment with the frog legs. There's no management, frogs are collected and tribals and villagers are destroying a living resource which might be of benefit to them for much a longer time than it is likely to be at the present form and status of exploitation.

The poor villagers which now depend on trade in frog legs are destroying their source of income.

We are not worried that there is a trade in frog legs - but we are deeply concerned that at the present status all these frogs are caught without taking into account the consequences of such an over-exploitation, without any long-term-benefit to the local human population and endangering the frog species in some regions. Lee M. Talbot, the former director general of IUCN said: "Unless development conforms to conservation principles it is not sustainable and human welfare is not served. At the same time, conservation cannot succeed because of the subsistence requirements of the increasing population in need of development assistance. The essential linkage between development and conservation is a new thought for most developers and conservationists, and indeed, that is one reason the global situation is as unsatisfactory as it is today".

I think this is exactly true for the problem we are discussing here.

Poor people in countries like Bangladesh, India, Indonesia need development and income. But short-sighted over-exploitation of the natural resources is never a solution to poverty and will not be of benefit to the human population but quite at the contrary will increase problems and poverty once the source is exhausted.

It's certainly better if a country cultivates plants or animals which naturally occur in this country and which can be kept and managed in natural or nature-like habitats than to cultivate species which are not part of the original fauna and flora and which therefore might do harm to other species or even alterate the landscape and environment.

Sound, scientifically based wildlife management in Africa and South America would be certainly a much better way to combat hunger than the keeping of e.g. foreign cattle.

Let me give you one example which may sound utopic to you, but may be it's only futuristic. One of the rarest mammal of the world, the White Oryx of Arabia was almost extinct by over-hunting. The few remaining individuals were caught and put together in a breeding group in a zoo. Breeding was successful, conservationists succeeded in convincing the inhabitants of the need of protection of this species and so a group of Oryx was released into the wild again - protected and safeguarded with the help of the inhabitants of this area.

No other animal is so perfectly adapted to the life in the Arabian deserts, no other animal is so effective in finding food and water there. So, once there are numbers big enough to allow sustainable yield - why shouldn't this now yet extremely rare and endangered species become an excellent source of animal protein for the local people ? Of course this requires basic studies, management programs and strict controls.

Several factors in the biology of frogs make it rather.

unlikely that it ever will be possible to establish economically working frog farms. Although the studies of possibilities of frog farming should be increased, in the same time there should be research done on how number of frogs or population densities in the wild can be increased and under which criteria and circumstances, within which limits catching of frogs from sound populations can be allowed without affecting the survival of the species. As long as these criteria are not established, trade in frog legs should be stopped. The declining frog populations need a chance to recover from over-exploitation.

A joined research programme, combining development aid and nature conservation will find the support of WWF.

WWF - International is concerned because something has to be done to resolve this international problem. "Frog management" might become an international model of high significance also for other species and other countries in the future. It is compatible with the World Conservation Strategy. WWF - India can help to do field research here in the countries of origin.

WWF - Germany will be glad to do it's part as an organisation in a "consuming country" that might give support in the frame of development aid programmes to a frog breeding project or to another project which can replace the trade in frog legs as a source of income for the poor people. We have to look also for alternatives to frog legs trade. When talking about development aid, usually the countries where development aid takes place are called "Third World Countries". I cannot accept this term, because it suggests that there are different worlds. But we have only one globe we all live on. As the frog legs problem shows, many problems in one part of the world sooner or later have effects also in other parts of the world. Such ecological problems have to be affronted by joined international action. Trade in frog legs is an ecological problem.

In Global 2000, the Report to the President of the United States, there's written : "For hundreds of millions of the desperately poor, the outlook for food and other necessities of life will be no better. For many it will be worse. Barring revolutionary advance in technology, life for most people on earth will be more precarious in 2000 than it is now - unless the nations of the world act decisively to alter current trends."

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E C O L O G Y

A N D

CONSERVATION OF FROGS

- BY -

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INTRODUCTION : -

About 350 million years ago, a few vertebrate life forms embarked on a new life of adventure from the sea to the land and in this process they had to radically alter their basic life support system. First, they had to learn how to breathe in their new environ. All this while, they had their oxygen supply from the water by means of gills now they would need lungs to draw oxygen from the air. Similarly they are to attain the measures and tricks for mobility on land. Amphibians are such kinds of adventurists who seem to have some distant links with an extinct creature called the Eusthenopteron whose fossils have been found in the deposits of that critical period 400 million years ago when life forms began to colonise the earth. Both amphibians and the eusthenopterons had nasal air links in common. Amongst the bewil dering creatures that managed to carve out appropriate ecological niches for themselves for all these years frogs deserve special mention. They are one of such classes of the earliest four footed creatures.

ECOLOGY : -

It is an astounding fact of ecology that frogs modified their bodies to travel on land while retaining their swimming abilities. They developed legs in place of paired fins. They changed their skin composition to facilitate respiration. They also replaced their gills with lungs in so doing. In redesiging their circulatory system to assist the lungs and skin in respiration these frogs also contrived to possess sense organs that functioned equally well in air or water. In the evolution of history and ecology the most successful amphibians are recorded as frogs which constitute about 2600 anuran species.

Frogs however had never severed their relation with water as they need a moist environment to prevent their highly sensitive skins from drying and a majority also mate in water where their eggs are fertilised.

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Frogs in consequence live largely in fresh water or damp places some in brackish water but strangely none in the sea. The frog's eye is by far the most complex vertebrate sense organ. A special ability to aid clearer vision particularly in murky water, is a translucent flap in its lower eyelid that can be pulled upwards to wipe and moisten the eyeball. A frog which stays motionless for hours together if necessary, but a mere sight of a prey insect will revitalise the frogs to attack the insect with propelled rear legs while the sticky tongue is unleashed to snapits prey. Teeth are used only for grip and not for chewing.

But these prehistoric creatures are being hunted by men in the most inhuman ways. Late evenings are the usual hunting time when its prey species are also active. Frogs have strong homing instincts and if individual frogs are removed quite far from their hideouts, they do return unfailingly to their preferred habitats.

TRADE VIS-A-VIS CONSERVATION : -

Fresh water frogs are included in genus called Rana and its three species Rana tigrina, Rana hexadactyla and Rana crassa are primarily under commercial exploitation. The other species Rana limnocharis is a comparatively smaller frog with lesser potentiality of commercial exploitation than the other three species. Rana species is included in schedule IV of Wild Life Protection Act, 1972 and also its import and export are regulated by Convention of International Trade of Endangered Species.

India exports frozen froglegs to United States of America, France, Belgium, Netherlands, West Germany and a few other countries. There had been a steady growth in export on froglegs as the table below would shaw : -

Year	Quantity of Froglegs exported in metrictonnes from India	Value in Rs.1,000.00 (Rupees one thousand)
1973	2698	44,979
1974	1454	28,652
1975	1317	27,983
1976	3170	77,970
1977	2834	65,967
1978	3570	84,251
1979	3764	87,150

Year	Quantity of Froglegs exported in metrictonnes from India	Value in Rs.1,000.00 (Rupees one thousand)
1980	3095	73,200
1981	4368	1,19,570
1982	2271	55,453
1983	1871	49,590
1984	2834	79,527

The legs of Rana species are considered a delicacy in the foreign countries and this had encouraged a boom in import - export trade of the meat of fresh water frogs. An annual average (calculated for the last twelve years) export of 2770 metric tonnes of frogs' meat means colossal sacrifice of these frog species. If it is estimated that 60 numbers of froglegs weigh about 1 kilogramme and 15 frogs may contribute a net weight of 1 kilogramme of meat. Thus the annual export of 2770 metric tonnes of frogs' meat means sacrifice of 41 million fresh water frogs per annum. These frogs would have reasonably consumed daily 4.1 million metric tonnes of insects, pests and other preys considering a frog consumes about 100 grammes of food daily almost equivalent to their body weight. Frogs feed largely on insects and with growth in size,eat rats, birds and snakes. As a result of trapping the population of Rana species has been depleting at an alarming rate. The agricultural loss through depletion of this bull frog population had caused heavy economic strain on the tremendous upward rise on allocation on insecticide apart from causing irreparable damage to the ecosystem, the extent of which is incompletely known so far.

CONCLUSION : -

THAT frogs have survived for so many million years, speaks much of their successful adaptability to the environment. They are a legendary part of man's life since prehistory and enriched our lives in myriad ways. But men had been causing ruthless destruction because the legs of thes-e species are a delicacy for them. This has resulted in unprecedented rise in insect pests causing imbalance in the natural ecosystem and resulted in crop blights and spread undesirable diseases adding to human misery again. It is unfortunate that human beings being a trustee of animal kingdom should exhibit better sense of responsibility and restraint in dealing with lesser life forms like frogs as there is no other easier means to achieve harmony in nature. An intensive and integrated study

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on the ecological role of frogs need be undertaken to assess the intricate nature of man-frog interactions including the determination of population status and dynamics of this very useful species.

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SURVIVAL OF PATHOGENS SALMONELLA AND VIBRIO PARAHAEMOLYTICUS IN PROCESSED FROGLEGS

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Introduction

Among the products entering to world fish trade froglegs also captured a prominent place. Actually froglegs are not fishery products eventhough they were allowed to process along side by side, where the processing of fish and fishery products allowed for exports. Normally edible frog vi: Rana tigrina, Rana hexadactyla and Rana crassa, were captured from waste and polluted waters where pathogenic micro-organisms are constantly contaminate. In recent years an increasing awareness on quality and bacteriologically sound products of froglegs were envisaged. For that the use of low temperature technique to preserve the quality of foods, is based upon the fact that the activities of foodborne micro-organisms can be stopped or killed. At above freezing temperature all metabolic reactions of micro-organisms are slow down. With a rise in temperature there is an increase of reaction on microbial activity. When contaminated foods with pathogenic organisms were consumed, food poisoning take place. Food poisoning through microbial activity of Salmonella Vibrio parahaemolyticus and other pathogenic organisms become a major problem in recent years.

The alimentary tract of a man and animals are widely considered to be primary habitat for Salmonellae and V. parahaemolyticus is extensively distributed throughout the world especially warm coastal and brackishwaters and in

fish (Nakanishi, et al., 1968; Fishbein et al., 1970; Baross and Liston 1970; Vanderzant et al., 1970; Barrow, 1973; and Peffers et al., 1973). Clinically illness caused by both organisms vary from mild diarrhea to acute gastro-enteritis or it may occasionally be dysentry like with blood and mucus in the stool. In addition to this Salmonellae organisms produce enteric fevers also. These organisms were found in intestinal flora as well as in polluted waters. When the organisms contaminated with foods while processing and thereby consumed by men and animals, these organisms once again shed through feacal matters with a continuation cycle. When contaminated foods marketted through the international shipment is major responsibility for the present world wide distribution of foodborne gastro-enteritis. Infection can take place any time if these products are subjected to gross mishandling during harvest, processing and retail distribution. Many workers investigated the incidence of Salmonellae and V. parahaemolyticus in fish and fishery products Gulasekaran et al., (1956) isolated salmonella from marine fishes marketted from Colombo market. Occurrence of this organism in raw shrimps, cooked shrimps and picked meat of crab had been reported by Anderson et al., (1971). Butiaux (1962) found the presence of salmonella in fresh fish as well as in fish fillets and icing establishments. He also confirmed this organisms in oysters, mussels and shell-fish, Wyatt et al., (1979), noted the incidence of salmonella in frozen fish of fresh water. In India Bhat and Albuguerque (1953), reported that dried Bombay duck was frequent source of salmonella. In fish and fishery products many investigators isolated this pathogenic organism(James and Iyer 1972; Iyer et al., 1974. Similarly infection V. parahaemolyticus in fish and fishery products had been

reported by several authors (Aoki, 1967; Sakazaki, 1969; Fishbein et al., 1970; Colwell, 1979; Baroos and Liston, 1970; Bartley and Slanotz, 1971; Kampolmatcher et al., 1977; and Natarajan et al., 1979)

Incidence of Salmonellae processed frozen froglegs had been reported by several investigators (Iyer et al., 1975; Rao and Nandy, 1976; Srivastava, 1978; and Rajagopalan 1978). Behavious Salmonella and V. parahaemolyticus to low temperatures had been carried out in fish and fishery products by James and Iyer, 1962; James et al., 1982 and Karunasagar et al., 1982. This evidence evoked interest to study the behaviour of these organisms in low temperatures in processed froglegs. This communication deals briefly the commonly occurring organisms of Salmonellae serotypes Vibrio parahaemolyticus. Normally freezing will induce bacterial death or injury. But the extent of death and injury will be influenced by the surrounded nutrients such as amino acids, vitamins and nucleic acids.

MATERIALS AND METHODS

The following cultures, which are commonly isolated from environs where frogs captured: S. typhimurium, S. typhi, S. anatum, S. enteritidis, S. saintpaul, S. weltevredon, S. newport, S. cubana, S. arizonae, S. virchow and S. senftenberg and Vibrio parahaemyticus, were used in this study. These cultures were grown and maintained in Brain-Heart infusion agar slants and V. parahaemolyticus and like organisms were in Tripticase Soy agar with 3% sodium chloride stab in semi-solid medium. Two different concentration of low and high (less than 10 colonies per

gram and less than 10000 per gram) were aftificially inoculated in different portions processed froglegs and wrapped in polythene papers and subjected to chilled (o-4°C) and freezing (- 20°C) temperatures. The total viable counts and inoculated counts were carried out initially as control in a non-inhibitory medium of Triptose Glucose Yeastextract agar for salmonellae and vibio organisms. Initially after freezing the samples thawed and the recovery was carried out in tripticase Glucose Yeastextract agar. During storage at chilled and cold store (- 20°C) the enumerations were carried out by using different enrichment procedures recommended by Poolma and Silliker (1976). For V. parahaemolyticus recovery Glucose salt teepol broth was used as enrichment and further streaked in previously prepoured place medium of Thiosulphate Citrate Bilesalt agar and confirmed by using the important biochemical properties such as: Gram negative; asporogenous rod, catalase +, glucose acid under anaerobic condition, sucrose -, H_2S in Triple sugar iron agar -, Indole+, Galactose +, Growth in 8% Nacl +, Growth in 10% Nacl-, Utilization of Starch under anaerobic condition in the presence of 5% Nacl (Baross and Liston 1968; Kampelmatcher et al., 1970).

Results and Discussion

During chilling the processed froglegs and further storage of 14 days the organisms under study were all viable both concentrations (Table 1). Angelotti et al., (1961), Matches et al., (1971), and James Jay (1970) had reported the minimum temperature for growth and toxin production was 5-7°C. In a review by Mitchner and Elloitt(1964)

discussed the survival and growth of Salmonella organisms at low temperature. Recently James et al., (1982) reported the survival of these organisms in fish and shellfish homogenates at 0-6°C for upto storage for 14 days. In the case of V. parahaemolyticus some of the Vibrio like organisms survived only upto 10 days. Various investigators pointed out that the minimal temperature for growth multiplication was 5.0°C. (Baumann 1972 and Beuchat 1973) and 8.0°C (Baross and Liston 1970) in an artificial media, and 10.0°C in oyster homogenates (Thomson and Thacker 1973).

Table 2 shows the effect of freezing on the behaviour of different serotypes of Salmonella and Vibrio parahaemolyticus organisms. In this study relatively low level of inoculum (less than 10^2 cells per gram) and larger concentration of 10^4/gram were used. It has been found that these serotypes of Salmonellae and V. parahaemolyticus were viable after freezing at - 20.0°C. During frozen storage held up at -20.0°C the studies indicated that the following serotypes S. anatum, S. tuphimurium, S. arizonae and S. senftenberg survived upto 60 days in the lower concentration and other serotypes organisms lost their viability within 30 days. On the contrary the higher concentration showed longer stability for S. anatum, S. arizonae, S. enteriticis, S. typhimurium and S. senftenberg and survived upto six months, while other serotypes lost their viability after four months. In this study beyond six months these serotypes could not be isolated since they were undergoing stress or death. In other food products and fish and fishery products these organisms were survived much longer period during freezing and frozen storage Gunderson and Ross 1948,

Bergstress, 1961; Woodburn and Strong 1960., Kerelek et al., 1961). Raj and Liston,(1971), Leperted that survival of S.typhimurium in seafoods upto 393 days. However in our studeis it was found that the test organisms of Salmnellae viable only upto 180 days (James et al., 1982). Digrelemo et.al.,(1970) reperted that the survival of Salmenellad In homoganates was differed from that of whole oysters.

During frozen sterage V.parahaemolyticus and like arganisms last their viability with in 15 days while higher concentration showed viability upto 25 days (table3) In fish homogenates the survival was slightly longer at 20°C (James et al., 1982). Various investigators (Vanderzant and Nickelson, 1972; covert and Woodburn 1972) obtained analegus results. On comparing with Salmonellase serotypes organisms the study showed that the V.Parahaemolyticus and like organisms is very sensitive to low tem erature and storage. This study is in agreement with the findings of carious workers (Baress and Liston, W968; Matches et al., 1971; Jobnson et al., 1973 Kaneke and Calwe l,1973; Bradshaw et al,1974; Beuchat, 1975 Van den Broek and Mossel 1977). Eventhough V.panahaemolyticus and like organisms present froglegs, fish and fishery products (Bartely and Blanetz,1971; Thompson and Thacker 1973), the protection of these organisms if fish and allied products is thought to be that the protein molecule which acts as a true colloid and obstruct the erstallization of water from bacterial cell. so denaturation of protein from bacterial cell is prevented and protected from injury and hold bound water to maintain the equilibrium (Raj and Liston 1971).

In considering the effect of freezing and further storage these organisms were found to be killed slowly and thereby reducing the bacterial population Earlier Ingram (1951) in his studies showed that these organisms were killed immediately after freezing, and the proportion of cell surviving will be independant on the rate of freezing. Gunderson and Ross (1948) studied the effect of freezing at -25.5°C for several strains of Salmonellae and found the viability after 270 days in Chicken choumein.

Conculsion

This study indicated that refrigeration and freezing and further holdup in cold storage will not completely remove or killed these organisms in froglegs if it is contaminated during inadequate handling and processing. So exphasis is placed much on hygienic handling and implant sanitation with well chlorinated potable water and washing can yield good bacterial standards in the processed froglegs and good attention is required to the usual methods of assosising the cleanliness of the environs of the frog cutting centres and processing places. Quality of froglegs ultimately depends much on stringent micro-biological standards carried during processing and packaging the final products and also on stressing the training and education in personnel hygiene and proper in plant sanitation.

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Table :1. Behaviour of Salmonellae seretypes, V.parahaemolyticus during chilled and further holdup in storage at 0-6°C.

Organisms	Initial T.V.C /g.	Inoculated Load/g	After Chilling	7days	14days
S.typhimurium	230000	Less than 10	+	+	+
		38000	+	+	+
S.typhi	190000	Less than 10	+	+	+
		7300	+	+	+
S.anatum	38000	Less than 10	+	+	+
		8400	+	+	+
S.enteritidis	47000	Less than 10	+	+	+
		6600	+	+	+
S.sainpaul	380000	Less than 10	+	+	+
		7800	+	+	+
S.weltevreden	47000	Less than 10	+	+	+
		9100	+	+	+
S.newpert	180000	Less than 10	+	+	+
		6800	+	+	+
S.cubana	98000	Less than 10	+	+	+
		6500	+	+	+
S.arizenae	82000	Less than 10	+	+	+
		7900	+	+	+
S.Virchow	90000	Less than 10	+	+	+
		4700	+	+	+
S.senftenberg	130000	Less than 10	+	+	+
		7800	+	+	+
V.parahaemolyticus (Type strain)	78000	Less than 10	+	+	+
		7900	+	+	+
V.parahaemolyticus	69000	Less than 10	+	+	+
		4500	+	+	+
V.parahaemplyticus like organism	79000	Less than 10	+	+	+
		9800	+	+	+

T.V.C. = TOTAL VIABLE COUNT PER GRAM.

TABLE:2

SURVIVAL OF SALMONELLAE SEROTYPES, V.parahaemolyticus and V.para haemolyticus like organisms during frozen and further storage at -20°C.

Organisms	Level of inoculation in muscle portion/ per gram.	After freezing & thawing	Days of storage 30	60	90	120	150	180
S.typhimurium	Less than 100	+	+	+	-	-	-	-
	2000	+	+	+	+	-	+	+
S.typhi	Less than 100	+	+	-	-	-	-	-
	9100	+	+	+	+	-	-	-
S.amatum	Less than 100	+	+	+	-	-	-	-
	8300	+	+	+	-	+	+	+
S.enteritidis	Less than 100	+	+	-	-	-	-	-
	7600	+	+	+	+	-	-	-
S.saintpaul	Less than 100	+	+	-	-	-	-	-
	9100	+	+	+	+	-	-	-
S.weltevreden	Less than 100	+	+	-	-	-	-	-
	4900	+	+	-	+	+	-	-
S.newpert	Less than 100	+	+	-	-	-	-	-
	7900	+	+	+	-	-	-	-
S.cubana	Less than 100	+	+	-	-	-	-	-
	9100	+	+	+	-	-	-	-
S.arizonae	Less than 100	+	+	+	-	-	-	-
	11000	+	+	+	+	-	+	+
S.virchow	Less than 100	+	+	-	-	-	-	-
	6600	+	+	+	-	-	-	-
s.sontenberg	Less than 100	+	+	+	-	-	-	-
	7600	+	+	-	+	+	+	+

TABLE : 3

Survival of V.parahaemolyticus and V.parahaemolyticus like organisms during freezing and coldstorage at - 20°C.

Organisms	Inoculated organisms per/ gram	After freezing	7days	15days	25dyas	35days
V.parahaemolyticus (Type strain)	Less than 100	+	+	+	-	-
	7800	+	+	+	+	-
V.parahaemolyticus straia isolated from fish	Less than 100	+	+	-	-	-
	6100	+	+	+	-	-
V.parahaemolyticus shellfish.	Less than 100	+	+	+	-	-
	7400	+	+	+	+	-
V.parahaemolyticus like strain isolated fish	Less than 100	+	+	-	-	-
	4900	+	+	-	-	-
V.parahaemolyticus strain shellfish.	Less than 100	+	+	-	-	-
	7800	+	+	+	+	-

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FROGWASTE UTILIZATION

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Frogs are caught in large quantities in Japan, Cuba, Mexico, Taiwan and India. There are about 50 species of true frogs in India among which are Rana tigrina Daud (bull frog), R. cyanophlyctus Schneider (water skipper) and R. hexadactyla Lesson(green tank frog) (Anon, 1956). They are available in almost all swampy and low lying areas of Kerala, Tamil Nadu, Andhra Pradesh, Maharashtra, Assam, West Bengal and Orissa.

Hindlegs of certain varieties of frogs are served as a delicacy in Western countries. Besides this, frog meat is consumed by the poor and tribal people in several parts of the world.

Frog meat resembles chicken white meat in appearance and taste. The edible portion of frogleg analyses to moisture 79.6-81.9%, crude protein (Nx6.25) 16.4-17.1%, fat 0.3-1.2%, ash 1.0-1.1%, calcium 17.0-18.0 mg, phosphorus 147.0-173.6 mg, iron 1.1-2.1 mg, thiamine 0.07-0.14 mg, riboflavin 0.15-0.25 mg, niacin 1.2-2.0 mg/100 g (Anon, 1956 ., Dani et al 1966). Dani et al (1966) also reported presence of lysine, methionine, cystine and tryptophan around 9.7, 3.0, 1.0 and 0.07 to 1.15 g/16 gN respectively in the edible meat. It may be seen from the above data that the meat is rich in protein as well as in minerals and vitamins. The proximate composition closely resembles the average values obtained for fish (Anon, 1962).

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Only the hind legs of the frog are used by the freezing industry. Total export of frozen froglegs from India has shown a steady increase from 514 tonnes valued at Rs.0.32 crores in 1963 to 2778 tonnes valued at 7.77 crores in 1984-1985, the export figure touching a maximum of 4065 tonnes valued at 11.20 crores in 1981-1982 (Anon 1970, Anon 1985). In 1984-1985 frozen froglegs constituted 3.22% of the total marine products exports from India contributing to 2.02% of our earnings from marine products exports. Only about 30-33% of the whole frog constitute the hind legs, which are processed and used. The rest of the body and front legs which contain comparatively little edible flesh are discarded and do not find much use at present. Development of suitable methods of converting this waste into useful products will not only enhance the profit made by the industry, but will also indirectly solve in part the protein shortage faced by the country. Earlier, cutting of frogs being done at scattered places, collection, preservation and transportation of the wastes from the cutting centres to a place where the waste could be processed presented various difficulties. However, recently a convenient and effective method for electrical stunning of live frogs has been evolved, so that severing of the hind legs of live frogs for processing and export can now be done in a more humane manner than before. This method has now been officially prescribed by the MPEDA as the only acceptable method for cutting frogs and export licences for frozen froglegs will henceforward be issued only to those who follow this new method of painless killing of frogs in licenced premises or centres (Anon, 1985a). As a result, procurement of frog waste in good condition

has been made easy and further processing of the same into suitable products can be done effectively. Frog oil which can be extracted from the waste is supposed to have some medicinal properties especially in the cure of asthma and other pulmonary disorders. Small quantities of this oil in crude form is also available in places where frog cutting exists. However, there is vast scope for utilizing the frogwaste by converting it into various products.

Leather from aquatic sources could supplement or replace many types of leather from land animals, provided the economics of the process would permit such substitution. They could produce beautiful leather, particularly suitable for the manufacture of small novelties. The skin can easily be separated from the frog carcass and preserved. The operations required to convert the skins into leather depend upon a number of variable factors such as the kind of raw stock available, ultimate use of the leather produced etc. The following operations are involved (1) beam house (2) tanning (3) fat-liquoring and dyeing (4) drying and (5) finishing (Brody, 1965). Leather produced from frogs can be used in the manufacture of purses, vanity bags and other fancy items. Frog skins are tanned into leather in Japan (Anon, 1956).

Glue having excellent adhesive properties and without any bad colour or odour can be prepared from frog skins by using the same procedures as are followed in the manufacture of liquid fish glue from fish skins viz. clearing of stock and removal of dirt by washing, cooking of washed stock, addition of preservatives and evaporation. The glue so prepared can be used for all operations where liquid fish glues are used at present (Brody, 1965).

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Since the frogwaste contains a high amount of protein, several attempts have been made to suitably convert the entire waste into meal by wet or dry reduction methods. Advantages and disadvantages of both methods and the nutritive quality of the products obtained have been extensively studied by Rao and Kamasastri (1963). Lekshmy Nair and Prabhu (1980) studied the quality of meals prepared from frogwaste collected from cutting centres and from the laboratory. The waste is washed well with water to remove dirt and other extraneous matter, cooked in steam at 0.7 Kg/sq.cm. for 30 min., stick water is drained off, residue pressed well in a canvas bag, the press cake is dried either in the sun or in a hot air dryer and the dried meal pulverised. Same method for the preparation of fish meal can be used for the preparation of frogwaste meal. Studies on the effect of various methods of drying viz drying in the (1) sun (2) tunnel dryer at 50°C showed that the best quality meal is obtained by sundrying or drying in a tunnel dryer.

However loss in available lysine during hot air drying was only 0.2 to 0.3g/16 g nitrogen showing that decomposition during the drying process is not appreciable. Dry rendering process gave a product of inferior quality both physically and chemically (Rao and Kamasastri, 1963). Yield of the meal usually varied from 18.6 to 21.5% of the original fresh weight of waste. Determination of proximate composition of the meals showed that the meals conformed to the standards prescribed for fish meal (IS: 4307-1973). The amino acid profile of the meals also compared favourably with that of fish meals prepared from sardine, miscellaneous fish and silver belly (Lekshmy Nair & Prabhu, 1980). Frogwaste meals can therefore act as a good substitute for fish meals for

the supplementation of poultry/animal feed. Work of Sultan et al (1980) has shown that an excellent feed for cultured prawns can be prepared incorporating frog flesh waste.

Yield of oil from frogwaste varies from 6-8% of total weight of waste (Rao & Kamasastri, 1963). However the amount of oil which can be extracted out is highly variable depending upon the maturity and season and occasionally the yield of oil is reduced to almost nil. Good quality oil can be prepared from the waste by boiling in water, pressing through canvas cloth and allowing the stick water to separate. The clear oil at the top is siphoned off and purified by centrifuging to remove traces of suspended materials and water. Clear yellow to pale brown oils are obtained by this method (Rao & Kamasastri, 1963). By heating the waste in a pan directly on a sand bath or oil bath without addition of water gives higher yield of the oil, but of far inferior quality. The oils so obtained have a brownish black charred appearance and the quality is poor. Saponification value of the oil is within the range of marine oils and iodine value is less than that for fish oils. The oil extracted from the waste on conversion into the fatty acid methyl ester by the method of Morrison and Smith (1964) and analysis of the ester by gas liquid chromatography show certain significant features as is evident from Table 1. The frog oil contains high amount of oleic acid unlike fish oils. The major fatty acid in fish oils is palmitic acid. Significant quantities of linoleic acid is also present in frog oil unlike in fish oils.

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Another important byproduct which can be processed from frog waste and which can bring in excellent returns for the processor is the frog gall which is having application in the pharmaceutical industry. There are three kinds of galls which are exportable, black, brown and green of which, the black ones fetch maximum price in the market. Brown and green ones are also acceptable at a lower price. In Japan, the indicated price is around $ 250 per kg. for better quality product. Processing of frog galls require great care and attention. Remove the galls from the frog in fresh form immediately after the hindlegs are cut off, then carefully pick off the galls from the surrounding waste, and dry them by hanging in sunlight for one full day and from next day onwards in the shade, until they become hard. Cut them off by scissors and pack in strong polythene bags. The galls are marketed in 1 kg. packs. Larger galls are always preferred, even though galls of small size also find a market. Frog gall is mainly amino acid derivative of lithocholic acid and dehydrochlolic acid. Its main use is for medicinal purposes.

Although presently the frogwaste is almost totally discarded, the above account suggests that it can be put to better use by converting into useful products. The scope of putting the waste into better use has been brightened now since the waste can easily be made available from the organised cutting centres. However, more research work is also necessary to evolve suitable technologies for economic utilization of the waste.

Table 1

Fatty acid composition of frog oil

	Saturated fatty acids	
	12:0	0.72
	13:0	0.61
	14:0	2.39
	15:0	1.09
	16:0	21.38
	18:0	7.59
Total		33.78
	Monosaturated acids	
	13:1	0.30
	14:1	0.39
	16:1	8.55
	18:1	39.52
	20:1	1.20
	22:1	0.43
Total		50.39
	Polyunsaturated acids	
	18:2	11.40
	18:3	1.93
	20:2	0.72
	20:3	0.12
	20:4	1.39
Total		15.56

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EDIBLE FROG ECOLOGY

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Frog has been classified under amphibians - group of animals that live both in water and in the land. The ancestors of amphibians were fishes that took million of years to venture out of water to live on land as fins had to change to limbs and gills to lungs.

Ectotherm - cold blooded animals such as amphibians are divided into 3 groups - caecileans, salamanders newts and frogs and toads. The caecilians are limbless creatures which could easily be mistaken for worms. The salamanders have tails and can regrow its limb and tail just like lizard. Newts are very much like salamanders with the exeption of male cersted newt which has a fine crest running along its back.

Frogs and toads differ in number of ways. Toads breed in water but spend much of their time on land, sometimes miles away from the permanent pools. Their skin is rough, and moist without slippery. Frogs on the other hand seldom stray far from water. Their skin is smooth and fells wet to the touch, for it is well lubricated with mucus. Toads lay their eggs in long strings, where as frogs lay their eggs in a single clump. The development of both kinds of eggs, however is the same. They hatch into tadpoles on which extermal gills soon appear. The gills disappear when the fold from the head grows back to cover them. The tail becomes shorter and lungs develop. Then the bony

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jaws and a mouth replace the beak like parts of tadpoles, the fully formed creature is ready to venture on land. When on land, they hunt insects and other small invertabrates using eye-sights which is keen but limited. The nervous net-work in the retina of frog's eye has special circuits that are trigered only by small moving objects. This lies neatly with the observation that frogs only catch small, moving animals. Their diet consists of large proportion of active animals such as flies, beetles and spiders. Frogs just do not see motionless animals so a frog will starve when surrounded by dead flies.

As we know animals can not manufacture their own food to fuel the body process of movement, growth, digestion and so on. Hence the first link in the food chain consists of herbivores - the plants eating animal. They are eaten by the primary carnivores, the flest eaters which are preyed upon inturn by secondary carnivores and thus the energy initially trapped by the plant during photosynthesis is passed progressively along the chain:-

Sun's energy - Algae (plant) $\frac{\text{Tadpole}}{\text{(herbivore)}}$ Fish $\frac{\text{(primary carnivore)}}{}$ - Frog (secondary carnivore)

Frogs uses marshes & wetlands but like fish their miches and habitats differ with age. Larvae amphibians (tadpoles) are aquatic and feed on minute plants but as adults they gradually shift to animal food including fish and invertibrates - mainly insects, beetles and bugs. The adults may be totally predaceous but their ranges in food, probably changes by habitat as well as by season.

The most conspicuous aspect of frog associated with marshes and paddy fields is its role in checking the population of myriad of insects that we consider both

a muisance and at times, a serious problem. Without a doubt, the most abundant group are true flies, - the Diptera which include midges, mosquitoes and craneflies.

The aquatic larvae of mosquitoes occur on the surface of shallow edges of paddy fields and marshes are mainly eaten by frogs, fishes and other invertebrates. The large family of insects-blood worms serve as a food for frog, fish and diving birds.

The family of insects is one of the most important in marsh system. Our paddy crop is attacked by cut worms, water bugs sucking insects and brown leaf hopper at different stages of development and these worms and insects are the favourite food of our amphibians and this is the reason the frog is called the farmer's friend. A frog eats its own weight of food per day and not very much choosy about diet - eating all kinds of insects, bugs, hopper and even crabs - which damage bunds of the agricultural fields and letting out water needed by paddy plants. It is said that frogs also control many of the water borne larvae and insects which are responsible for the spread of disease in human and cattle such as encephalitis and malaria. It is undisputed that frog is beneficial to agriculture as it consumes vast quantities of pests which destroy India's much needed food crop.

Professor Abdulali with the assistance of Dr. A G Joshi and M M Hosalkar all of Bombay Natural History society have produced a small but limited report at the request of Indian Council of Agricultural Research on their 3 years project to determine the ecological disturbance in agri-cultural and adjoining lands caused by the removal of frogs (Rana tigrina and Rana hexadectyle) for export. Their report states that "It is undoubtely true that number of

frogs (Rana tigrina) in most parts of Bombay and Konkan has declined greatly in numbers due to their capture for export. The work has been carried out in Bombay and Konkan area only. An examination of the frog's food reveals that 90% consists of crab, insect and insect larvae all detrimentel to rice and removal of frog in turn adversely affects the growth of rice crops".

In order to combat the loss of this valuable insect predaor, India is spending £ 13 million on insecticide which are non selective and have many for reaching dangerous side effects.

There is another side of picture which can not be ignored altogether. Amphibians are prime food sources for all the larger predators like herons, bitterns, pelicans, fish and smakes. The prey of certain variety of snakes particularly striped keel back is mainly frogs.

On the basis of species and numbers, the present era should definitely be called the age of insects. Practically every square inch of land harbours one type of insect atleast. We cannot dismiss the insects as insignificant. They effect our daily life in a host of ways. Termites weaken our house, the gypsy moth strips our shade giving trees, beetles devour our beans and potatoes, mosquitoes and flies carry diseases cloth moth chew holes in our garments.

There is another important role of the insects too some beetles save our apple crop and are reared by farmers, all the silk in the world, all the honey and all the shellac in the world comes from the insects. The most important contribution made by insect, is bearing pollen from bloom to bloom, fertilizing flowers and enabling plants to propagate themselves. Out of 472 tree species in rain forests of Thailand, 471 are pollinated by insect themselves.

Thus while insects exact a toil of our paddy crop and vegetable graden, but some of them are so important that without them, there would be no crop at all.

Thus there is no form of life which is superfluous. Man can not eliminate a single species without potentially affecting the whole tightly knit fabric of life. Nature is like a vast web, composed of myriads strands. Through the ages it has been woven by nature and placed in equilibrium with the environment. But when men, through his ignorance and greed medles with it, the web is thrown out of biological balance and work done by nature for million of years is destroyed in no time with dire consequence.

During recent years, some thousand tons of frogs particularly of Rana species are caught from the fields, their hind legs are dipped in chlorine water and processed and are frozen in plants and exported to Europe and U.S.A. About 6,000 MT. of frozen froglegs are exported from India meaning thereby about 18,000 tones of frogs (about 1 lack in number) are killed every year to earn foreign exchange without considering the ecological needs. Live frogs fetch the catcher anything between Rs.2 to Rs.5 per kg. Only one third of the frog is recovered as processed legs and hence the base cost of a kg. of legs, ranges from Rs.6 to Rs.15. Where as f.o.b. price ranges between Rs.25/- to Rs.40/- a kg. depending upon the size. The business is so lucorative that many of the large commercial organizations are involved in this trade and export have risen from 500 MT. and accounted 12% of India's marine product export.

The cry of the farmers are genuine and not without basis. There is urgent need to study the frog ecology and its effect in our environment. However wild life conservation

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doesnot imply preservation - but the appropriate husbanding of resources on long term basis to insure optimum benefits. By abiding with ecological principles socip-economic goal can be achieved without entailling ecological desaster.

Farming of edible frogs can be attempted like farming of crocodile, fishes, birds and turtles leaving the natural stock to recuperate. Farming requires detailed knowledge on aspects such as rate of reproduction, meat-yield, resistance to diseases, behaviour under controlled conditions, cost of rearing quality of the product, marked of the product and economics of the enterprise, it has already been started in some countries.

In order to gain benefits from the experience of rearing techno-economic evaluation of frog - farming should be carried out and circulated to the countries of the region. The edible frog provides the dish of frog legs which may be fried crisp and served with sauce. Frogs need fresh water to lay their eggs. The summer must be long enough for eggs and tadpoles to develop and animal must have suitable place for hivermation. Each female can produce 10,000 eggs, but size of eggs is important for their survival.

In order of the world, bull frogs are also relished as food. The flesh of its muscular back legs apparently tastes delicious and frog is so popular for dinner that large specimens are difficult to find. The South American bull frog can grow to $8\frac{1}{2}$" long and weighs several kg. Even larger than South American **bull**frog is the giant frog from West African Specimen of this monster have been reported as 2' long and weighing upto 6 Kg. The giant is also found tasty to eat.

If Shakespeare could find books in the running brooks and sermons in the stones, how many volume can we grow in pond.

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BIOLOGY, CONSERVATION AND CULTURE OF INDIAN FROG SPECIES

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A B S T R A C T

The frogs form an important component of our ecosystem. Indiscriminate capture of frogs from their natural habitats for the export of froglegs as well as academic purposes has been resulting in fast depletion of frog population in Indian subcontinent. At certain places, the common Indian bullfrog, Rana tigrina is not available. This paper suggests to undertake intensive research on the biology, breeding, growth rates and culture of local frog species in all parts of the country. Need for status survey of economically viable species has been suggested; and their conservation through the help of Universities, colleges and schools in every locality has been emphasized. A frog culture programme which can be practised under Indian conditions has been proposed.

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PITHING : A PROCEDURE FOR PAINLESS KILLING OF FROGS PRIOR TO PROCESSING

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A B S T R A C T

Ethics and hygiene are the two interrelated aspects which need to be followed while utilising natural resources, either it be a forest resource or a natural animal population. The collection and processing of frogs for consuming their legs is not exception to this rule. It is a fact that either at the collection point or at the processing centres, the frogs are put to unimaginable amount of torture when their legs are chopped of their sacral region leaving the rest of the body for its fate to die a slow and painful death. Ethics interfered when painful processing of frogs was brought to the knowledge of the consumer who resisted this painful killing of frogs.

Different methods are being attempted to make the killing of frogs as painless as possible. As the legs alone are preferred for consumption than the rest of the body, the heads of frogs are not cut as it is done in the case of slaughtered cattle. Therefore, a method similar to beheading which puts the rest of the body under permanent anaesthesia is to be adopted for painless killing.

Pithing is a process by which the central nervous system is disconnected from the brain. A flash shot with a sharp

..2.

and stout pin through the medulla oblongata of the frog will only stun the frog for a fraction of a second and leaves only a puncture at the medulla oblongata region of the head. Thus the pithed frog is brought to a permanent anaesthetic and inactive condition leaving the entire body painless until death.

On the hygienic point of view the frog is clean since no other major injury is caused to the animal thus leaving no chance for external contamination. The leg muscle remain live fresh since the involuntary pumping action of the pithed frog continues to keep a steady blood circulation for atleast two hours. The occurrance of blood clots on leg muscles due to biting among frogs are also avoided when frogs are made inactive by pithing at the collection point itself and transported to the processing centres.

. . . . . .

PROCESSING OF FROGLEGS

Mr. Yoshiji Okano, Japan.

Mr. Yoshiji Okano of Osaka Commercial Co. Ltd., Japan suggested the following method of processing for obtaining good quality froglegs free from salmonella and other pathogenic bacteria.

1. Wash the frogs in clean running water and put them in 300 ppm hypochlorous acid solution for about 30 minutes before killing.

2. While eviscerating the head cut frogs, care should be taken that the intestine are not cut or broken.

3. After deskinning, trimming and deveining, froglegs should be put in 300 ppm chilled hypochlorous solution for several hours. To keep the water at a low temperature, the container should be covered up and stored in a cool room.

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QUALITY CONTROL OF FROGLEGS IN INDIA FOR EXPORT.

By

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INTRODUCTION.

In some developing countries, the frogleg industry has made significant contribution to the national economy by providing employment to their people and earning foreign exchange. In most of these countries, froglegs are not consumed by the local population beacuse of their aversion, customs and religious belief. India is one of such developing countries where over one lack people are engaged in the collection of frogs and pre-processing and processing operations of frozen froglegs exclusively for export purpose, as there is no domestic consumption of this item. However, in certain parts of the world, consumption of froglegs has been constantly increasing as more and more prople have started regarding this item as a delicious and highly nutritious food. Thus, the export of raw frozen froglegs (skinned but unseparated hind-legs without claws) is becoming increasingly important in the international trade.

India, which started exporting frozen froglegs in 1963 with a meagre quantity of 514 tonnes valued at Rs.31.92 lac, is today exporting this item to several sophisticated and fastidious markets such as the USA, France, Netherlands, Belgium and other European countries. In 1981, India exported 4367.889 tonnes of frozen froglegs to fifteen countries - principally to Netherlands (1702.240 tonnes), the USA (1296.201 tonnes) and France (646.541 tonnes). Because of the occurrence of Salmonella in frozen froglegs, difficulties have arisen in the export of this product to such countries whose import surveillance includes checking the product for these bacteria.

This paper attempts to briefly describe the various measures implemented by Export Inspection Council (EIC) and Export Inspection Agencies(EIAs) to upgrade the quality of frozen froglegs which have resulted in exporting organoleptically and bacteriologically sound frozen froglegs from the country.

ENFORCEMENT OF COMPULSORY QUALITY CONTROL AND PRE-SHIPMENT INSPECTION OF FROZEN FROGLEGS

With a solemn purpose of ensuring sound development of the export trade in India through quality control and inspection, and improving the image of the Indian products in the international market, the Government of India enacted a comprehensive legislation entitled "The Export (Quality Control and Inspection) Act, 1963". Frozen frogleg was brought under the compulsory quality control and pre-shipment inspection scheme under the

above Act with effect from March 1, 1966. The Act empowers the Government of India to notify the commodities which shall be subjected to compulsory quality control or inspection or both prior to export and to specify the type of quality control or inspection which shall be applied to a notified commodity. Initially, the scheme of pre-shipment inspection of fishery products was operated by the Director, Central Institute of Fisheries Technology, Cochin, who was recognised as the Inspection Agency, under Section 7 of the Act. Consequent on the decision of the Government of India, the scheme was taken over by the EIAs from May 1, 1969.

While enforcing statutory pre-shipment inspection, the Government of India had notified certain standards regarding various quality factors relating to each product. Initially, in the case of frozen froglegs, these standards pertained only to organoleptic factors. Later, in April, 1969, certain bacteriological standards were also enforced. The pre-shipment inspection and quality control schemes are operated by the five Export Inspection Agencies with head quarters at Bombay, Calcutta, Cochin, Delhi and Madras. These Agencies function under the administrative and technical control of the Export Inspection Council of India at New Delhi.

CONSIGNMENTWISE PRE-SHIPMENT INSPECTION OF FROZEN FROGLEGS

In the initial years, the pre-shipment inspection of frozen froglegs was carried out under consignmentwise pre-shipment inspection scheme which required inspection

and testing of only the final product to ensure conformity of the product to the prescribed standards. The organoleptic and bacteriological standards for frozen froglegs applicable at the time are given in Table-I. This system of consignmentwise pre-shipment inspection ended in May, 1979.

IN-PROCESS QUALITY CONTROL (IPQC) SCHEME FOR FROZEN FROGLEGS

Taking into account the experience gained and the strides made by the industry over the years and, above all, with a view to making the quality assurance programme for frozen froglegs more meaningful and effective, the Government of India introduced IPQC Scheme for frozen froglegs with effect from June, 1979. Under this scheme, processing of frozen froglegs for export is permitted only in the processing units which are approved by the EIA. To qualify for such approval, a production unit must have the minimum sanitary and hygienic facilities stipulated in the 'Export of Frozen Froglegs (Quality Control and Inspection) Rules, 1979'. These rules prescribe requirements in respect of the processing units, environmental, sanitary and hygienic aspects of the Units, processing facilities available and the health and personal hygience of the workers employed. The production units which do not have these prescribed facilities are not allowed to process frozen froglegs for export. As per the IPQC System, the entire processing operations are carried out under the supervision of a competent technical personnel employed by the processing unit. Standards

have been laid down for the acceptance of raw-material also and only approved raw-material is allowed for processing. At all the stages of processing, the necessary inspection is conducted by the technologist of the production unit and his observations counter-checked regularly by the officers of the EIA. The final product is further subjected to physical, organoleptic and bacteriological examinations, and if, on such inspections and examinations, the product is found to be satisfactory, then only certificate of exportworthiness is issued by the EIA for the relevant consignment. The existing organoleptic and bacteriological standards for frozen froglegs are given in Table-II.

Subsequent to certification, the Agency conducts further checks on the certified export consignments in the cold storages and at wharves also, just prior to shipment. Thus, IPQC Scheme, now enforced, entails continuous surveillance and vigil by the EIA Officers during the entire processing and packing operations starting with the receipt of the raw material till the final product is exported.

MEASURES ADOPTED BY EIC/EIAs CONSEQUENT ON THE LARGE SCALE REJECTIONS OF INDIAN FROZEN FROGLEGS BY THE UNITED STATES - FOOD AND DRUG ADMINISTRATION(US-FDA) DURING 1973-74

The quality assurance programme in respect of the exports of frozen froglegs worked very smoothly till the middle of 1973. Probably, the first turmoil Indian Fishery Export Industry witnessed was when, suddenly, in the

latter half of 1973, the US-FDA tightened up their sampling and testing procedures for imported frozen froglegs. This resulted in large scale rejections of Indian frozen froglegs in the United States which rocked our frogleg industry for a while. To evaluate the problem, a series of dialogues between US-FDA officials and the officials of the Marine Products Export Development Authority and the EIC were held which paved the way for a two-member EIC delegation to visit the USA in the end of 1974. This delegation was able to solve the problem by striking an agreement i.e. 'Memorandum of Understanding' (MOU) between the US-FDA and the EIC on the subject. The underlying philosophy behind the agreement was that the US-FDA regarded the EIAs as a technically competent organisation and as such recognised the certificates of exportworthiness issued by the EIAs to cover Indian froglegs exported to the USA, reducing the intensity of sampling to the barest minimum. According to the MOU, only the surface Salmonella and Arizona were to be considered for the acceptance or rejection of frogleg consignments. Besides, the MOU stipulated production of "sanitary frozen froglegs" utilizing updated pre-processing and processing techniques and reliable bacteriological procedures. Indeed, it is gratifying to note that the pre-processing and processing techniques, the proposal to look only for the surface Salmonella/ Arizona and the technique to isolate these bacteria from the surface of froglegs, which formed the basis of the MOU, were that of the author who was the technical member of the delegation. However, the MOU required that the procedure described in the Official Analytical

Chemists, Washington, be followed for the identification of suspected Salmonella isolates. Following the conclusion of the MOU, remarkable improvements were effected in the sanitary and hygienic conditions of the frogleg cutting centres and processing establishments, and pre-processing and processing techniques were also updated to meet the requirements of the agreement. The main steps taken to upgrade the quality of frozen froglegs were as follows :

1. Stipulation of sanitary and hygienic requirements in respect of cutting centres, pre-processing and processing units in the Export of Frozen Froglegs (Quality Control and Inspection) Rules, 1979;

2. Upgradation of pre-processing and processing techniques (Table-III) laying special emphasis on -

   (i) the use of live frogs,

   (ii) depuration technique i.e. subjecting live frogs to at least a 24 hour bath in running potable water,

   (iii) good sanitary practices during preparation of the material while chopping off, skinning and dressing the hind-legs, and

   (iv) the use of potable water containing appropriate concentration of chlorine during various stages of pre -processing and processing ;

3. Adoption of the procedures of isolation and identification of Salmonella as stipulated in the aforesaid MOU.

Although the above steps helped to reduce the quantum of rejections of our froglegs in the USA to the minimum and the Indian frogleg industry found its feet again, the MOU which was signed on January 13, 1975 was unilateraly abrogated by the FDA in August, 1977. This was unfortunate in view of the observation of the Second Joint FAO/WHO Expert Consultation held in Geneva, in February - March, 1977 that Salmonella contamination of the raw frozen froglegs was likely to remain at the current level, since the existing technology did not significantly reduce such contamination. However, due to steady improvements in the bacteriological quality of the product, the abrogation of the above agreement did not seem to affect the exports of Indian froglegs adversely.

IMPROVEMENTS IN QUALITY OF INDIAN FROZEN FROGLEGS AS EVIDENCED BY THE INVESTIGATIONS MADE IN INDIA AND ABROAD

Results of Investigations made in India -

In response to the large scale rejections of Indian frozen froglegs by the US-FDA, the author (1978) conducted two different surveys on the incidence of Salmonella in frozen froglegs - one during March to December, 1974 and another during July to December, 1975. The results of these surveys are summarised below:

One hundred and thirty (40%) of the 325 frogleg samples examined in the first survey yielded salmonellae (Table-IV). Of the 412 cultures presumptively identified with Salmonella spp., only 226 were confirmed. Of these, 148 (65.5%) were obtained from the enrichment incubated at 43°C and 78 (34.5%) at 37°C.

Of the 100 pairs of froglegs examined in the second survey, 36 were positive for salmonellae (Table-V). Of the 1011 presumptive cultures, 128 were identified with Salmonella spp. The results showed that the 36 positive samples yielded salmonellae from a total of 70 different sites; namely, surface, muscle, bone-marrow and saddle (Table-VI), and salmonellae were present on, or in, either only a particular site, or 2 to 4 sites of the same sample, most of the organisms being on the surface. The incidence of salmonellae in the saddle and bone-marrow was also high.

Results of Investigations made in the USA -

Andrews et al. (1977), in their studies on 'Comparison of Methods for the Isolation of Salmonella from Imported Froglegs', obtained the following results on the relative incidence of Salmonella in frozen froglegs imported to the USA from various countries:

Country of origin	No. of legs analyzed	Legs positive for Salmonella	
		No.	%
India	984	93	9
Japan	192	0	0
Bangladesh	168	22	13
Indonesia	72	26	36
Mexico	72	7	10

These US-FDA Scientists, on the basis of their findings, made the following observations:

> "As recently as 5 years ago, the violative rate of Indian froglegs due to Salmonella contamination was in excess of 60%. The 9% incidence of Salmonella in Indian froglegs in this study would indicate that more stringent processing procedures, as well as closer bacteriological quality control checks on the finished product to be exported, have subsequently been implemented by the Indian Government."

The reason for this strikingly low contamination level may be that the test samples were drawn from those imported consignments which were already certified by the EIAs as Salmonella-free.

Regarding the absence of Salmonella in 192 Japanese froglegs, the US-FDA Scientists reported that, during examination of plates of selective agars streaked from the selective enrichments of the Japanese froglegs, the absence of

colonial growth was not unusual. However, the overall appearance of the Japanese froglegs did not differ from those legs imported from other countries.

Results of Investigations made in France -

During the period from February, 1977 to March, 1981, Catsaras (1983) examined 304 samples of frozen froglegs, which included materials imported from India, Indonesia and Bangladesh, and obtained the following results :

Country of origin	No. of samples tested	No. of samples positive for Salmonella	
		No.	%
India	106	27	25.4
Indonesia	157	81	51.5
Bangladesh	22	8	36.3

Based on his results, Catsaras noted that the different measures taken by the Government of India to improve the hygienic conditions during the preparation of frozen froglegs have upgraded the quality of the product imported from that country.

CONCLUSION

Apparently, the occurrence of Salmonella in frozen froglegs is the main single factor which has hampered the growth of frogleg export trade. As frogs generally live in unhygienic habitat and habitually visit unclean places, their skin and alimentary tract usually get contaminated with Salmonella. As long as legs are derived from

such frogs which are collected from polluted habitats, processors can only hope to minimize the risk of Salmoneela contamination by adopting good sanitary practices during the preparation of the material. To overcome this problem, the author (1974) suggested a depuration technique which involved subjecting live frogs to at least a 24 hr bath in running potable water, using a clean and disinfected tank with an outlet at the bottom, so that the bacterial load on the skin and in the alimentary tract could be brought down to the minimum by constant washing of the skin and by the removal of gut contents resulting from defaecation and vomiting. Perhaps, the incidence of salmonellae in froglegs could be reduced to a great extent, if the legs are obtained from such frogs which are cultured in cultivation areas maintained with a high degree of sanitation and hygiene.

Findings of the author(1978) suggest that, initially, only the skin and digestive tract of frogs are contaminated with Salmonella and that in the raw frozen froglegs Salmonella contamination in the saddle, muscle and bone-marrow takes place during the chopping off, skinning and dressing of the hind-legs. It is most likely that the salmonellae multiply and enter deeper into the bone-marrow and muscles during the delay in chilling the dressed legs before freezing; because of this, they are probably protected from the chlorinated water used by the processors. It is, therefore, not surprising that the current frogleg processing methods employed by various countries have not been found to reduce significantly contamination by salmonellae in frozen froglegs.

However, it is gratifying to note that Andrews et al. (1977) and Catsaras (1983), based on their findings, have concluded that due to the different measures adopted by the Government of India to upgrade pre-processing and processing techniques, the quality of Indian frozen froglegs has improved considerably.

It is strange as to why the US-FDA feels that unless froglegs are completely Salmonella-free, they may be hazardous to health. Since froglegs are cooked prior to consumption and the normal time and temperature are adequate to destroy salmonellae, the presence of these bacteria in the product has not, so far, conclusively provided hazardous to health. Further, we are not aware of any reported outbreaks of disease resulting from the incidence of salmonellae in frozen froglegs. As far as the danger of outbreaks of disease due to cross-contamination between uncooked froglegs and food handlers or other food items is concerned, the risk involved is certainly greater in the case of poultry eggs and poultry meat whose world-wide consumption is much higher than that of froglegs.

Finally, it may be added that the Second Joint FAO/WHO Expert Consultation (1977) also observed that it was not aware of any reported outbreaks of disease associated with froglegs and it did not recommend the establishment of microbiological criteria for frozen froglegs. Furthermore, the Consultation also maintained that Salmonella contamination of the raw frozen froglegs was likely to remain at the current level, since the existing technology did not significantly reduce such contamination.

T A B L E - I

ORGANOLEPTIC AND BACTERIOLOGICAL REQUIREMENTS FOR FROZEN FROGLEGS

A. ORGANOLEPTIC

Sr. No.	Factor	Tolerance	
		In a Sample	In a code
1.	Discolouration	50%	30%
2.	Deterioration	10%	5%
3.	Blood clot	30%	10%
4.	Broken or damaged pieces	20%	15%

B BACTERIOLOGICAL

Sr. No.	Factor	Tolerance
1.	Total Plate Count	5 lakh/gm. max.
2.	E.Coli	10/gm. max.
3.	*Coagulase - positive staphylococcus	100/gm. max.
4.	Salmonella	Nil

*Not included initially.

T A B L E - II

EXISTING ORGANOLEPTIC AND BACTERIOLOGICAL REQUIREMENTS FOR FROZEN FROGLEGS

A. ORGANOLEPTIC

Sr. No	Factor	Tolerance limit in a sample	
1.	General apperance and odour	Satisfactory	
2.	Dehydration	20%	Aggregate tolerance of 30% in a sample
3.	Discolouration	20%	
4.	Deterioration	5%	
5.	Blood clot	15%	
6.	Broken and damaged piece	5%	
7.	Non-uniform pieces	10%	
8.	Objectionable foreign matter	Nil	

B. BACTERIOLOGICAL

Sr. No	Factor	Tolerance
1.	Total Plate Count	5 lakh/gm.max.
2.	E.coli	10/gm.max.
3.	Coagulase - positive Staphylococcus	100/gm.max.
4.	Salmonella/Arizona	Nil

T A B L E - III

PRE-PROCESSING AND PROCESSING OPERATIONS FOR FROZEN FROGLEGS

	Material	Operation	Treatment					Purpose
			Method	Running potable water	Chlorine solution (ppm)	Common salt (%)	Time	
1	Live frogs	Washing	Dip or spray	,,			5 min.	Removal of extraneous dirt
2	,,	Holding	Dip or spray	,,			24 hrs.	Folding and cleaning
3	,,	Anaesthetizing	Dip	,,	250	10	15 min.	To render frogs insensitive to pain and to reduce number of bacteria on the skin.
4	,,	Slaughtering*						
5	Legs with skin	Washing	Dip or spary	,,	200		½-1 min	Washing off blood, remnants of viscera, faeces, slime etc. and to reduce number of bacteria.
6	Legs with skin	Bleeding	Dip	,,	20	5 (Chilled)	15 min.	To remove blood from blood vessels and to prevent weight gain due to clotting of blood inside.
7	,,	Washing	Dip or spray	,,			½-1 min.	Washing off blood, pieces of skin, etc.
8	,,	Sanitizing	Dip		500	5 (Chilled)	15 min.	To reduce number of bacteria and to chill the legs
9	,,	Washing	Dip or spray	,,			½-1 min.	To wash off excess of chlorine.
10	,,	Trimming**						
11	,,	Washing	Dip		20		10 min.	To wash and to progressively reduce number of bacteria
12	,,	Sanitizing	Dip		500	5	15 min.	
13	,,	Skinning & deveining						
14	Skinless legs	Washing	,,		200		1-2 min.	To wash and to reduce number of bacteria.

15	Skinless legs	Grading	Dip		
16	,,	Washing	,,	20	1-2 min. (To wash off excess of
17	,,	Washing	,,	20	1-2 min.) chlorine and to reduce
18	,,	Washing	,,	20	1-2 min. (bacterial load.
19	,,	Wrapping ≠			
20	,,	Freezing & Storage ##			

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* The head of live frog shall be cut off below the ear drum, and immediately after that, the hind legs shall be cut at the abdomen not more than 2.5 to 3 cm. from the waist.

** The legs shall be trimmed by removing bits of membrance, hanging pieces of flesh and remaining portions of cloaca in a hygienic manner.

≠ The material shall be wrapped in polythene or any other suitable moisture proof film already dipped in potable water containing 20 ppm chlorine for 5 min.

The wrapped legs shall be loaded into a pre-cooled freezer and quick frozen at or below -40°C and be transferred immedicatly to a cold storage mainatined at or below -18°C.

T A B L E - IV

ISOLATION OF SALMONELLA STRAINS FROM RAW FROZEN FROGLEG SAMPLES IN THE FIRST SURVEY

Samples*			Derivation of positive strains from enrichment£ incubated at	
Tested	Found Positive	Strains isolated	37°C	43°C
325	130	226	78(34.5%)	148(65.5%)

* Each sample consisted of 15 pairs of froglegs or 15 legs from 15 different pairs, depending on the size.

£ Selenite cystine and tetrathionate broths.

T A B L E - V

ISOLATION OF SALMONELLA STRAINS FROM RAW FROZEN FROGLEGS IN THE SECOND SURVEY

Paris		Isolation of strains from different sites				
Tested	Found Positive	Surface	Muscle	Bone-marrow	Saddle*	Total number of strains
100	36	37	26	24	41	128

*Without muscle.

T A B L E - VI

DISTRIBUTIOF OF SALMONELLA STRATINS IN DIFFERENT SITES OF 36 PAIRS OF FROGLEGS IN THE SECOND SURVEY

Samples yielding salmonella from only				Samples yielding salmonella from							
Surface	Muscle	Bone-marrow	Saddle*	Surface, saddle*	Surface, muscle	Surface, muscle, bone-marrow, saddle*	Surface, bone-marrow saddle*	Bone-marrow saddle*	Bone-marrow muscle, Saddle*	Bone-marrow muscle surface	Total No. of sites
10	1	2	4	5	1	4	3	2	2	2	
(10)**	(1)	(2)	(4)	(10)	(2)	(16)	(9)	(4)	(6)	(6)	(70)

* Without muscle

** Number of sites in parenthesis.

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LARVAL ENERGETICS OF RANA TIGRINA

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A B S T R A C T

Significant negative correlation was observed when the rates of consumption, egestion, assimilation and respiration in the Larvae of Rana tigrina were studied against the body weight and age. The total consumption and assimilation per larva during metamorphosis increased, but the rate of consumption and assimilation per unit body weight significantly decreased. The assimilation efficiencies (A/C) varied between 80 and 88% in the I and II larval stages, while their average growth efficiencies (P/A) were found to be 23% and 28% respectively. The efficiency for respiratory energy loss (R/A) averaged 61% in I and 66.1% in II stages. The egestion and excretion were in the order of 22.53 and 20.69% in these stages respectively.

The total energy consumed during the entire larval period of 29 days was 48.59 Kj/g body weight, at the rate of 1.68 Kj/g/d. The amount of energy spent out of this for egestion and assimilation were 7.55 and 41.04 Kj/g at the rates of 0.26 and 1.42 Kj/g/d respectively. Growth efficiency was maximum in stage II larvae. An energy budget was also prepared for the larval period.

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EFFECTS OF SOME OF THE SIZE REGULATORS ON THE TIMING OF METAMORPHOSIS

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A B S T R A C T

The abundance of an adult frog population depends on the chance of successful metamorphosis of their larvae into frog lets before they are killed by unfavourable enviornmental conditions such as drying of ponds, starvation due to food shortage or the ravage of predation and diseases. Therefore, the developmental speed is of much importance because the transitional individual is neither fish nor frog and well adopted to neither of the species environment.

The effects of some of the environmental stresses have been studies with particular reference to Rhacophorus maculatus (Gray). The faster differentiation process adapted by the larvae of this species has been viewed as an adaptation to avoid desiccation of breeding grounds. Under biological stress of crowding condition the lability in the time of metamorphosis is a particular case of adaptation to reach the threshold size for transformation into healthy froglegs. The real effect of crowding is mullified by the effect of the time.

Results of the energetics studies reveal that the rate of production is high during early stages (Stage I & V). This might have been a strategic adaptation to reach the threshold size quick quickly for the onset of metamorphosis and to avoid predation. Again, just before metamorphic climax (Stage VII) a high rate of energy is channelised for production. This productive stage helps the larvae to overcome environmental hazards and also to compensate the non-feeding stage lying ahead. On the whole, the energy budget strategy of these larvae aimed at reaching the transformation size at an early date.

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Addendum to "Diagnosis, distribution and bionomics of the edible frogs of India"

by

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Madras - 28.

Mr. Humayun Abdulali's paper on the frogleg export is both timely and relevant. Unfortunately this was not available to me when I wrote my paper last year. We too did study for two years the stomach contents of three species of frogs available in paddy fields in and around Madras. Our findings agree in a large way with that of Mr. Humayun Abdulali. We encountered more caterpillars in their diet which fact bestows greater importance to frogs since caterpillars are confirmed pests. Mr. Abdulali, quoting facts and figures, has rightly called for a total stop of the removal of frogs from nature.

Frog farming has often been suggested as an alternative. But will any exporter waste his money trying to breed frogs when they are available in nature just for the picking? The present legislation banning collection of frogs during the short period of their breeding has imposed only a small obstacle which may not prove to be much of a deterrent and the total export figures are unlikely to register any significant fall. Under these circumstances we should think of frog seed, like fish or prawn seed, along the lines suggested by the CIFRI in their induced breeding technique.

To try to replenish the 15 million frogs that are removed from natural population annually, atleast 10,000 million frog seeds, are required. Even this is rather too modest an estimate because the survival rate of frogs in nature is rather too low. No one knows precisely but I doubt whether one in every 100 eggs would reach maturity. Tadpoles are very vulnerable, they do not even conceal themselves cleverly thus constituting a ready source of food to a variety of predators - insects, fish, birds etc. The practice of using pesticides liberally in paddy fields to eradicate pests and in tanks and ponds to kill mosquito larvae should take a very heavy toll of tadpoles. These factors coupled with the defenceless, comparatively long period involved to attain maturity are all against even an optimum survival rate.

Induced breeding viz. stripping ova and artificial fertilization is known for quite some time. We were doing this in the laboratory about thirty years back to study the neurosecretory system of Amphibians. However, the frog seed production technology evolved by the CIFRI is very commendable and convenient. It would be desirable if the release of hatchlings into natural habitats is delayed for more than 40 hours. A week or 10 days shall be better so that their survival rate is higher. The tender hatchlings with feeble powers of locomotion are likely to be gobbled up by any predator including a variety of aquatic insects. This would necessitate their feeding while in the hatchery and a cheap, nutritive diet could easily be designed for this purpose.

P.T.O.

Two aspects are involved towards a successful programme of frog seed production and release. The frog hatchery is fine and more than a million tadpoles were actually released by CIFRI to celebrate the World Environment Day. What happened to these? A certain amount of monitoring is very much on the cards. Which organisation should take up the onus of establishing and maintaining hatcheries and releasing the hatchlings in time? The expenses may not be high but there should be a string of hatcheries all over the country and they should undertake to monitor the released ones. Like the UPASI (United Planters Association of S.India) which funds research programmes on tea plants or the World Wildlife Fund or the Wildfowl Trust, the exporters and buyers of frogleg all over the world should form an organisation and fund research programmes on hatching, release and monitoring to maintain the ecological balance to ensure a sustainable yield of frogleg.

Another point to be considered is that the legs, after processing, amount to about one-third the weight of the live frogs, Basing 1981 export figures, the total weight of discarded body parts (all except the legs) should have been around 8700 tonnes. Throwing away as waste this quantity should amount to a crime. I do not know whether subsidiary industries are there to process this for the preparation of frog oil, poultry feed/manure or fancy articles made out of frog skin.

Breeding commences after the first shower of the monsoon period. The present ban on collection is restricted to the summer monsoon months (May-June) which becomes ineffective as far as Tamilnadu is concerned where they breed during the October rains. This necessitates a review and reappraisal of the period of the closed season for the various states for a correct management of this wildlife resource.

One last point I want to make concerns the species diversity of edible frogs. Three species that support the industry are Rana tigerina, R. hexadactyla and R. crassa. Mr. Abdulali states that large examples of R. cyanophlyctis are occasionally added. It would be worthwhile to examine whether there are other species of Rana species which could be utilised for their legs. The export quantity being fixed (and progressively being reduced), the inclusion of another species shall certainly reduce the existing pressure on the present species.

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Crocodile Breeding & Management Training Institute
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INTERNATIONAL
INDIA BRANCH : 4 PRINCE OF WALES' DRIVE, WANOWRIE, POONA 411 040. TEL: 64321 GRAMS: 'AHINSA'.

11th April, 1986.

Paper presented at the INTERNATIONAL CONFERENCE ON TRADE IN FROGLEGS VIS-A-VIS ENVIRONMENTAL CONSIDERATIONS held in Calcutta:

FUTURE OF INTERNATIONAL TRADE IN FROGLEGS

At long last it has been established that frogs play a vital role in the control of crop pests. Over the years, restriction on collections from the wild during the breeding season has not helped in the least. It is therefore hoped that due to ecological reasons the collection of frogs from the wild will be entirely phased out if not stopped immediately.

France, where frog legs has been a traditional delicacy has eaten its frogs to near extinction. The country now relies almost exclusively on imports from Indonesia, India and Bangladesh.

India is considering a suitable technology for farming of fresh water frogs. Frogs will be specially bred only to be grusomely killed. And the killing can certainly never be termed "humane" irrespective of the method used.

Furthermore, as an example, a check on a frog farm in Taiwan has led to the discovery by the Department of Health officials that 14% of the frogs reared on farms carry typhoid, or a bacterium known as vibrio parahaemolyticus. This added to the fact that the Indian frog can cause tuberculosis, leprosy, buruli ulcers and other mycobacterial infections in humans, and keeping in mind Salmonella and other infections which have already led America and other

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countries to destroy entire consignments of frog legs received from India, it is hoped that India will quickly lay down the policy against the setting up of frog farms.

Have we forgotten our Indian culture and beliefs which support reverence for life and non-violence? Can such animal exploitation be justified? It is sincerely hoped that the Government of India will re-consider its decision and not develop frog farms thereby creating a new industry. NOW is the time to call a halt.

In conclusion: INDIA SHOULD NOT EXPORT FROG LEGS irrespective of whether the frogs are caught from the wild or farmed. By taking this stand the country will be internationally respected.

Diana Ratnagar

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Chairperson, BEAUTY WITHOUT CRUELTY (India Branch)

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10th April, 1986

Paper presented at the INTERNATIONAL CONFERENCE ON TRADE IN FROGLEGS VIS-A-VIS ENVIRONMENTAL CONSIDERATIONS held in Calcutta:

CAPTURE, HANDLING AND TRANSPORTATION OF FROGS

The species of frogs collected in India are Rana tigrina and Rana hexadactyla. Officially the frogs are mainly collected just after the monsoon from mid-August to October, as the capture and export of frogs during the breeding season which is from 15th June to 15th August has been banned by the Government of India due to ecological considerations.

However, it has been admitted by frog legs processors that this ban does not prevent the frogs from being collected and slaughtered during that period. It is obviously much easier to locate the frogs at this time of the year when they sit in the open calling loudly to their mates.

The frogs collected are then either sent for slaughter and kept in cold storage until the breeding season is over and they can be legally exported. Or they are kept alive in large shallow troughs of water until they can be sent to the processing plants. This practise has obviously prevented the normal reproduction of the species and lessened their number.

Certain factories send out their own trucks in the night to catch frogs in the paddy fields. Primitive type of kerosene torches are used for the purpose. The frogs are caught by hand and dumped into gunny sacks.

Frogs collected by local people from areas around Calcutta and Hyderabad are often slaughtered in the fields. The hind legs are cut in a most grusome and unhygenic manner on the spot and then sent for processing.

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Those collected in other parts of India like Gujerat, around Bombay, and in Kerala, Karnataka and around Madras, are usually sent live in gunny bags to the frog legs factories. These gunny bags are known to be filled to the brim and then thumped on the ground to settle the contents after which they are securely tied on the top. The journey can take upto 2-3 days. Each gunny bag usually contains about 50 frogs. The frogs are further kept in this manner at the factories till such time as a sufficient number for processing are obtained. They are obviously given no food or water.

At the processing plants on finally opening the gunny bags containing the frogs, the ones found dead are discarded. The balance are dipped in a 10% common salt solution (as was compulsory at one stage) before they are cut into two. The frogs take upto 15 to 45 minutes to die depending on exactly where the cut took place.

The local people who actually catch the frogs in the field get about Rs.4/- to Rs.5/- for 15 to 20 large or jumbo sized frogs. They are not dependent on this collection money for their livelihood. Now the farmers have also realised that the catching of frogs has resulted in them having to use expensive pesticides to control the crop pests which would normally have been consumed by the frogs.

In conclusion: THE CAPTURE, HANDLING AND TRANSPORTATION OF FROGS IS MOST CRUEL AND ONLY GOES TO UNNECESSARILY SUPPORT A LUXURY TRADE IN WHICH COMMERCIAL GAIN IS CONSIDERED IRRESPECTIVE OF THE ECOLOGICAL AND ENVIRONMENTAL HARM.

Nalini Z. Mehta

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HP-112
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10th April, 1986.

Paper presented at the INTERNATIONAL CONFERENCE ON TRADE IN FROGLEGS VIS-A-VIS ENVIRONMENTAL CONSIDERATIONS held in Calcutta:

PAINLESS KILLING OF FROGS

A great deal of anti-publicity about the cruel methods of catching, transporting and killing, together with the unhygenic conditions of processing of frog legs has recently made a mark on the European news. Demonstrations and boycotts against those marketing frog legs have materialised.

India therefore felt it essential to pass an Export Control Order in June 1985 by which "the frogs can only be killed by the painless electrical stunning method developed by scientists of the College of Fisheries, Mangalore, and as modified by the Central Institute of Fisheries Technology". The Marine Products Export Development Authority issues licences only to exporters using this procedure and currently 31 exporters of frog legs are registered with them.

Leading animal rights groups all over the world have now declared electrical stunning as ineffective and have even admitted to millions of creatures having suffered needlessly due to its use. It has been further condemned by the Farm Animal Welfare Council's Report (U.K.) which could certainly not be biased & exaggerated on this delicate issue.

To quote:

1. F.A.W.C. Report:

This report destroys completely the popular myth that animals are

at least slaughtered humanely.

On the stunning itself, F.A.W.C. have concluded "that unconsciousness and insensibility are being assumed to exist in many slaughtering operations when it is highly probable that the degree is insufficient to render the animal insensitive to pain."

Breaches of the recommendation for the length of time the tongs should be applied, the minimum voltage and the correct positioning of the electrodes, were common, and woeful ignorance of the requirements was found amongst slaughterhouse staff. It was all too common for the tongs to be used as a method of catching and immobilising the animal rather than an accurately placed and effective stunning instrument.

2. Association of Meat Inspectors:

"Humane killing" is a euphemism to stifle critisism. For half a century committees and investigators have been pronouncing on it.

The question that continually faces us is, how effective are the present slaughtering methods in minimising pain? Electrical stunning poses the greatest cause for concern as there is often uncertainty about how effective it is in stunning animals and there are reservations about the length of time the animals remained stunned. These doubts cover an eon of agony for millions of animals.

3. Research by Official Veterinary Surgeons of U.K.:

→ Humane stunning fails for 500,000 broilers a day.

Reports available give cause for concern that at least a third and possibly the majority of chicken may die a very inhumane death. The electric stunning of poultry is useless.

Research carried out by Official Veterinary Surgeons states that traditional stunning methods have been based on beliefs that have been proved to be fallacies.

The Veterinary Record report further states that in U.K. more than half a million chicken are sentient every day when they go to the knife.

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4. Compassion in World Farming:

Torture before slaughter: In many slaughterhouses, pre-stunning simply does not work, acting only as torture before slaughter. In short "humane slaughter" is a myth.

Why then is India advocating some thing which causes intense suffering? The humane angle is entirely lost and no purpose is served. This would be the second time that an eye-wash has been implemented in the case of the frog legs industry, the first one being when dipping the live frogs in a 10% common salt solution prior to them being cut into two was compulsory so that "cutting becomes easy and less painful and removes contaminating organisms". This was also recommended by the Central Institute of Fisheries Technology, Ernakulam, in 1967.

In conclusion: THERE IS NO SUCH THING AS PAINLESS KILLING irrespective of the method of so-called "humane" killing used.

Diana Ratnagar

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Chairperson, BEAUTY WITHOUT CRUELTY (India Branch)