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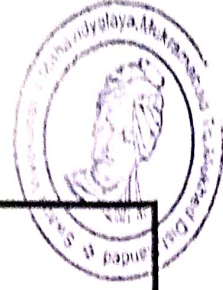
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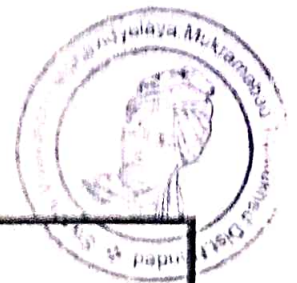
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७. बॉल बॅडमिंटन खेळाचा उदय व विकास

डॉ. दिलीप मोहनराव काळे

संचालक, शारीरिक शिक्षण व क्रीडा विभाग, स्वामी विवेकानंद महाविद्यालय, मुद्रमबाद.

प्रस्तावना

शिक्षण ही एक माणुस घडविणारी प्रक्रिया होय. मानवाच्या व्यक्तिमत्त्वातील सुप्त गुणांचा विकास करण्यासाठी शैक्षणिक प्रक्रिया अत्यंत पोषक ठरतात. प्राथमिक शाळेपासून ते उच्च शिक्षणापर्यंत व्यक्तिमत्त्व विकासाची प्रक्रिया निरंतरपणे घडत असते. त्यातून होणाऱ्या अंतर्बाह्य बदलांचा संबंध हा मानवी मनाशी आसतो. त्यामुळे मानवाच्या व्यक्तिमत्त्व विकासात शारीरिक, बौद्धिक आणि मानसिक विकासात संतुलन साधण्याची गरज आहे. हे आधुनिक शिक्षणतज्ञ सुद्धा मान्य करतात. व्यक्तिमत्त्व हळूहळू फुलविताना होणारे अंतर्बाह्य बदल घडविण्यात क्रीडा किंवा खेळ या प्रकारातही विशेष महत्त्व आहे.

शारीरिक शिक्षण ही नवी ज्ञानशाखा असून, या ज्ञानशाखेत विविध खेळांच्या तसेच खेळाडूंच्या समस्यांचा अभ्यास केला जातो. त्यात राष्ट्रीय तसेच विदेशी खेळांचाही समावेश होतो. श्रीपाल जर्दे यांच्या मते, खेळाडूंच्या व्यक्तिमत्त्वाचा सर्वांगीण विकास साधून त्यांना चारित्र्यसंपन्न असा आदर्श नागरिक बनविण्याचे कार्य शारीरिक शिक्षणाद्वारे करणे आवश्यक आहे.¹ खेळाच्या माध्यमातून शारीरिक तसेच अध्यात्मिक मूल्यांचे संगोपन होते व त्यातून सांस्कृतिक जीवनाला भक्कम आधार प्राप्त होतो.

शारीरिक शिक्षणाच्या अभ्यासाचे महत्त्व नवीन जगात वेगाने वाढत आहे. डॉनाल्ड च्यू यांच्या मते, Whereas games occur only in the present, sport has a demonstrated historic pattern-one that gives intreco grizable farm and that speaks for its continuation in the future.² विविध खेळांची प्रात्यक्षिके व त्याची उत्कृष्टता पाहता त्यातून त्यांची प्रकृती विकसित होते व पुढील परंपराही तयार होतात. शारीरिक शिक्षणाबाबतच्या ग्रामक गैरसमजूती दूर करून शारीरिक शिक्षणाकडे पाहण्याचा दृष्टिकोन बदलण्यासाठी आणि शारीरिक शिक्षणाचा प्रसार व प्रचार करण्यासाठी समाजशास्त्रीय तत्वांची आवश्यकता आहे.³

इतिहास व विकास

बॉल बॅडमिंटन हा भारतीय खेळ असून सतराव्या शतकाच्या मध्यावधीत विंगवा अठराव्या शतकाच्या सुरुवातीला तामिळनाडू राज्यातील तंजावर येथील मराठी राज्यात बॉल-बॅडमिंटनचा खेळ खेळला जात असल्याचे दाखले सापडतात. शिवछत्रपतींच्या चुलत घराण्याकडे तंजावरची जहागीर बासा



हमकाने चालत आली होती. घेऊन राज्यातील त्रावणकोर येथील राजघराण्यातील मंडळी आणि अमीर उमराव मंगोरजनासाठी हा खेळ खेळत असल्याचा देखील उतारा तेथील दप्तारात आढळतो.

बॉल बॅडमिंटन या खेळाबद्दल सांगताना भारतीय बॉल बॅडमिंटन असोसिएशनचे जनरल सेक्रेटरी एम. रंगा राव म्हणतात, Ball Badminton is a racket game played with a woollen ball of yellow colour, upon a court of fixed dimensions.⁴ याचा अर्थ असा की, बॉल बॅडमिंटन हा एक पिचक्या रंगाच्या वुलनच्या बॅडच्या सहाय्याने रॅकटसह खेळला जाणारा खेळ आहे. पुढे ते म्हणतात, 'The game was played as early as 1856 by the royal family in Tanjore district of Tamilnadu. It is extensively played for over three decades since the Ball Badminton Federation of India was formed in 1954. The Federation was recognised by the Government of India.'⁵ म्हणजेच १८व्या शतकाच्या मध्यामध्ये हा खेळ खेळण्यास सुरुवात झाली व १९५४ साली भारतात बॉल बॅडमिंटन फेडरेशनची स्थापना करण्यात आली.

या खेळाच्या महत्त्वात्मक सांगताना राव म्हणतात, Ball Badminton is one of the very few indigenous games of our country. It is one of the regular games in the school games nationals and inter university competitions. Ball Badminton has got six Arjuna Awardes among its players. This is a game having a rural origin.⁶ याचा अर्थ असा की, काही मोजक्या चांगल्या खेळांपैकी बॅडमिंटन हा एक खेळ असून हा शालेय स्तरावर राष्ट्रीय तसेच आंतर विद्यापीठ पातळीवरील स्पर्धांमध्ये खेळला जातो. बॉल बॅडमिंटनच्या खळाडूंमधून सहा अर्जुन अवार्ड विजेते खेळाडू आहेत आणि या खेळाचा उगम हा ग्रामीण भागातला आहे.

मूळ भारतीय खेळ

मुळात बॅडमिंटन हा खेळ देखील भारतीयच आहे. आज संपूर्णपणे पाश्चत्य स्वरूप असलेला हा खेळ सुमारे सव्वाशे वर्षापूर्वी खडकी येथील गोऱ्या सोजिराच्या छावणीत खेळला जात असे. म्हणून सुरुवातीला त्याचे नावाभिधान 'पूना गेम' असेच होते.⁷ १८५७ च्या स्वातंत्र्य समारंंतर मायदेशी परतणाऱ्या सोजिरांनी हा खेळ आपल्याबरोबर इंग्लंडमध्ये नेला. बरोबर भारतीय बनावटीची शटर -कार्ड देखील नेली. ग्लुस्टरशायमध्ये राहणाऱ्या ड्यूक ऑफ ब्युफोर्ट या उमरावाला सतत नवीन नवीन प्रकार शोधून काढण्यात मोठा रस होता. त्याने या सोजिरांना आपल्या बॅडमिंटन या गावी नेऊन पूना गेम या नव्या भारतीय खेळाचे बदलून करण्याचे आमंत्रण दिले. तिथे मेजवानीला जमलेल्या अमीर उमरावांना हा खेळ परतत पडला आणि तेव्हापासून बॅडमिंटन खेळ हे नावाभिधान रूढ झाले.⁸ अशा प्रकारे हा खेळ पुढे रूढ होत गेला.



सभोवताली असलेल्या हिरवळीवर खेळण्यात येणारा हा खेळ इंग्लंडमधील सतत पडणाऱ्या पावसामुळे नंतर राजवाड्यातील दरबार हॉलमध्ये विंवा डान्स हॉलमध्ये खेळला जाऊ लागला. या बॅडमिंटनच्या खेळाचे नाव चेंडूफळीच्या खेळाशी वेव्हा जोडले गेले आणि 'बॉल बॅडमिंटन' हे नाव वेव्हा प्रचारात आले याची अधिवृत माहिती मात्र उपलब्ध नाही; परंतु एकोणिसाव्या शतकाच्या अखेरच्या काळातच 'बॉल बॅडमिंटन' हे नाव रूढ झाले असावे. सन १९०० मध्ये रतनलाल नावाचा तंजावरचा रहिवासी मद्रास येथे आला आणि त्याने स्वातंत्र्यसमराच्या धामधुमीत नामशेष झालेला बॉल बॅडमिंटनचा खेळ परत सुरू केला असा उल्लेख आढळतो.^१ दक्षिण भारतात हा खेळ खूपच लोकप्रिय आहे. आज लाकडी सांगाड्याची रॅकेट आणि लोकरांचा पिवळा चेंडू यांच्या सहाय्याने हा खेळ खुल्या मैदानात खेळला जातो.

या खेळाचा दिवसेंदिवस खेळण्याकडे कल वाढत चालला होता. ट्रेड स्टाफ क्लब ऑफ मद्रास या संस्थेने विसाव्या शतकाच्या सुरुवातीला बरेच परिश्रम करून बॉल बॅडमिंटन या खेळाची पहिली वहिली नियमावली बनविली आणि १९०६ साली बॉल बॅडमिंटनची स्पर्धा मद्रास येथे आयोजित करण्यात आली.^२ सुरुवातीच्या काळात पेन्शनरांचा खेळ विंवा बायकांचा फावल्या वेळातील मनोरंजनाचा प्रकार म्हणून या खेळाची उपेक्षाच झाली. परंतु सुधारित रॅकेटस आणि चेंडूचे वाढविलेले वजन यामुळे खेळाच्या गतिमानतेत वेगढी तरा स्थित्यंतर घडून आले. त्यामुळे आज हा बॉल बॅडमिंटनचा खेळ अत्यंत वेगाने खेळला जातो. वजनदार लोकरांचे चेंडूमुळे खुल्या आवारात खेळल्या जाणाऱ्या या खेळाला बंदिस्त क्रीडागणाची आवश्यकता नाही. त्यामुळे शहरापेक्षा ग्रामीण भागातच बॉल बॅडमिंटन अधिक खेळला जातो.

बॅडमिंटनशी साधर्म्य असलेला खेळ

बार्जेस यांच्या मते, बॅडमिंटनशी बरेच साधर्म्य असलेला हा एक खेळ आहे. या खेळात फुलाऐवजी पिवळ्या रंगाचा लोकरांचा चेंडू वापरतात. त्याचा व्यास ५.०८ ते ५.३५ सें. मी. असून, वजन १३.११ ते १४.५७ ग्रॅम असते.^३ या खेळात वापरली जाणारी रॅकेट टेनिस रॅकेटपेक्षा हलकी व बॅडमिंटन रॅकेटपेक्षा काहीशी जड व जाड तातीने विणलेली असते. बॉल बॅडमिंटनच्या ग्राऊंडविषयी सांगताना बार्जेस म्हणतात, या खेळाचे क्रीडांगण २४.४० मी. x १२.२० मी. असते. त्याच्या मध्यभागी १.८२ मी. उंचीवर जाळे बांधलेले असते.^४ या खेळात एकूण किती खेळाडू असतात व हा खेळ कशा प्रकारे खेळला जातो याबाबत सांगताना बार्जेस म्हणतात, हा खेळ प्रत्येक पाच खेळाडूंच्या दोन संघात खेळला जातो. खेळाडू क्रीडांगणाच्या आपापल्या अर्ध्या भागात पुढे दोन, मागे दोन व मध्यभागी एक याप्रमाणे उभे राहतात. बॅडमिंटनप्रमाणेच जाळ्यावरून चेंडू रॅकेटने



माणेपुढे अधांतरी टोलवीत राहणे, हे या खेळाचे स्थूल मानाने स्वरूप होय.^{१३} या खेळाचा एक डाव २९ गुणांचा असतो व तीन डावांपैकी दोन जिंकणारा सामन्याचा विजेता ठरतो.

समासौष

बॉल बॅडमिंटन हा सांघिक व दुहेरी खेळ आहे. असा दोन्ही पद्धतीने खेळला जातो. सांघिक खेळामध्ये प्रत्येक संघात सात खेळाडू असतात. सामन्यात प्रत्यक्ष क्रीडांगणात पाचच खेळाडू खेळतात. दोन खेळाडू राखीव असतात, तर दुहेरी खेळामध्ये प्रत्येक संघात दोन खेळाडू असतात. हा खेळ खेळताना सर्किटसल फार महत्त्व आहे कारण प्रत्येक गुणची सुरुवात सर्किटस करूनच केली जाते. आपल्या बाजूने बॅड टोलवून प्रतिस्पर्धी टिमच्या बाजूला जाऊन पडेल असा फटका मारण्याच्या पद्धतीचा सर्किटस करणे असा सरळ अर्थ अनेक खेळाडू करतात. बॉल बॅडमिंटन खेळात एकूण पाच खेळाडू खेळतात, पैकी दोन खेळाडू पुढील फळीत, एक मध्यभागी आणि दोन खेळाडू मागील फळीत खेळतात. बॉल बॅडमिंटन खेळ खेळण्यासाठी लाकडी रॅकेट व लोकरीच्या बॅडूचा वापर केला जातो. या खेळाला सांघिक खेळ असे म्हणतात. गुणांचा एक डाव ह्याप्रमाणे सर्वोत्तम तीन डाव खेळले जातात. बॉल बॅडमिंटन खेळ दुहेरी पद्धतीने देखील खेळला जातो दुहेरी पद्धतीमध्ये एक खेळाडू पुढे व एक मागे ह्या पद्धतीने खेळतात. दुहेरी खेळात क्रीडांगणाची रंदा सांघिक खेळासाठी लागणाऱ्या क्रीडांगणाच्या रंदापेक्षा निम्मी असते. इतर सर्व मापे व नियम सांघिक खेळाप्रमाणेच आहेत.

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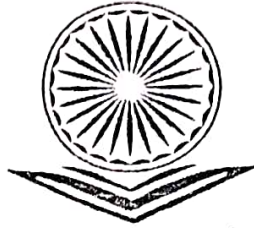
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18. Agro - Based Industries in India

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Abstract

Agriculture and industry have traditionally been viewed as two separate sectors both in terms of their characteristics and their role in economic growth. Agriculture has been considered the hallmark of the first state of development, while the degree of industrialization has been taken to be the most relevant indicator of a country's progress along the development path. Moreover, the proper strategy for growth has often been conceived as one of a more or less gradual shift from agriculture to industry, with the onus on agriculture to finance the shift in the first stage.

Keywords: definition, importance, Agro-based industry, agro-based industries in India.

Introduction

Industrial development not only depends on innovation and capital outflow in a country, but also it needs availability of raw materials and adequate physical infrastructural facilities. Agriculture is one of the major raw materials providing sector for major industries like paper, sugar, textile, fertilizers, chemical, edible oil, etc., Agro-based industries can play an important role to a large extent in solving the problem of poverty, unemployment and inequality in India and can significantly contribute to the overall development of the economy by efficiently utilizing the local raw materials which consequently may result in increase of gradual employment opportunities to poor people mainly landless, marginal and small farmers. This paper discuss in the performance of agro based industries in India.

This view, however, no longer appears to be appropriate. On the one hand, the role of agriculture in the process of development has been reappraised and re-valued from the point of view of its contribution to industrialization and its importance for harmonious development and political and economic stability. On the other hand, agriculture itself has become a form of industry, as technology, vertical integration, marketing and consumer preferences have evolved along lines that closely follow the profile of comparable industrial sectors, often of notable complexity and richness of variety and scope. This has meant that the deployment of resources in

agriculture has become increasingly responsive to market forces and increasingly integrated in the network of industrial interdependencies.

Objectives of the Study

- i) To study the Agro-based industries.
- ii) To study the Agro-based industries in India.

Data and Methodology

For the present study agro-based industries in India has been considered as a basic units for investigation. The present research is based on secondary sources i.e. Central Statistics Office (Economic Survey 2014-15), India, Famine Enquiry Commission, 1994, Annual Survey Industries Report 2013-14, articles and books are used in this research paper.

Definition of Agro-Based Industries

'Agro-based industry' is an omnibus expression. It could cover a variety of industrial, manufacturing and processing activities based on agricultural raw materials as also activities and services that to as inputs to agriculture. Some of the definitions are as below.

"Agro-based industries are those industries which have either direct or indirect links with agriculture." (S.N. Bhattacharya, Rural Industrialization in India, BR Publishing Corporation, Delhi, 1980, P.192.)

"Agro-based industries are those, which are involved in supplying the farm with agricultural inputs besides handling the products of the farm." (India, Famine Enquiry Commission, 1944)

"An agro-industry is an enterprise that processes raw materials, including ground and tree crops as well as livestock. The degree of processing can vary tremendously, ranging from the cleaning and grading of apples to the milling of rice, to the cooking, mixing and chemical alteration that create a texturized vegetable food... agro industries can be roughly categorized according to the degree the raw material is transformed. In general, capital investment, technological complexity, and managerial requirements increase in proportion with the degree of transformation." (James E. Ausin, Agro-industrial Project Analysis, John Hopkins University Press, London, 1981, P.3.)

A common and traditional definition of agro-based industry refers to the subset of manufacturing that processes raw materials and intermediate products derived from the



agricultural sector. Agro-based industry from the agricultural sector. Agro-based industry thus means transforming products originating from agriculture, forestry and fisheries.

Importance of Agro-Based Industries

- Establishment of Agro-based industries at a Particular place is based on the availability of raw material.
- Establishment of agro-industries in rural areas helps in the upliftment of rural economy.
- Agro-industries provide employment opportunities to rural population.
- Setting up of agro-based industries in rural areas will generate income thereby improving the economic conditions of the people, which in turn create the potential for demand based industries.
- Establishment of Agro-based industries in rural areas will help in:
Dispersal of industries, reducing, exploitation of producers by middleman, assuring a better price to producers, bringing more areas under different crops, reducing wastage of perishable agricultural commodities, increasing the incomes of farmers, development of backward areas, preventing in the migration of people from rural areas to urban areas.

Agro-Based Industries

Agricultural products are shaped by technologies of growing complexity, and the incorporate the results of major research and development efforts as well as increasingly sophisticated individual and collective preferences regarding nutrition, health and the environment. While one can still distinguish the phase of production of raw materials from the processing and transformation phase, often this distinction is blurred by the complexity of technology and the extent of vertical integration. The industrialization of agriculture and development of agro processing industries is thus a joint process which is generating an entirely new type of industrial sector.

1) Agro-produce Processing Units

They merely process the raw material so that it can be preserves and transported at cheaper cost. No new product is manufactures. Ex : Rice Mills, Dal Mills etc.

2) Agro-Product Manufacturing Units

Manufacture entirely new products. Finishing goods will entirely different from its original raw material Ex : Sugar factories, Bakery, Solvent extraction units, Textile mills etc.

3) Agro-Inputs Manufacturing Units

Industrial units which produce goods either for mechanization of agriculture or for increasing productivity come under this type Ex : Agriculture implements, seed industries, pumpset, fertilizer and pesticide units etc.

4) Agro Service Centre

Agro service centre are workshops and service centre which are engaged in repairing and servicing of pump sets, diesel engines, tractors and all type of farm equipment.

Agro-Based Industries in India

Agro industry is an enterprise that processes raw materials, including ground and tree crops as well as livestock. The degree of processing can vary tremendously, ranging from the cleaning and grading of apples to the milling of rice, to the cooking, mixing and chemical alteration that create a texturized vegetable food agro industries can be roughly categorized according to the degree the raw material is transformed. In general, capital investment, technological complexity and management requirements increase in proportion with the degree of transformation.

Table 1 : Agro-Based Industries in India

Sr.	Description	Industries	Productive Capital*	Workers
1	Food products	35346	21979802	1232679
2	Textiles	18645	24860635	1267670
3	Rubber and plastic products	13147	10079179	466790
4	Tobacco products	3294	1310788	425799
5	Beverages	2103	3881305	121346
6	Paper and paper products	6810	5415903	193026
7	Cotton, ginning, cleaning and bailing, seed processing for propagation	3301	1474036	73096
8	Wood and products of wood and cork, except furniture	4269	891952	60034
	Total	86915	69893600	3840440

* Capital measured as Rs. in Lakh

Source : Annual Survey Industries-2013-14



Table No.1 shows that, as per the annual survey of industries 2013-14, there are 8815 agro based industries with 3840440 workers and its productive capacity amounted to Rs.69893600 Lakhs.

Agro-based industries can provide increasing employment opportunities to the kindles poor's and rural peoples. Agro-based industries will help to diversification of rural economy it will help to reduce extreme dependence only on agriculture which makes for in stability of rural economy. Agro-based industries would help to solve the unemployment and under employment especially among landless agricultural labour and tribal population.

Table 2: Agro-based Manufacturing Industries Production Growth Rate in India

Sl.	Industry Group	2009-10	2010-11	2011-12	2012-13	2013-14
1	Food products and beverages	133.5	142.9	164.8	169.5	167.7
2	Tobacco products	102.0	104.1	109.7	109.2	110.2
3	Textiles	127.4	135.9	134.0	142.0	148.3
4	Wood and products of wood and crops, except furniture, manufactures of articles of straw	160.1	156.5	159.2	147.9	144.6
5	Paper and paper products	121.1	131.4	138.0	138.7	138.6
6	Rubber and plastic products	167.4	185.2	184.6	185.0	181.1
	Total	811.5	856.0	890.3	892.3	890.5

* Base 2004-05=100

Source : Central Statistics Office (Economic Survey 2014-15)

Table No. 2 reveals that agro-based manufacturing industries production growth rate in the year 2009-10 was 811.5 and it has been increased to 890.5 in the year 2013-14. Agro-based industries has been consistently growing in India during the year 2009-10 to 2013-14.

Agro-based industries by providing employment and income to rural masses would help to reduce extreme inequalities of income that persist today in Indian economy because industries have got concentrated in urban areas. Agro-based industries would thus be a step in the direction of reducing extreme inequalities of income and wealth both in rural and direction of establishing socialist pattern of society. It ensure to rural people for employment and steady income. Agro based industry is the most important factor of poverty alleviation and developed the socio-economic rural people.

Table 3: Exported Agro-based Products

Sl. No	Commodity	2014-2015			2015-16 (Prov.)		
		Quantity	Value	%	Quantity	Value	%
1	Rice (Basmati)	1698.91	1516.28	23.33	2388.82	2172.52	23.01
2	Rice (Except Basmati)	8278.23	3136.84	17.08	3824.16	1398.39	14.81
3	Spices	926.02	2430.35	12.44	491.29	1472.71	15.60
4	Cashew	131.57	909.26	4.65	59.08	452.58	4.79
5	Sugar	1955.19	871.41	4.46	1639.48	611.81	6.48
6	Other Cereals	1514.35	869.11	4.45	645.48	162.33	1.74
7	Wheat	2924.05	828.75	4.24	415.92	102.5	1.08
8	Coffee	221.04	814.02	4.18	147.07	460.25	4.87
9	Fresh Vegetables	2061.00	763.24	3.90	923.63	388.05	4.11
10	Groundnut	708.39	760.37	3.89	219.74	278.07	2.94
11	Tea	215.41	681.79	3.49	137.07	414.98	4.39
12	Processed Fruits & Juices	-	592.26	3.03	-	330.38	3.49
13	Fresh Fruits	486.94	516.26	1.64	231.06	244.56	2.59
14	Cereal Preparations	305.43	496.41	2.54	188.15	298.47	3.16
15	Processed Vegetables	-	281.75	1.44	-	145.82	1.54
16	Pulses	222.14	199.86	1.02	130.44	122.51	1.29
17	Other Oil Seeds	247.54	185.03	0.94	116.89	86.13	0.93
18	Milled Produced	419.86	168.76	0.88	259.99	101.01	1.06
19	Cocoa Products	20.88	138.87	0.74	19.55	108.34	1.15
20	Vegetable Oils	42.05	94.56	0.48	15.23	46.35	0.49
21	Fruits & Vegetable Seeds	12.05	69.96	0.38	3.61	42.48	0.48
	Total	26394.88	19525.14	100	11857.92	9440.33	100

* Quantity measured as Thousand Million Tonnes and Value measured as million in \$

Source : Ministry of Commerce and Industry

In the year 2014-15, export of Agro-based industries quantity amounted a 26394.88 thousand million tones with the value of \$19525.14 million, of which basmati rice (23.33%) is the major agro based export products. In the year 2015-16, export of agro based industries quantity amounted to 11857.92 thousand million tones with the value of \$9440.33 million of which basmati rice (23.01%) in the major agro based export products.



Conclusion

The Agro-based industry includes related to textiles, sugar and vegetable oil. These industries use agricultural products as their raw materials. Textile industry is the largest industry in organized sector.

The impact of agro-based industries was significant on the income levels of all categories of the rural population. The increase in income was more spectacular in the households of agriculture workers employed in agro-based industrial units. Agro-based industries in India is one of the basic and backbone of Indian economy which provide employment, income generation, industrial inputs and outputs, regional growth and associated with all kind of walks of human beings. Growth of agricultural sector became a growth of socio-economic development of the country. Therefore it is concluded that, there is a vast scope in the export of agro-based products in future with huge volume of foreign exchange.

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5. Geochemistry of Groundwater of Terekhol River Basin, Sindhudurg District, Maharashtra

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Abstract

To study the geochemistry of groundwater from Terekhol River and its quality total sixty five (65) samples of groundwater were collected in May-2015. Standard methodology was adopted while collecting water sample from Dug wells (DW), Bore wells (BW). Electrical Conductivity (EC), pH and TDS were measured in the field with portable meter, while cations (Na, K, Ca, and Mg) were analyzed on ICPAES-9000 (Shimadzu, Japan) and Anions (NO_3 , SO_4 , Cl, and HCO_3) were measured on High Performance Ion Chromatography (HPIC). From physico-chemical data of groundwater, it is observed that Calcium (Ca) is dominant cation than Sodium (Na), Magnesium (Mg) and least is Potassium (K). Major source of all these cations in groundwater are from the lithologies present in that area. In anions, Bicarbonate is dominant and dissolution of atmospheric gases in the soil by rain water and weathering are the sources of it in groundwater. Remaining anions i.e. Chloride (Cl), Sulphate (SO_4) and Nitrate (NO_3) found high in groundwater in patches due to anthropogenic, agricultural activity and domestic effluents. So, the quality of groundwater is good for drinking purpose, but in future, may be due to more extraction of it will lead to contamination.

Keywords: Geochemistry groundwater Terekhol river Basin,

Introduction

The groundwater is essential resource in India for drinking, agricultural and industrial purpose (Wagh et al, 2016). Similarly, in Maharashtra, coastal populations are mostly dependent on groundwater (Gaiikwad, 2012). As the groundwater quantity and quality modifies due to topography, climate, geological heterogeneity and lithologies through which it is flowing i.e.

aquifer, evaporation and land use and land cover pattern (Freeze and Cherry, 1979; Hem, 1991; Raghunath, 1996; Ramgir, 2011; Brindha and Elango, 2013)

In the area under investigation varied lithologies are present from Precambrian to recent in age (GSI, 2001). So study of groundwater chemistry will give clues about the factors responsible for changes in elemental concentration of groundwater. As the proposed area is studied by few governmental agencies and workers (CGWB 1992, 1995, 2001; GSDA, 2003; GSI, 2001; Gaikwad, 2008, 2012). So, the present work is undertaken to study in details the chemistry of groundwater of Terekhol river basin and its quality in comparison with WHO standards parameters.

Study Area and Geology of Area

The study area is Terekhol river basin in the southern part of Sindhudurg district of Maharashtra, India. The study area is bound by Longitudes $73^{\circ} 61'$ to $74^{\circ} 90'$ E and latitudes $15^{\circ} 70'$ to $16^{\circ} 60'$ N and is included in the Survey of India's toposheets No. 47 W/1, 47 H/16, 47 L/4, 48E/5, E/9, E/10, of scale 1:50,000. It covers an area of about 687.5 sq.km. The origin of Terekhol River is in the Western Ghats and it meets to the Arabian Sea at Querim, Goa (Fig 1). Geologically area under investigation having lithologies ranges in age from Precambrian to Recent (GSI, 2001) (Fig 1)

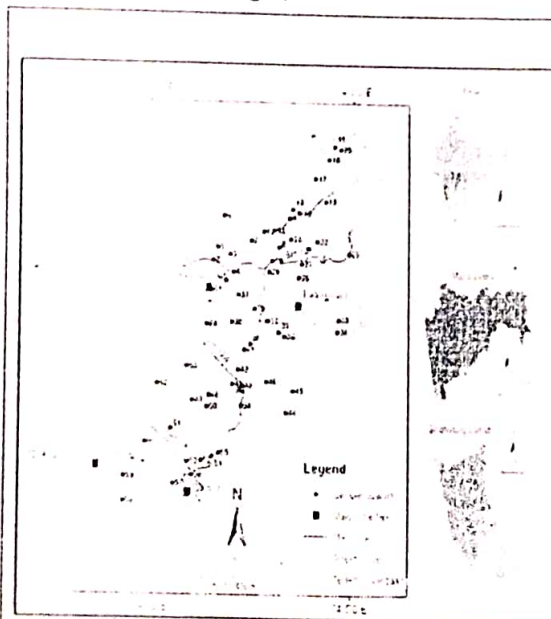


Fig 1 Location map and sampling location of water samples in Terekhol River basin

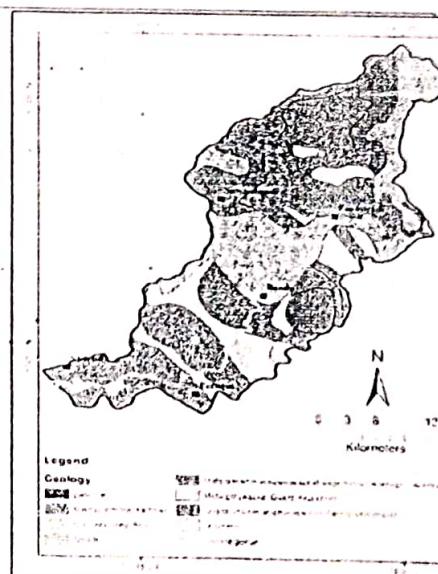


Fig 2: Geology of the study area (GSI, 2001)



Methodology

Total Sixty Five (65) samples of groundwater collected from Terekhol river basin (Pre-monsoon 2015) Sample were collected from Dug wells (DW), Bore wells (BW), in one liter and 125 milli-liter polyethylene bottles which were pretreated with acid and rinsed by distilled water two to three times to avoid contamination (APHA, 1998) Then these bottles were acidified (for cations 125 ml), properly sealed and labeled for laboratory analysis. Separate water samples also collected for anions studies without acidification in polyethylene bottles.

The EC, pH and TDS were measured in the field with potable meter (eco Testr pH and EC meter Hanna Instruments Model number-CD 98303) Cations (Na, K, Ca, and Mg) were analyzed on ICPAES-9000 (Shimadzu, Japan) with Merk Standards (Germany Made) and Anions (NO_3 , SO_4 , Cl, and HCO_3) were measured on High Performance Ion Chromatography (HPIC) using anion column in laboratory of Department of Geology, Savitribai Phule Pune University. Further obtained data subsequently corrected (cation-anions balance error $\pm 5\%$) (Honuslow, 1995) and used to make spatial maps of cations and anions using Arc GIS 9.2

Result and Discussion

Spatio-Temporal Variation in pH and EC

The high pH is recorded in the northern and northwestern part and low pH value in southern west part of the study area (Fig 3) The highest and lowest pH value is 8.2 and 5.53 respectively with a mean of about 6.94, indicating near about alkaline nature (Hem, 1991) Most of the samples show to some extent alkaline pH of groundwater ($\text{pH} > 7$) High EC values are reported near the mouth of river. The value of EC ranges from 14 $\mu\text{S}/\text{cm}$ to 585 $\mu\text{S}/\text{cm}$ (Fig 4) The EC values recorded in basin are average which give information of low mineralization in basin (Pawar et al, 2008)

Spatial variation in Cations

Sodium (Na), Potassium (K), Calcium (Ca), and Magnesium (Mg) were studied in cations. The high values of Na are seen in North east, South west and North west side of basin (Fig 5). These high values of Na may be due weathering and leaching of local lithologies of that area (Keesari et al, 2013). The map of K ion shows high values in south west side of map this indicates use of fertilizers in that area (Pawar et al, 2008). Otherwise in the most of the studied area showing low K values (Fig 6) indicating low K bearing minerals (Subbarao et al, 1994) Calcium (Ca) is the dominant cation in the study area. High Ca values (Fig 7) in groundwater are

reported from central and northern parts suggesting dominance of hydroxyl bearing feldspar, pyroxene and amphiboles (Hem, 1999; Han and Buchanan, 2016). High Magnesium (Mg) values are seen in central part of the basin indicating weathering of ferromagnesian minerals and rock-water interaction (Hem, 1999) (Fig 8).

Spatial Variation in Anions

Bicarbonate is the dominant anion in the study area. The values of Bicarbonate are highest in central north-west and north-west side of map (Fig 9). This high value of bicarbonate in that area is due to supply of CO_2 and dissolution of atmospheric gases in the soil by rain water (Pawar et al, 2008; Hem, 1999). High values of Cl (Fig 10) in central and north-west part of the basin may be due to subsequent activity (i.e. domestic effluents, fertilizers and septic tanks) (Yang et al, 2013). High Sulfate (SO_4) values (Fig 11) are reported in north-east side of basin this may be due to more use of fertilizers and human influence (Sureshramoorthy et al, 2011; Pawar et al, 2008; Al-Aboudi, 2011). High Nitrate (NO_3) values are found in patches form in map (Fig 12) indicate local human activities, animal waste and use of nitrogenous inorganic fertilizers (Dhandra et al, 2010; Wu and Sun, 2016).

Groundwater Quality for Drinking Purposes

The water to be used for drinking purposes must meet very high standards of physical, chemical and biological purity (CGWB, 1993, 1995, 2001). It should be clear, transparent with constant temperature and also free from undesirable physical properties like cloudiness, objectionable colour and taste (Edmunds, 1997; Rudra Rao, 2018).

Certain minimum quality parameters for this requirement have been suggested by World Health Organization (WHO, 1971). This has been included in Table 1. The minimum and maximum values of groundwater samples from study area have also been given. It is evident from these values that major ions are under the permissible limits given by (WHO, 1971). Except pH, Electrical conductivity (EC) and Alkalinity (HCO_3) all elements showing optimum to high value prescribed by World Health Organization.

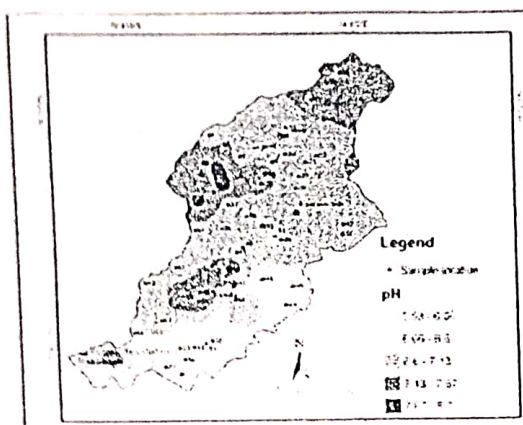


Fig.3: Spatial variation of pH

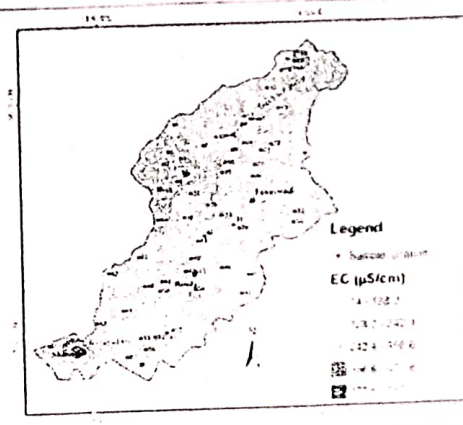


Fig.4: Spatial variation of Electrical Conductivity (EC)

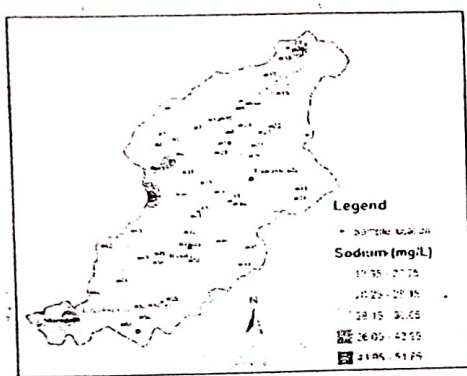


Fig.5: Spatial variation of Sodium (Na)

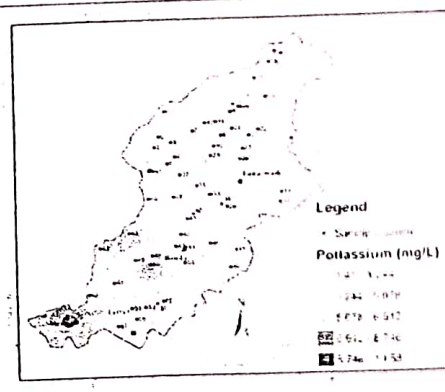


Fig.6: Spatial variation of Potassium (K)

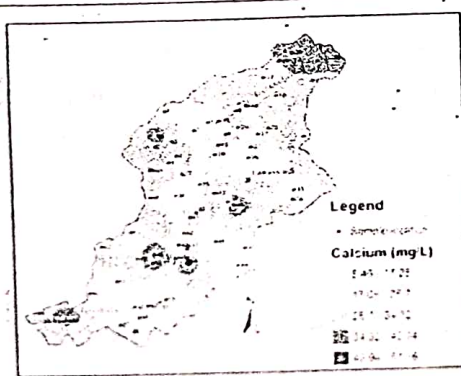


Fig. 7: Spatial variation of Calcium (Ca)

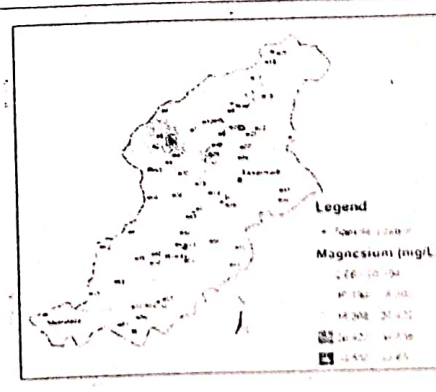


Fig.8: Spatial variation of Magnesium (Mg)

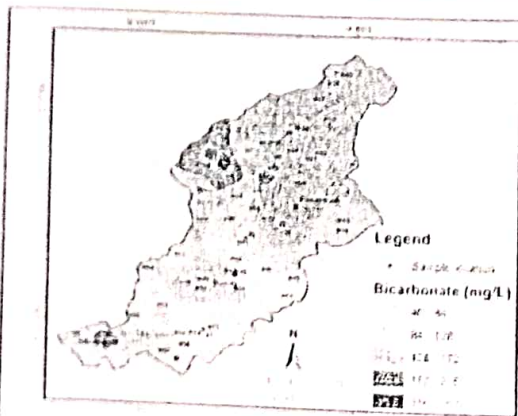


Fig 9 Spatial variation of Bicarbonate (HCO_3)

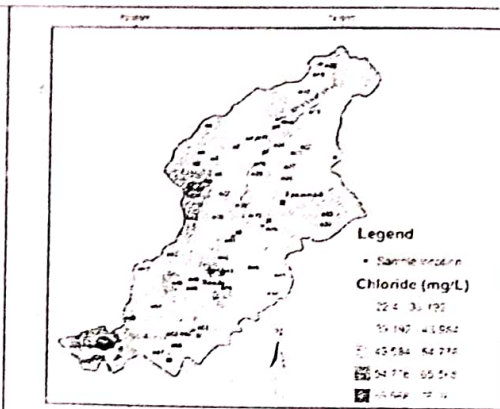


Fig 10: Spatial variation of Chloride (Cl)

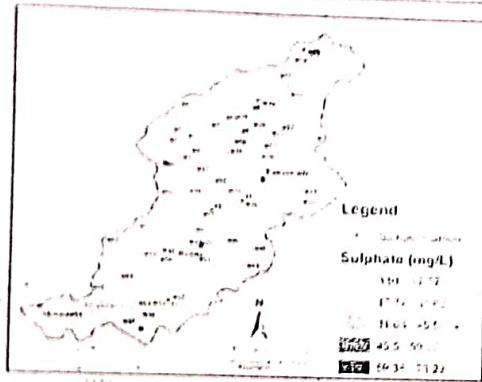


Fig 11: Spatial variation of Sulphate (SO_4)

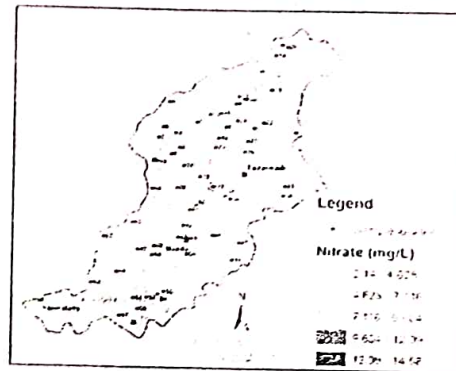


Fig 12: Spatial variation of Nitrate (NO_3)

Table.1: Physico-Chemical Data of Major Elements of Water Samples and Water Quality for Drinking Purpose in Study Area (All Values are in Mg/L Except Ph and EC in)

S N	Statistics of Physico-chemical analysis of Groundwater				Groundwater Quality for Drinking (WHO,1971)			
	Parameters	Min	Max	Mean	Permissible limit for Drinking	Below	Optimum	Higher
1	pH	5.53	8.2	6.94	6.9-9.2	43.08 %	56.92%	----
2	EC	14	585	191.97	300 $\mu\text{mhos/cm}$	88%	----	12%
3	TDS*	9.1	380.25	126.75	500-	100%	----	----



					1500mg/l			
4	Na ⁺	12.35	51.85	23.31	50-60 mg/l	96.92 %	3.07%	----
5	K ⁺	1.41	10.58	4.5	20 mg/l	100%	----	----
6	Ca ²⁺	8.46	51.56	27.44	75-200 mg/l	100%	----	----
7	Mg ²⁺	2.08	42.65	11.24	30-150 mg/l	95.38 %	4.61%	----
8	Cl ⁻	22.4	76.36	37.92	200-600 mg/l	100%	----	----
9	HCO ₃ ⁻	40	260	135.69	200 mg/l	86.15 %	6.15%	7.69%
10	SO ₄ ²⁻	3.91	73.22	8	200-400 mg/l	100%	----	----
11	NO ₃ ⁻	2.14	14.58	6.01	45mg/l	100%	----	----

*WHO(1997)

Summary and Conclusion

Present work is undertaken to study the chemistry of groundwater of Terekhol river basin and its quality in comparison with WHO standards parameters. It is found that the highest and lowest pH value is 8.2 and 5.53 respectively with a mean of about 6.94, indicating near about alkaline nature. While the EC values recorded in basin are average which give information of low mineralization in basin. In cations, Calcium (Ca) is the dominant and high in the central and northern parts suggesting dominance of lithologies bearing feldspar, pyroxene and amphibole Sodium (Na) in groundwater due to leaching from lithologies. In cations low K in groundwater indicating meager presence of K bearing minerals. High Magnesium values in groundwater due to weathering of ferromagnesium minerals and rock-water interaction. In anions Bicarbonate in the study area is the dominant anion. The source of this is due to supply of CO₂ and dissolution of atmospheric gases in the soil by rain water and weathering also.

High values of Chloride (Cl), Sulphate (SO₄) and Nitrate (NO₃) reported in patches may be due to anthropogenic activity (i.e. domestic effluents, fertilizers and septic tanks).

The water quality of groundwater was studied in comparison with WHO (1971) standards, showing optimum to high value of pH, Electrical conductivity (EC) and Alkalinity (HCO₃) in groundwater. So, on an average the quality of groundwater is good for drinking purpose, but due to more extraction of it will lead it to contamination in future. So proper

development and management of precious groundwater resources is required for sustainable use of water.

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6. Study of Sea Water Intrusion along the Querim Beach, Goa using Vertical Electrical Sounding (VES)

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Abstract

To know the extent of intrusion of saline water in Querim area of Goa, Vertical Electrical Sounding (VES) studies has been carried out. In all, four (04) electrical resistivity soundings were conducted. In that, Schlumberger VES technique was employed for delineating vertical and lateral changes in resistivity. In addition to this, hydrogeological study of the dug well (DW) and bore well (BW) also studied to know the extent of intrusion, directly. The water level in these wells ranges from 2.17 to 19.23 meter bgl during premonsoon and 0.43 to 14.90 m bgl during post monsoon. Most of VES were carried out near well sites DW-1, DW-2 and DW-3. The depth of penetration is restricted to a depth of 35 m. It is found that, DW-1 and BW-4 show low values of resistivity below about 6 m depth, indicating the presence of seawater or mixed zone below this depth. However, at other sites, there is no indication of the seawater mixing upto 30 m depth. Presently, seawater intrusion in the study area is confined only upto 60 to 80 m from the coast under normal rainfall conditions and present draft pattern. In general, wells located in low lying sandy alluvial areas show seawater mixing than the wells located in laterites at higher altitudes. Seawater intrusion may further advance inland if withdrawals of groundwater by tourist establishments continue to increase in the coming years. Groundwater salinity needs to be continuously monitored near the coastal area, especially within 16 km from the coast. So proper development and management of groundwater resources especially by rain water harvesting, rooftop harvesting is needed to be initiated to lessen the problem of sea water intrusion in future.

Keywords: Sea water intrusion, Querim beach, Goa, Vertical Electrical Sounding

Introduction

Groundwater is a major source used for different purposes in the coastal belts (Chachadi, 2005). Excessive extraction of this is now vulnerable to saline water intrusions into the freshwater aquifers and in some cases to land subsidence in coastal flatlands (Andreasen and Fleck, 1997; Barbecot, et al, 2000, Capaccioni, et al, 2003; Chachadi, 2003). In general, the extent of saline water intrusion in any coastal area is influenced by the physico-chemical properties of the geological formations, sea to inland hydraulic gradient, and the rate of recharge and withdrawal of groundwater (Freeze and Cherry, 1979). The variations in sea level and changes in aquifer recharge control the processes at the interface between the freshwater and seawater.

Salt water intrusion can usually be observed using different tools and methods like chemical analysis of groundwater resources, observation of the water table, geophysical techniques, geological evaluations and isotopic studies. Many workers in India and abroad have studied saline water intrusion problem using geochemical, hydrogeological, geophysical, and stable isotope techniques (Andreasen and Fleck, 1997, Barbecot, et al, 2000, Capaccioni, et al, 2005, Gattacceca, et al, 2007, Gopnath and Srinivasamoorthy, 2013, Anilkumar et al, 2013, Rina et al, 2013, Moghimi, 2016, Di Sipio et al, 2006, Post et al, 2003).

As the area under investigation is a coastal beach site and having inevitable saline water intrusion. So to know the extent of saline water intrusion along with geology of the area has been studied using geophysical and hydrogeological methods.

Study Area

Querim area is located in Pernem taluka of North Goa within the watersheds of Terekhol River and covered in Survey of India toposheets number 48E/10 on 1:50,000 scale. Querim is 17 km west from Pernem Municipal Area. It is bound by river Terekhol in north and from Arabian Sea in the west. The location co-ordinates of the area are 15°42'47.94" N and 73°41'54.52" E and elevation range 1 to 11 meter altitude from msl (Fig 1).

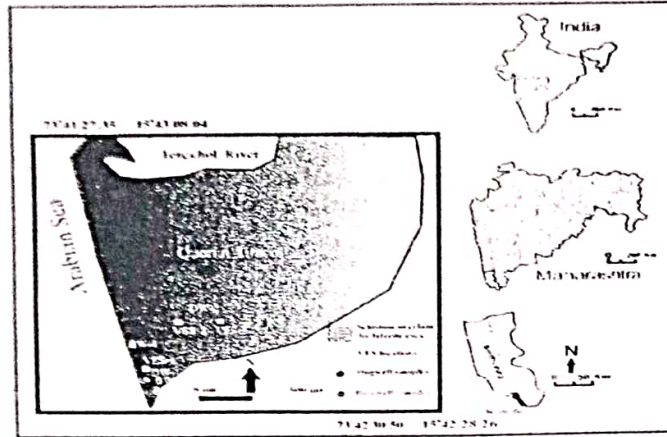


Fig.1: Location map, Geology and sampling locations of Querim beach, Goa

Physiography and Climate of Study Area

Physiographically the Querim area can be broadly divided into three distinct morphological units from west to east namely, 1. Coastal plain with marine land forms on the west. 2. Vast stretch of plains adjoining the coastal plain and 3. Low dissected denudational hills & tablelands towards the east. (CGWB, 2012; CGWB, 2013).

According to the Central Groundwater Board (CGWB, 2010), temperature ranges from 20°C to 34°C. The temperature is highest (around 34°C) in pre-monsoon months of April & May and again in post monsoon months of November & January. Due to proximity to the Arabian Sea, humidity throughout the year is more than 60% with range from 80 to 90% during monsoon period (CGWB, 2010). Average annual rainfall of the study area is 2929.10 mm (CGWB, 2010).

Geology of Querim Beach

The area under investigation is part of Bicholim Formation of Goa Group, dominated by Quartz sericite schist of Archean age while sand, alluvium, lateritic soil and laterite of Late Cenozoic to Recent in age is also reported there (Dessai, 2013). While in beach are consists of fine to coarse sands with intercalations of sandy loam, silt and clay (Fig.1).

Hydrogeology of the Study Area

Groundwater in the study area generally occurs under unconfined conditions in the sandy aquifers of the plains and under semi-confined conditions in the aquifers constituted of laterite (CGWB, 2010). The area occupied by schist and laterites may contain water in joints and weathered zones under semi-confined conditions (CGWB, 2010; 2012). In laterite the specific capacities varies between 1.73 to 3205 m³/day/m (CGWB, 2010; CGWB, 2013), while in alluvium aquifer the specific capacities vary between 27.10 & 200.78 m³/day/m and

WATER TABLE 1957 - 1958
 AREA - (1957) - (1958) - (1959) - (1960) - (1961) - (1962)

Investigation made from 75 ft. - 115 ft. (July 1957 - 1958) - (1959) - (1960) - (1961) - (1962)

In order to study the general subsurface geological conditions of the area, geophysical investigations (Electrical Resistivity Surveys) were carried out. This was to understand the

Table 1. Details of the deep well and bore well situated at P. S. Chinnayy P. S., D. D. S. S.

Muzhappilly, 1957 - 1958

No.	Well	Depth (ft)	Water Table (ft)	Water	Flow	Direction	Time	Flow	Direction	Time	Flow	Direction
1	HW	150	73°41'2"	11	Fresh	Fresh	d 10 m	Flow	Flow	d 10 m	Flow	Flow
		150	73°41'2"									
2	HW	150	73°41'4"	5	Fresh	Fresh	d 12 m	Flow	Flow	d 12 m	Flow	Flow
		150	73°41'4"									
3	HW	150	73°41'5"	5	Fresh	Fresh	d 17 m	Flow	Flow	d 17 m	Flow	Flow
		150	73°41'5"									
4	HW	150	73°41'2"	17	Saline	Saline	d 17 m	Flow	Flow	d 17 m	Flow	Flow
		150	73°41'2"									
5	HW	150	73°41'3"	11	Fresh	Fresh	Flow	Flow	Flow	Flow	Flow	Flow
		150	73°41'3"									
6	HW	150	73°41'4"	14	Fresh	Fresh	Flow	Flow	Flow	Flow	Flow	Flow
		150	73°41'4"									
7	HW	150	73°41'3"	5	Fresh	Fresh	Flow	Flow	Flow	Flow	Flow	Flow
		150	73°41'3"									

Result and Discussion

Geological Profiling and Correlation

In order to study the general subsurface geological conditions of the area, geophysical investigations (Electrical Resistivity Surveys) were carried out. This was to understand the



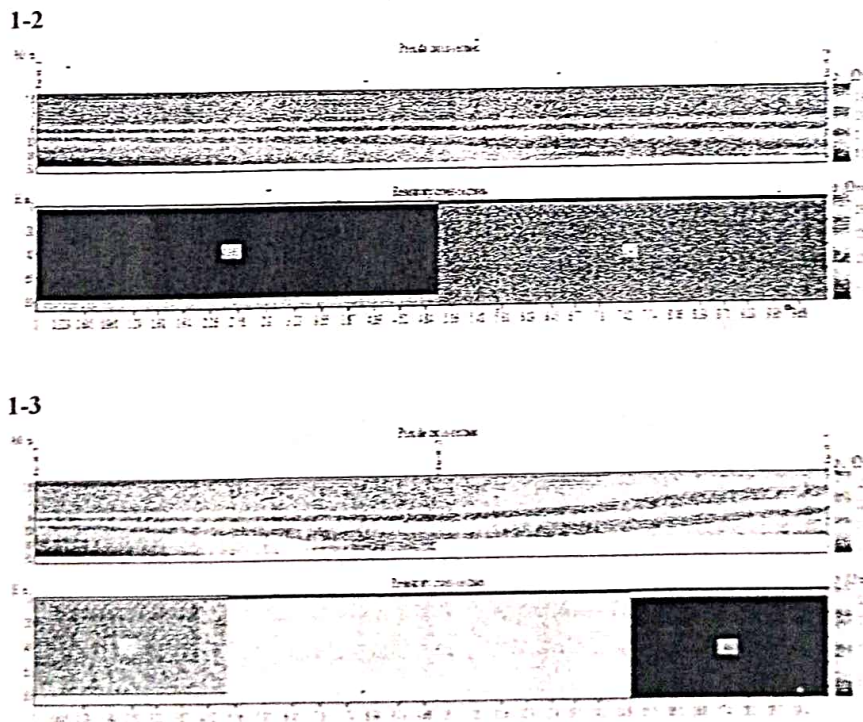
overall spread of sub-surface geological formations in the entire area. From the Electrical Resistivity Surveys, Electrical Resistivity Method (IS: 1892-1979 Appendix B clause 3.3 B-2) was used.

Geophysical investigation incorporated use of electrical resistivity method. In all 04 electrical resistivity soundings were conducted (Fig). Schlumberger VES technique was adopted for delineating vertical and lateral changes in resistivity. Resulting geoelectrical layer succession was used for predicting various conducting zones on the basis of true resistivities (Pawar et al, 2008). Employing Schlumberger Configuration the apparent resistivity was calculated (Kearey and Brooks, 1988) as,

$$\rho_a = \pi [(L/2)^2 - (b/2)^2] / b * V/I$$

Where, L and b is the current and potential electrode spacing respectively.

The data obtained from the field was processed and modeled using IPI2WIN software, version 3.0.1 a7.01.03 (Bobachev, 2003) for interactive semi-automated interpretation. Apparent resistivity geo-electrical cross-sections were generated to understand 2-D geometry of the aquifer developed along the profile (Pawar et al, 2008). Interface of fresh and saline water has been studied after creation of iso-apparent resistivity maps at various depths ranging from 0 to 30 meters (fig.2)



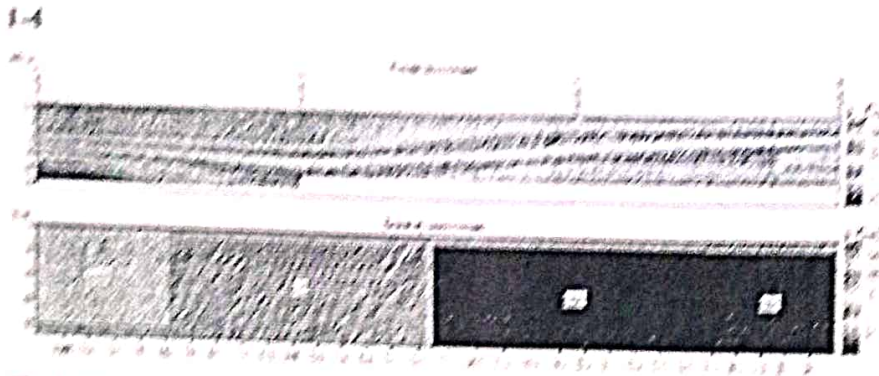


Fig.2: Geoelectrical Cross Section along Different Profiles

The geoelectrical cross-sections passing through various points have been presented in the figure 2. It is to be noted that these are apparent resistivity ρ_a sections, which broadly match the true resistivity of formations. Using IP12WIN software, the values of true resistivity of strata (ρ), its thickness (h) and depth (d) have been obtained after modeling of data and are depicted in table form besides each curve (Table 2)

Apparent electrical resistivity (ρ_{app}) was measured in four profiles along the Quaternary coast. The inter-electrode separation was kept at 35 meter, that is, the resistivity values measured are at 35 m depth plane. The seawater mixed zone is witnessed along VES-1 and VES-2 sections along the low lying sandy alluvial areas (fig 2). In contrast, relatively higher apparent resistivity is reported very close to the sea, may be due to dry sand dunes. However, along VES-2 and VES-3 locations, there is no indication of seawater mixing at 10 m depth (fig 2)

Most of Vertical electrical soundings were carried out near well sites DW-1, DW-2 and DW-3 (Table 1, Table 2). These were restricted to a depth of 35 m. As seen from the apparent resistivity values, well numbers DW-1 and DW-4 show low values of resistivity below about 6 m depth, indicating the presence of seawater or mixed zone below that depth. However, at other sites, there is no indication of the seawater mixing upto 30 m depth (fig 2). It is noted here that wells located in low lying sandy alluvial areas show seawater mixing than the wells located in laterites at higher altitudes. In both laterite and alluvial soils, the wells are built well above the salt water- fresh water interface.



Table 2: Modeled Electrical Resistivity Data Output

No.	Graph	Value					
		R ₁	R ₂	R ₃	R ₄	R ₅	R ₆
1		200	15	10	100		
2		200	15	10	100		
3		200	15	10	100		
4		200	15	10	100		

Conclusions

To know the extent of intrusion of saline water, VES studies has been carried out in the Querim beach of Goa. As the area under investigation is beach and is low lying. The geological

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formation in the area is Laterite and Metasediments of Precambrian to recent in age. Taking into account the geology and geomorphology of the area, four (04) electrical resistivity of Schlumberger VES technique was employed to delineate vertical and lateral changes in resistivity. In addition to this, hydrogeological study of the dug wells as well as bore wells also noted to decipher the extent of intrusion, directly. It is found that the water level in these wells ranges from 2.17 to 19.23 meter bgl during premonsoon and 0.43 to 14.90 m bgl during post monsoon. The VES were carried out near well sites DW-1, DW-2 and DW-3. The depth of penetration is restricted to a depth of 35 m. It is found that, DW-1 and BW-4 show low values of resistivity below about 6 m depth, indicating the presence of seawater or mixed zone below this depth.

The seawater mixed zone is witnessed along VES-1 and VES-2 sections along the low lying sandy alluvial areas. Relatively higher apparent resistivity values near the sea are due to dry sand dunes. However, along VES-2 and VES-3 locations, there is no indication of seawater mixing at 10 m depth, as all values are higher. However, at other sites, there is no indication of the seawater mixing upto 30 m depth. It is also noted that wells located in low lying sandy alluvial areas show seawater mixing than the wells located in laterites at higher altitudes. In both laterite and alluvial soils, the wells are built well above the salt water - fresh water interface. Now at present, seawater intrusion in Querim of North Goa is confined only upto 60 to 80 m from the coast under normal rainfall conditions and present draft pattern. It may slightly extend farther toward inland in low rainfall years.

Seawater intrusion may further advance inland if withdrawals of groundwater by increasing hotels and other tourist establishments in future. So, need of monitoring of groundwater salinity is need of hour, especially within 1.6 km from the coast. Proper management and development of groundwater resources by rain water harvesting and roof top harvesting will lessen the problem of sea water intrusion in future.

Acknowledgements

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भारतातील पाण्याची समस्या व संवर्धन

डॉ. आर.बी. मादळे

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२१ व्या शतकात पाण्याच्या कमतरतेचा प्रश्न हा केवळ भारताचीच समस्या नव्हे तर संपूर्ण जगाच्या दृष्टीने गंभीर प्रश्न मानला जातो. आज वेगवेगळ्या प्रदेशात पाण्याच्या कमतरतेमुळे संपूर्ण सजीवसृष्टीवर वेगवेगळ्या गंभीर समस्या निर्माण होत आहेत. याचा सर्वांत जास्त परिणाम मानवी प्राणी व वनस्पती जीवनावर होत आहे. लोकसंख्या वाढीमुळे, उद्योगधंद्याच्या आणि जलसिंचनाच्या विकासांमुळे पाण्याच्या मागणीत वाढ होत आहे. पाण्याच्या उपलब्धतेवर मानवी उद्योग अवलंबून असतात. जगातील सर्व लोकांना शुद्ध, स्वच्छ व आरोग्यदायी पाणीपुरवठा होणे आवश्यक आहे. त्यासाठी पाण्याच्या वापराचे, वितरणाचे योग्य नियोजन करणे जरूरीचे आहे. पाण्याचा प्रत्येक थेंब महत्त्वाचा मानला पाहिजे. पाणीपुरवठात निसर्गतः उपलब्ध असलेल्या ह्या जलसंपत्तीचे योग्य संधारण होण्याची आज नितांत गरज आहे. भूपृष्ठावर उपलब्ध असलेल्या पाण्याचे संरक्षण, संवर्धन व विकास करणे व त्याची उपयुक्तता वाढवणे यासाठी पाण्याचे केलेले व्यवस्थापन म्हणजे जलसंधारण होय. निरनिराळ्या कारणांसाठी उपयुक्त असलेल्या पाण्याचा पुरवठा सर्वकाळ व नियमित व्हावा व तो फायदेशीर ठरावा यासाठी प्रकल्प राबविणे हे जलसंवर्धनाचे उद्दिष्ट आहे.

प्रस्तुत शोधनिबंध हा दुय्यम स्त्रोतांच्या आधारे तयार केलेला आहे. शोधनिबंधाची उद्दिष्ट्ये खालीलप्रमाणे आहेत.

उद्दिष्ट्ये

- १) भारतातील पाण्याच्या समस्येचा अभ्यास करणे.
- २) भारतातील पाण्याचे संवर्धनात्मक उपाय अभ्यासणे.

भारतातील पाण्याची समस्या

भारतात जलसंपदा विपुल प्रमाणात आहे. तथापि संवर्धन आणि नियोजनाचा अभाव मात्र प्रकटाने जाणवतो. एकूण पावसाच्या पाण्यापैकी फक्त १०% पाणीच वापरले जाते. भारतातल्या शेतीला मोसमी पावसाचा जुगार म्हणतात. पावसाचे वितरण, कालखंड व प्रमाण फारच विषम आहे. याशिवाय वनस्पतीची अनिवंध तोड, मृदेची अतोनात धूप यामुळे मोसमी पावसाचा बराच भाग वाहून जातो. जलसाठ्याच्या वापरात अजिबात नियोजन नाही. तळी व सरोवरे नष्ट होण्याच्या मार्गावर आहेत.

भारतातील पंजाब, हरियाणा, गुजरात, तामिळनाडू, उत्तरप्रदेश ही राज्ये सुमारे १/३ पाण्याचा वापर करतात. संपूर्ण भूजलाचे पुनर्व्यवहारण होऊ शकत नाही. त्याकरिता भूजलसंवर्धन महत्त्वाचे मानले जाते. पंजाबमधील कपूरथळा, हरियाणातील मोहिंदरगढ, उत्तर प्रदेशातील बागपत, शहरनपूर या भागात नलिका विहिरीची संख्या दिवसेंदिवस वाढू लागल्याने भूजलपातळी वरचेवर खाली उतरत आहे व यामुळे आज शेतकरी आत्महत्या करताना दिसून येतात.

महाराष्ट्रामध्ये प्राकृतिक वैशिष्ट्यांमुळे काही मर्यादित भाग वगळता भूपृष्ठाखाली जलपातळी ३० मीटरपेक्षा खोल आढळत नाही. परंतु वारंवार पडणाऱ्या अवर्षणामुळे शेतकरी १०० मीटरपेक्षाही खोल विंधन विहिरी खोदताहेत. अशा नलिकाविहिरींना सुरुवातीस पूर्वीचा भूगर्भातील साठा मिळाल्यामुळे चार-सहा महिने नलिका विहिरी व्यवस्थित चालतात. त्यासाठी किमान ५०-६० हजार रुपये खर्च येतो. पुढे, नलिकाविहिरी कोरड्या झाल्याने महाराष्ट्रातील शेतकरी कर्जबाजारी झाले आहेत. केवळ महाराष्ट्रात खोदलेल्या नलिका विहिरीपैकी ८० ते ९०% नलिका विहिरी आटल्या आहेत ही अतिशय गंभीर बाब आहे.

गुजरात राज्यामध्ये दरवर्षी सुमारे २ मी.मी. जलपातळी खाली उतरत चालली आहे. सागरकिनारी भागात खारट पाणी जमिनीत उतरण्याचा गंभीर धोका निर्माण झाला आहे. पूर्व किनारपट्टीवर नदी-तलावाच्या वाढत्या प्रदूषणामुळे पिण्याचे पाणी व अंतर्गत मासेमारीवर भयानक संकट कोसळले आहे. त्यामुळे मच्छिमारांचे स्थलांतर अटळ आहे. कलकत्याजवळच्या 'सॉल्ट सरोवरा'सारखी सर्वत्र अनेक सरोवरे होण्याचा धोका आहे. सांडपाणी, कोटकनाशकांचा वापर, खते पाणवतनस्पतीची भयानक वाढ यामुळे काश्मीरमधील वूलर, दाल, नगिना उत्तरप्रदेशातील नैनोताल, भीमताल, राजस्थानमधील पुष्कर, जयसमंदर, हैद्राबादचा हुसेन सागर, कोल्हापूर रंकाळा, जळगावचे पद्मालम वासासारखी भारतातील सरोवरे सडकी, उबडी होण्याचा धोका आहे.


जलसंवर्धनाचे उपाय

जलाचे संवर्धन करणे ही काळाची गरज आहे. त्यासाठी खालील जलसंवर्धनात्मक उपाय महत्त्वाचे मानले जातात.

- १) प्रसार माध्यमांतून पाण्याचे महत्त्व लोकांना समजावून दिले पाहिजे. कायद्याचा दुरुपयोग केल्यास होणारा दंड व शिक्षा यांची सर्वांना जाणीव झाली पाहिजे. पाणी ही राष्ट्राची संपत्ती असल्याने कायद्याचे उल्लंघन करणाऱ्यांना योग्य ती शिक्षा करावी.
- २) भूडभगावर स्वच्छ पाण्याचे स्रोत सर्वत्र समान नाहीत. तेव्हा सर्वांना शुद्ध पाण्याचा उपभोग समप्रमाणात घेता येणे शक्य नाही. याकरिता उपलब्ध पाण्याच्या वापराचा अतिरिक्त टाळून आवश्यक तेवढेच पाणी वापरावे.
- ३) पुरामुळे, अवर्षणामुळे पाणी दूषित होते. याकरिता अवर्षण, पुरासारख्या घटना घडू नयेत म्हणून जंगलतोड, चराईवर पूर्ण नियंत्रण आणावे. पावसाचे पाणी वाहून जाऊ नये म्हणून सपाटीकरण, बांधविदस्ती, कंटूर बँडिंग हे राष्ट्रीय कार्यक्रम म्हणून नेहमी राबवावेत.
- ४) शेतकीकरिता पाटाने पाणी दिल्याने खूप पाणी जमिनीत झिरपून पाण्याचा क्षय होतो. याकरिता ठिबक सिंचन पद्धत, फवारा, मटका पद्धतीचा वापर करून जलसंवर्धन करावे.
- ५) पिण्यासाठी वापरावयाचे पाणी शक्यतो बंदिस्त असावे. ते शुद्ध करून, जंतूनाशके वापरून, बंद पाईपमधून जलाशयातून आणावे. पाणी दूषित होऊ न देणे म्हणजे जलसंवर्धन होय.
- ६) जलसंवर्धन ही वैश्विक हाक आहे, हे प्रत्येक सुजाण नागरिकाने लक्षात घेणे नितांत गरजेचे आहे.

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- ७) माऊस धरणामुळे धरण पाडीमागच्या सरोवरात उजवाड शेली, नदीकाठच्या वसाहती, आदिवासी वस्ते, पाण्याबाबी जाऊन पर्यावरणास धोका पोहोचतो. याकरिता नर्भदेवरील सरदार सरोवरसांगठी मोठी धरणे बांधण्यात येऊन लहान व्होले बांधण्याने पर्यावरणास संतुलन देईल.
- ८) जल प्रदूषित होणार नाही याची सर्व संबंधितांनी खबरदारी घेणे आवश्यक आहे. कारखान्यातील पाण्यात दुकामामुळे 'मिनीगटा' व मज्जातंतूच्या आजारांमुळे जमान्याचे ५२ लोक मृत्यू पावले व १०० व्या वर अंग व विकृत झाले. खाडीतील दुग्ध पाण्यामुळे गंगे धारतात ते घासे खाल्ल्याने मुंबईच्या परिसरात अनेकज्या विषकात झाली आहे. याकरिता सरकारने दुग्ध पाणी नदी, खाडी, समुद्राला सोडण्यास बंदी केलेली आहे. त्याची अतिशय काटेकोरपणे अंमलबजावणी होणे आवश्यक आहे.
- ९) जलचक्र, आर्वाचन, जलप्रदूषण, धरणे, मोठे प्रकल्प, भूगर्भजल यांच्या यावरील संरक्षण, उपाययोजना आणि पर्यावरणाची सर्वसाधारण जनतेला गरज आहे. हे कार्य पंचावरण व नियोजन विभागाकडून प्रणवीणणे होईल.
- १०) इराक, चीन, जपान या देशांनी अधिकारलेल्या जलसंयोजन पद्धतीचा आपण काटेकोरपणे वापर केल्यास पाण्याचा योग्य वापर होऊन पाण्याचे दुर्भिक्ष्य कमी होण्यास मदत होईल.

निष्कर्ष

पृथ्वीवर जलसंपदा भरपूर असली तरी मानवाने तिचा उपयोग निष्काळजीपणाने केला आहे. शिवाय नद्या, सरोवरे, समुद्र यांच्या पाण्यात दूषितके, सांडपाणी, त्याच पदार्थ, अपद्रव्ये सोडली जातात. त्यामुळे पाणी प्रदूषित होते. थोडक्यात मानवी इच्छामुळे जलचक्रात विघाड होत आहेत. जलवापराच्या बाबतीत (दरडोई वापर) जगात भारताचा नव्या क्रम लागतो. भारतातील कारखान्यांमध्ये होणाऱ्या पाण्याचा वापर प्रोत्साहित नव्यावर नसल्याने घरेघरे पाणी वाया जाते व खर्चही वाढतो. म्हणून पाण्याचा वापर काँग्रेसही क्षेत्रात करताय त्यांना आवश्यक प्रमाणात विचार व नियोजन होणे गरजेचे असते.

पाणी ही सजीवांचे मूलभूत गरज असल्याने वनस्पती, प्राणी, मुश्मजीव यांच्या राहत-मोठ्या परिस्थितीत पाण्याने अन्वयमापारण महत्त्व आहे. म्हणून पाण्याचे महत्त्व जपण्यासाठी प्लेकाने पाण्याचे महत्त्व समजून पाण्याचा वापर करणे व त्यावरचे पाण्याचे संरक्षण करणे पद्धतीने करावचे याची मार्हिती आपल्याकडून इतरांना वेगवेगळ्या माध्यमातून देणे व जलसंयोजन करणे हीच आजच्या काळाची घरी गरज आहे.

संदर्भ

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Research Methodology In Geography

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Introduction

Research methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge.

Research simply meaning a search for facts-answer to question and solution to problems. It is a purposive investigation. It is a planed enquiry. It seeks to find explanation to unexplained phenomena to clarify, doubtful proposition and to correct the misconceived facts. The true education is to bring out the physical, the mental and the spiritual power of being. Research comprises defining and redefining problems, formulation of hypothesis, suggesting of solutions, collecting, tabulating and analyzing of data and information and drawing a conclusion. The researcher is manipulation of the things, concept for the purpose of generalizing to extent correct knowledge for the construction of theory or in the practice of an art. Research is an original contribution to the existing knowledge making for its advancement. The research is the finding for the facts again and again through the objective and systematic methods of finding answers to the problem.

The process of selection & Formulation of Research Problem

Source of Research Problem

- i) Theory of one's interest
- ii) Technological problems
- iii) Daily problems
- iv) Unexplored areas
- v) Discussion with research guides.

A research process consists of action or steps necessary to carryout research.

- i) Formulating the research problem
- ii) Voluminous literature,survey
- iii) Formulation of hypothesis
- iv) Formulation of research design
- v) Collection of data
- vi) Classification, tabulisation, representation and interpretation of data
- vii) Enforcement of the project
- viii) Analysis of the data
- ix) Hypothesis testing
- x) Generalization
- xi) Report writing or thesis writing

Hypothesis

Whenever a research notices knows facts and takes up problem for analysis, he has to start anywhere and this point of start is hypothesis. Hypothesis are the facts and realities exist in particular region. These are presupposition and yet to be tasted. 1) Imagination 2) Idea 3) Thoughts 4) Assumption 5) Postulates 6) Statement 7) Explanation 8) Theory 9) Model 10) Rules 11) Laws.

A hypothesis is a provisional formulation or possible solution or tentative explanation or suggested answer to the problem facing the scientist.

Without hypotheses is the research is unfocused a random empirical meaning hypothesis is essential link between theory and investigation, which lead to discover of addition to knowledge.

While applying the test of significance, both kinds of hypothesis are setup. i) A null hypothesis ii) Alternative hypothesis.

Research Design

Research design is naught but a scheme of work to be undertaken by a research at various stages. Systematic work of research and methodological conducting of various could be facilitated by research design. Research design is naught but a working plan prepared by researcher before actual starting a research. In the research design including following steps.



Interpretation of Data

Generally for the interpretation of data following techniques are used :

- i) Average ii) Percentage iii) Dispersion

Use of Computer Application in the Geography Research Field

In the field of research of geography, geographers are commonly use GIS (Geographical Information System) GPS (Geographical Positioning System), Remote Sensing techniques for the analysis of data. The computer can perform a very immediately. And many statistical calculations are make easily and quickly. A computation of mean, standard deviation, Correlation of co efficient 't' tests, analysis of variances, multiple regression, Factor analysis, non parametric analysis are just a few of the programs and sub-programs that are available all most all computer centres.

Conclusion

Social sciences are not exact science like physical sciences. It deals with human beings. Human nature and man's environment are so complex, that it is more difficult to comprehend and predict human behavior than the physical phenomena. Geographical sciences seeks to find explanations to unexplained phenomena, to clarify the doubtful and correct the misconceived fact of social life. It involves the application of scientific method for understanding and analyzing of social life in order to correct and verify the existing knowledge as a system.

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PRINCIPAL
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- i) Choice of the research problem
- ii) The presentation of the problem.
- iii) Development of hypothesis
- iv) Conceptual clarity
- v) Research Methodology
- vi) Review of literature
- vii) Bibliography
- viii) Data collections
- ix) Testing of hypothesis
- x) Interpretation
- xi) Presentation
- xii) Thesis or report writing

Data Collection

The base of the word 'data' is a datum. A datum is what is observed where as a datum is the product of the process of recording response.

Field Survey and Sampling Techniques

Field survey and case studies are conducted by the research according of the need of information and facts associated in the field.

Sources of Data Collection

- I) Primary Data Collection
 - i) Observation Method
 - ii) Interview Method
 - iii) Schedules and Questionnaire Method
 - iv) Internet

- II) Secondary Data Collection Sources

The secondary data means are already available in Gazetteer, District Census Handbook, Socio-economic abstracts, Crop and seasonal reports, periodicals, year books, diaries, book etc. secondary data used in Geographical research work.

Processing of Data

Editing, grouping, coding and tabulation are important stages in the Geography research work. Data processing is an intermediary stage of work between data collection and analysis.

Graphic Presentation or Data

The presentation of tabulated data in Geography research, researcher can take the help of various types of charts, various maps (Isopleth maps, Choropleth maps, Dot method maps, Distributional maps, Location map etc), diagrams (like proportional circle, proportional square, proportional diagram etc.) graphs (like Line graph, Bar graph, Ergo graph, Hither graph, Pie diagram etc.) is a method of attracting the attention of the reader

Analysis and Interpretation of Data

Wherever interpreting the data, in the geography research work like what?, where?, which?, why?, when?, and how?, should be considered in order to get the degree of perfection. Analysis and interpretation of the data is the main part of the geographical research.

Data analysis done by various types which is as follows

Types of Analysis : i) Descriptive analysis, ii) Casual analysis iii) Co-relative analysis and iv) Inferential analysis

Testing of Hypothesis

Hypothesis is a proposition set fourth as an explanation, for the occurrence of some phenomena. Hypothesis states what we are looking for and it is a proposition which can put a test to determine its validity. There are number of quantitative techniques or statistical methods are commonly use by researcher in various branches in researcher in Geography is as follows

- a) Measurements of central tendency (Mean, Median, Mode)
- b) Measurement of dispersion (Quartile deviation)
- c) Chi-square tests
- d) Co-relation analysis
- e) Regression analysis