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WOMEN IN VEDIC PERIOD: A SOCIO-POLITICAL ANALYSIS

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WOMEN IN VEDIC PERIOD: A SOCIO-POLITICAL ANALYSIS

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Abstract

In every era the status and position of women is one of the most fundamental matter to study. Without any hesitation the Vedic women in India enjoyed high position in society and their situation was quite satisfactory. In high spiritual and intellectual ground their participation was very spontaneous. Even that period was also free from social superstitious rituals like sati system, early marriage etc. The aim of this paper is to analyze the status and position of women in Vedic period in India. In account of wide narrative it represents and pursues to analyze women's situation in various areas like social, religious, educational, legal etc.

Index Terms

Women Status, Vedas, Religious, Rights.

Introduction

"Divine souls take birth in such houses where the women are respected, where they are not respected, all works become useless there" (Manusmriti 3/56).

Men and Women are two fundamental element of our human community, where both of them depend upon each other. Around the world in generally and especially in the context of Indian society socio-political philosophers and others have try to evaluate the issues faced by women over the years. We know that men and women are two wings of a bird, and it is not possible for a bird to fly on only one wing. Same as, a society never improved without women.

Women's endeavor plays the key role to en-strength the dynamism of human civilization by dint of their superiority and confinements to make a rapid progress of it in all spheres on this globe since ages. Although the tale of women's accomplishment remained subdued in history, yet the ancient Indian texts symbolizes women's visibility in this regard where women's status had varied with space and time (Chakravarti & Roy, 1988).

Without study the status and role of women in society, any kind of improvement of civilization is incomplete. Women represent the keystone in the arch of Indian culture. Indian culture constructs on the spirit that women's cause in men. In connection with social role structure, privileges, right and duties refers the status and position of women in society. It also refers to her right and responsibilities in family and social life. The position and reputation of women is normally evaluated in the account of honor and appreciation accorded to her with that of man.

The Vedic society was a liberal and humanistic society. In this period the Aryans distinctly favor male child to female child. However, females were as liberal as their male fellow. In Vedic era the women in India consumed high position in society and their

EMPOWERMENT OF WOMEN: THE BUDDHIST PERSPECTIVE

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Abstract

Buddha, being a great thinker and a social reformer, instituted an ethical faith to free human minds from the age old orthodoxies and opened a new vista of religious experience called Buddhism. His towering personality, simplicity and loving kindness for the impoverished and the sick, his denial of caste consideration for the attainment of salvation, his emphasis on conduct over birth and his admission of women into the *Sangha*, were the principles of a very high order incomprehensible in his era and they are quite applicable even today. This paper shows the position of women and the feministic philosophical view in Buddhism. By following the way of Buddha's teaching, many women in his time achieved highest goal, the state of ever happiness. Buddhism does not consider women as being inferior to men. For imposing the eight *Garudhammas*, many critics misjudged Buddha and consider that Buddha hesitated to give recognition to the right of women for two times. But, it was because of that, *Bhikkhuni Sangha* was well organized during the life time of Buddha. When they became skilled to defend themselves, Buddha withdrew *Garudhammas* observing their ability to run the *Bhikkhuni Sangha* progressively more. Keeping pace with men, they contributed Buddhism in many ways. The contribution of *Gautami, Visakha, Patachara, Sujata,* etc. will be highly appreciated always. Among the Bhikkhunis, many were learned in religion and philosophy. *Therigatha* is a strong evidence to eradicate the confusion about the role of women in early Buddhism. Women in Buddhist societies have enjoyed a much higher degree of freedom, independence and more often than not even equality of status.

Keywords: women, empowerment, Buddhism, Bhikkhuni Sangha, Garudhammas.

Introduction

The arrival of Buddhism in the 5th century B.C., created a minor rouse against Brahmin dogma and superstition. Buddhism rejected the caste structure, excessive ritualism and sacrifice. The basic doctrine of

preach the Dharma like the *Bhikkhus*. Buddha considered *Bhikkhuni Sangha* like as *Bhikkhu Sangha*. The Buddha gave woman an independent status and places her on a footing of equality with men. According to Ambedkar, "no caste, no equality, no superiority: all are equal. That is the Buddha stood for". Buddhism is a religion of humanity and is a religion of welfare of human beings (Bahu jana hitaya and bahu jana sukhaya). He gave his teachings to human beings so that their suffering can be removed. The main motto of his teachings was to bring happiness for human beings and make them free from sufferings. Being ordained in Buddhism, women developed themselves not only in spiritualism but also in creativity in the early Buddhist era.

Religious Freedom for Women

The establishment of the Bhikkhuni Sangha, the Order of Nuns, had really paved the way for full religious freedom for women in the days of the Buddha. Buddhist practice has no place for ritual. It is in the conduct of rituals in most religions that sex-typing becomes important and questions of precedence, ritual purity and the like arise. Later developments, in some Buddhist countries, have seen the emergence of some ritual, but even this kind of simple ritual has not involved any typing by the sex of the devotee. Buddhist ritual usually involves simple forms of worship or chanting or symbolic offerings, and all these are available to men and women on equal terms. In this connection it must also be mentioned that Buddhism has no place for a priestly class. Buddhist monks are sometimes mistakenly referred to as "Buddhist priests". The role of the priest in religious life is to officiate between the faithful and the God, and Buddhism being essentially atheistic has no place for God or priest. In practice Buddhist monks have assumed some kind of priestly role as when they recite stanzas of blessings to the lay followers. This is part of the process by which Buddhism has been made into a religion, but it was not one in its original form.

There were many eminent nuns who shone brilliantly in the study and practice of the Dhamma. The Buddha did not place any restrictions on the nuns in the matter of teaching and preaching of the Dhamma. The Bhikkhuni Order produced a remarkable number of brilliant preachers and exponents of the Dhamma e.g. Sukha, Patachara, Khema, Dhammadinna and Maha Pajapati (the foster mother of the Buddha). Buddhism never supported the Brahmin's view that a son was essential for the father's passage to heaven. Daughters became quite as good as sons and marriage was no longer a compulsory necessity. Women under Buddhism had the liberty to lead an independent life and go through their own business. The Buddha by granting women an active share in the religious life also helped to raise their status in secular life as well. However, the admission of women into the Order was a step in advance for the period. Whenever an innovation or improvement was in advance of the thinking and development of a people during a particular era, the people were unable to adapt themselves to the improved conditions and tended to regress back to the society that they were used to.

in Buddhism. Buddhists accept that whatever is real is free from any sort of constructions. Construction is a sort of *jneyavarana.*

Hence, within the framework of Buddhist thought, it can be said that instead of solving the woman's problem through attempts based on a dualistic model, it is better to transcend this difference and accept that each individual is an aggregation of *panchaskandha,* he is a unique individual. Each individual, either man or woman has good as well as bad qualities. Accordingly, he or she is morally good or bad. Buddhism has not only advocated this thought but through the dialogues between Mara, one of the symbolic men, and the Buddhist nuns, Buddha has shown that it is possible.

Conclusion

Thus, we may conclude that the advent of Buddha and the emergence of Buddhism opened a new horizon for women in society. By the inspiration of all women and with the counter-plea of Buddha, the women got the right of doing the work according to their will. In fact, the establishment of *Bhikkhunis Sangha* was very important to bring social change for women. Buddhist Era is the golden age for women's education and movement. But after the great passing of Buddha, *Bhikkhunis* again started to face the problem and slowly it was extinct in 11th and 12th century.

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महाभारतं सांख्यकारिकाञ्च अवलम्ब्य प्रकृतितत्त्व-निरूपणम्

मणिमाला मण्डल:
सहकारी अध्यापक:
संस्कृत विभाग:
गुसकरा महाविद्यालय:
पश्चिमवङ्ग:

कथासार:
महाभारतं इति ग्रन्थरत्नंसर्वशास्त्रानां भावनया समृद्धं जातम्। विशेषेण तु भारतीय षड्दर्शनस्य चिन्तयासम्यग्रूपेणअस्य ग्रन्थस्य पुष्टिं सञ्जातम्। महाभारते वेदान्तादि षड्दर्शनचिन्तासु सांख्यदर्शनचिन्ताया: समधिकं प्रभावं परिलक्ष्यते। सांख्यदर्शनस्य पञ्चविंशतितत्त्वेषु प्रकृतितत्त्वं तत्र सविशेषं पर्यालोचितम्। सांख्यदर्शनस्य अधुनाप्राप्तं एकमात्रं प्रामाण्यं ग्रन्थं ईश्वरकृष्णप्रणीतं'सांख्यकारिका' इति मन्यन्ते पण्डिता:। सांख्यकारिकायां ईश्वरकृष्णेण प्रकृतिस्वरूपं प्रतिपादितम्।अत: उभयग्रन्थप्रतिपादितं प्रकृतितत्त्वमवलम्बनेन तुलनात्मकस्य अलोचनाया: अवकाशमस्ति। तत्र परिलक्ष्यते उभयग्रन्थप्रतिपादितयो: प्रकृतितत्त्वयोर्मध्ये यद्यपि तादृशं किमपि समधिकं भेदं न विद्यते, तथापि महाभारते प्रकृतितत्त्वस्योपरि अपरमेकं तत्त्वं स्वीकृतं येन प्रकृति: नियन्त्रिता भवति। सांख्यकारिकायांतु प्रकृतिनियन्त्रकरूपेण किमपि अपरं तत्त्वं न स्वीकृतम्।
शब्दसंकेत: - महाभारतम्, सांख्यकारिका, प्रकृति:, अव्यक्तम्, गुणम्

महाभारतं भारत-इतिहासस्य अमूल्यं उपादानम्। महाभारतस्य महति कलेवरेविधृतमस्ति भारतसभ्यतायाः पूर्ण: इतिहास:। महाभारतस्य एतादृशं माहात्म्यं यथार्थमुपलभ्य भिण्टारनित्स् महोदयेन उक्तम् - "The Mahabharata is a whole literature"। यद्यपि अलंकारशास्त्रानुसारेण महाभारतं 'महाकाव्यम्' इति संज्ञा विभूषितं, तथापि इदं महाकाव्यं यथार्थरूपेण एक: संकलनग्रन्थ:इति मन्यते।महाभारतं न केवलं शान्तरसप्रधानमार्षमहाकाव्यम्, इतिहास-पुराणं वा, अपि तु पञ्चमवेद: धर्मार्थकाममोक्षरूपं सर्वशास्त्रमयं ग्रन्थं चेति। एतस्मात् महाभारतस्य माहात्म्यं कीर्त्तनार्थं सगौरवेन उच्यते - "यन्नेहास्ति न तत् क्वचित्।" महाभारतंभारतीय-सभ्यतायाः संस्कृतेश्च सर्वाङ्गीण: इतिहास:, सम्पूर्णं साहित्यं, सम्पूर्णं दर्शनञ्च - इति यत् कथ्यते, तत् न अतिकथनम्, यथार्थमेव।

महाभारतं तस्य अष्टादशपर्व-समन्विते महति शरीरे विविधविषयेन सह भारतीयदर्शनचिन्तनमपि धारयति वहति च। अखिले महाभारते प्रतिपादितानि दर्शनचिन्तानि सर्वान्येव सांख्यादि षडदर्शन-सम्भुतानि। किन्तु तत्र षडदर्शनेषु सांख्यदर्शनस्य प्रभावं समधिकं परिलक्ष्यते। विशेषेण तु शान्तिपर्वे भीष्मपर्वे च सांख्यमतं महाभारतकारेण सम्यग्रूपेण पर्यालोचितम्।

सुप्रसिद्धे सांख्यग्रन्थसमूहे प्रकृतितत्त्वस्य स्वरूपं येन प्रकारेण ज्ञापितं महाभारते तदपेक्षया किञ्चित् भिन्नरूपेण प्रतिपादितम्। यद्यपि उभयत्र 'प्रकृति' इति शब्दस्य अर्थ: समानमेव। यथा सांख्यकारिकायां प्रकृते: - 'प्रधानं', 'अव्यक्तं' चेति

विषादात्मकस्तमोगुण इत्यर्थः।"१८ अर्थात् जीवः तस्य देहे मनसि च प्रकृत्याः सत्त्वगुणजनितं सुखं, रजोगुणजनितं दुःखं तमोगुणजनितं मोहं च अनुभवति। अस्मिन् प्रसङ्गे एतद् कथनमावश्यकं यत् विज्ञानभिक्षुणा सत्त्वादिगुणानां सुखाद्यतिरिक्तानि अपरानि विविधधर्माणि उल्लिखितानि। तस्य मतेन सुखात् ऋतेऽपि सत्त्वगुणस्य प्रीतिः, तितिक्षादि, रजोगुणस्य शोकादि तमोगुणस्य च निद्रा, आलस्यादि धर्माणि सन्ति। किन्तु सत्त्वादि गुणानां सुखादि धर्माणां प्राधान्यत्वात् संक्षेपेण सत्त्वगुणः सुखात्मकः, रजोगुणः दुखात्मकः तमोगुणश्च मोहात्मकः कथितः। सुखादि सर्वैव सत्त्वादि-गुणानां कार्य एतत् महाभारतेऽपि पुनः पुनः कथितम्। यथा शान्तिपर्वे युधिष्ठिरेण पृष्टः सन् भीष्मेण ज्ञापितमेतत् यत् काये मनसि वा यत् प्रीतिसंयुक्तं भवति तत् सात्त्विकभावस्य कार्यं, यत् आत्मदुःखसंयुक्तं अप्रीतिकरं वा तत् रजोगुणस्य कार्यं यत् च् काये मनसि वा मोहं सञ्जायते तत्र च अनिर्वचनीयं अज्ञेयभावं च सञ्जायते तत् तमोगुणस्य कार्यम् -

<div align="center">

अत्र यत् प्रीतिसंयुक्तं काये मनसि वा भवेत्।
वर्त्तते सात्त्विको भाव इत्युपेक्षते तत्तथा॥
अथ यद्दुःखसंयुक्तमप्रीतिकरमात्मनः।
प्रवृत्तं रज इत्येव तदसंरभ्य चिन्तयेत्॥
अथ यन्मोहसंयुक्तं काये मनसि वा भवेत्।
अप्रतर्क्यविज्ञेयं तमस्तदुपधारयेत्॥१९

</div>

गुणानां कार्यविषये नीलकण्ठकृते भारतभावदीपटीकायां समुल्लिखितं वक्तव्यमपि लक्षणीयम्। तत्रोक्तं सत्त्वगुणात् दयादि, रजोगुणात् आसक्ति कामादि वा तमोगुणाच्च मोहादि धर्मे समुत्पन्नते - "सत्त्वस्य गुणां धर्मादीन् रजसः प्रवृत्यादीन् तमसोऽप्रवृत्तादीन् . . .।"२०

कार्यसाधने सत्त्वादि गुणत्रयाणां भूमिकानुसारेण सांख्यशास्त्रे तेषां स्वरूपाणि चरित्राणि वा निरूपितम्। अस्मिन् विषये सांख्यकारिकायां ईश्वरकृष्णेन उक्तं यथा सत्त्वगुणः लघुः प्रकाशकं वा, रजोगुणः प्रवृत्तिशीलं चपलः वा तथा क्रियाशीलः तमोगुणश्च गुरु आवरणकं वा -

<div align="center">

सत्त्वं लघु प्रकाशकमिष्टमुपष्टम्भकं चलं च रजः।
गुरु वरणकमेव तमः . . ,॥२१

</div>

साख्यकारिकोक्तस्य वक्तव्यस्य प्रायानुरूपं वक्तव्यं नीलकण्ठकृते टीकायां परिलक्ष्यते। तत् यथा - "तामसान् क्रोधादीन्, राजसान् प्रवृत्तादीन्, सात्त्विकान् प्रकाशादीन् ।"२२ अपि च नीलकण्ठ महोदयेन सत्त्वादिगुणत्रयाणां शुक्लादि वर्णधारणस्य हेतुरूपेण स्वच्छत्वं रजकत्वं मलिनत्वं च उल्लिखितम्। स्वच्छत्वादि पक्षान्तरे सत्त्वादि गुणत्रयाणां यथाक्रमेण प्रकाशत्वादि धर्ममेव निर्दिश्यते - " क्रमेण स्वच्छत्वाद्रञ्जकत्वान्मलिन्वाच्च सत्त्वादीनि शुक्ललोहितकृष्णाणि . . .।"२३ अतः एतावधि पर्यालोचनानुसारेण कथनमेतत् न असमीचिनं भवति यत् गुणस्वरूपविषये कार्यविषये च महाभारतस्य सांख्याकारिकायाश्च मतं समानुरूपम्।

त्रिगुणात्मकं प्रकृतितत्त्वमेव अव्यक्ततत्त्वम् एतत् प्रकृत्याः पर्यायशब्दालोचनावसरे प्रागेव उक्तम्। प्रकृति-पुरुषतत्त्वद्वयं व्यतीतं व्यक्ततत्त्वं महदादि-त्रयोविंशति विकारपदार्थः - " तत्र व्यक्तलक्षणमाह प्रोक्तमिति। तच्च महदादि- विकारान्तं त्रयोविंशकम्।"२४ अव्यक्ततत्त्वं अववोधार्थं व्यक्ततत्त्वस्य पूर्वज्ञानं आवश्यकम्। तेन अव्यक्तस्वरूपं सुवोध्यं भवति एतत् महाभारते कथितम् –

संस्कृतभाषायाम् :

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লালপরি-নীলপরি

শঙ্খ ঘোষের শিশুসাহিত্য
বিশেষ সংখ্যা

সম্পাদক
আসরফী খাতুন

শঙ্খ ঘোষের ছড়ায় প্রকৃতি চেতনা
কোহিনূর বেগম

লোকসাহিত্যের অন্তর্ভুক্ত সৌন্দর্যময় সৃজনশিল্প ছড়া। মানুষের মুখে মুখে ঝংকারময় এই পদ্যপ্রবাহ যুগ থেকে যুগে চিরপ্রবহমান। ধ্বনিমাধুর্য ও সুরঝংকারই ছড়ার প্রধান ও প্রথম বৈশিষ্ট্য। অর্থময়তা এখানে ম্লান। যেমন 'ছেলে ঘুমালো পাড়া জুড়ালো বর্গী এল দেশে, বুলবুলিতে ধান খেয়েছে খাজনা দিব কিসে'।– এই ছড়াটি কোনো রাজনৈতিক সমস্যা জাত নয়, চিরন্তন মানবিক সমস্যাজাত। সেটি হল ছোট্ট বাচ্চা শিশুকে মায়ের ঘুম পাড়ানোর সমস্যা। তাই ইন্দসুরের পাখায় ভর দিয়ে ছড়া শিশু মনস্তত্ত্বের উপযোগী হয়ে উঠেছে। কবিগুরু রবীন্দ্রনাথ বলেছেন– 'বুঝিতে পারি না, কেন এত মহাকাব্য এবং খণ্ডকাব্য এত তত্ত্বকথা এবং নীতিপ্রচার, মানবের এত প্রাণপন প্রযত্ন এত গলদঘর্ম ব্যায়াম প্রতিদিন ব্যর্থ এবং বিস্মৃত হইতেছে, অথচ এই সকল অসঙ্গত অর্থহীন সদৃচ্ছাকৃত শ্লোকগুলি লোক-স্মৃতিতে চিরকাল প্রবাহিত হইয়া আসিতেছে।" ছড়ার এই বৈশিষ্ট্যের আলোকেই আধুনিক কবি শঙ্খ ঘোষ শিশু মনস্তত্ত্বের উপযোগী বিখ্যাত ছড়াগুলি রচনা করেছেন। প্রকৃতি চেতনা তাঁর ছড়ায় কতখানি প্রভাব বিস্তার করে শিশুমনকে উদ্দীপ্ত করেছে তা বিচার করার প্রয়াস করবো।

আজন্ম বঙ্গ প্রকৃতির বুকে মগ্ন হয়ে কবি শঙ্খ ঘোষ হৃদয় দিয়ে অনুভব করেছেন বাংলার নদী, মাঠ, প্রান্তরকে। রূপকথা, নদী, পাহাড়, বৃষ্টি, ভ্রমণ যেগুলি শিশু প্রকৃতিকে গভীরভাবে নাড়া দেয় সেই বিষয়গুলিকে নিয়ে তৈরি করেছেন শিশুমনন। আমরা কবির 'ছড়া সমগ্র' গ্রন্থের কবিতাগুলো কেন্দ্র করে এই আলোচনায় অগ্রণী হয়েছি। পাহাড়ে চড়ার অভিজ্ঞতাকে শিশুর মানসিকতায় কবি লিখেছেন–

মানো বা না মানো একথা সত্যি
নিজে নিজে আমি উঠেছি পাহাড়ে
মন হয়ে গেছে খুশিতে ভর্তি
দশ দিককার রূপের বাহারে।
মানো বা না মানো এ কথা সত্যি।
আমি নেই আর সে একরত্তি।'

<div align="right">('পাহাড়ে' পৃ: -১৪৪)</div>

পাহাড়ে চড়ার প্রথম খুশী ছোট্ট শিশুর মনকে কতখানি আবেগে-আবেশে বিহ্বল করে তোলে তার প্রকৃষ্ট প্রমাণ এই ছড়াটি। বাংলা প্রকৃতিতে আষাঢ়-শ্রাবণের আগমন মানেই জলভরা মেঘের বারিধারা। কিন্তু যদি এর ব্যতিক্রম ঘটে তখন শিশুর কাছেও তা অসহনীয় হয়ে ওঠে। সে বলে ওঠে
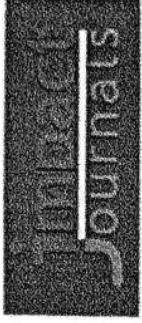
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THE ROLE OF WOMEN IN POLITICS

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India

ABSTRACT

The ideals of democracy are very far from destination, especially for women in India. Women play a marginal role in politics. Their political participation is almost not visible. But the importance of women's political participation has been increased in all corners of the world. In any country women constitute nearly half percent of the total population, but if it has to adopt a democratic system, it cannot run successfully with half of the population. It will become a crippled democracy. So, a democratic government is impossible without their participation and to empower them socially, economically and politically, their decision-making capabilities are necessary. Moreover, women have various problems, demands and aspirations which cannot be aptly expressed by men. The various problem issues of the people, such as, education, employment, health and nutrition besides foreign policies, relationships with other countries, issues of war and peace, science and technology, protection of the environment do need a women's angle, as they will affect them too in a particular manner. But the world scenario gives us a gloomy picture barring a couple of exceptions, such as, most of the Parliaments have ninety three percent male representatives and just only seven percent are women. The importance of increasing women's participation in Politics had been restated in the World Congress of Women at Beijing in 1995 and in its "Platform of Action" the ways and means had been recommended to increase "space for and visibility" of women in political institutions and processes. This is the most important first step towards women's empowerment. The Women's Reservation Bill in legislatures has shown some light at the end of the dark tunnel. Merely lamenting upon the state would not lead us anywhere. The movement for creating adequate space for women in the process of decision-making, right from within the home to the state and national legislature is required to be taken to its logical end. This article shows the need and imperatives towards enhancing women's participation in politics. An attempt has also been made to glance into the history of women's participation in politics.

KEYWORDS: *Women, Participation in Politics, Decision Making, Democratic Society*

INTRODUCTION

Politics is the process by which people in groups make decisions. It consists of social relations relating to authority or power, and refers to the rules and regulation of a political unit, and to the tactics used to formulate and apply policy. These units have both men and women, but men are always dominated in the field.

Jean Jacques Rousseau had advocated the idea of women's exclusion from politics in 1762. The American Declaration of Independence had also denied the right of equal political participation of women. But afterwards many thinkers like J.S. Mill had advocated gender equality in every field including politics. In post-World War II, the sensitivity

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Bhakti Movement: Roots of Indian Feminism

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Abstract

The Bhakti movement had been an all India phenomenon and not restricted to any particular area, language speaking people or followers of religion of India with the participation of women. The Bhakti movement was originated as a reaction against caste division, untouchability and ritualism in India. All the steps taken clearly indicate that the movement was for promoting, preserving and respecting the Indian womanhood taking all their affecting factors into consideration. The Bhakti women laid the roots of feminism in India. With sheer bravery, tenacity and their devotion to God, they created an autonomous space for themselves and refused to be tied down by societal norms. They did the unspeakable, and displayed the true strength of a woman's spirit. They created their own path to freedom, and inspired many others to follow their own will. They transcended the social identities and material realities into a universal spiritual realm. Saints like Chaitanya, Nanak, Kabir, Meera, Ramdas, Tulsi, Tukaram advocated women's rights for religious worship and as a result women secured certain social freedom too. In this way the Bhakti Movement and roots of Indian Feminism had grown up.

Key Words: Bhakti Movement, Brahmanism, feminism, societal norms.

Introduction

The Muslim period had witnessed several indicators of low status of women, particularly the Hindu women. The child marriage became a rule to safeguard the chastity and honour of the girls. In many cases the Hindu girls were given marriage before the age of nine or ten. This clearly indicated that the Hindu girls denied education by the force of society. During this period polygamy and 'purdah' system were also practiced. The Hindu widow spent her days in the most pathetic condition. The practice of child marriage resulted in rapid increase in the number of child widows. The death of a woman was preferred to her falling into evil hands. The practice of 'Sati' was encouraged and the widows who did not perform 'Sati' were looked down by the society. From the second invasion by the Muslims in the eleventh century till the mid-eighteenth century, India experienced the breakdown of social institutions, the upsetting of traditional political structure and economic depression. All these had effect on the social life, especially among women. However, during the fifteenth century Ramanujacharya organized the Bhakti movement. The movement brought new trends in the social and religious life of Indian women. Saints like Chaitanya, Nanak, Kabir, Meera, Ramdas, Tulsi, Tukaram advocated women's rights for religious worship and as a result women secured certain social freedom too. During the Bhakti movement, women were encouraged to educate themselves.

The Bhakti Movement

The term 'bhakti' is defined as "devotion" or passionate love for the Divine. The Bhakti movement in India was originated in ancient Tamil Nadu in the seventh century and spread to the north during the late medieval ages when North India was under Islamic rule. The movement was spontaneous and originated as a reaction against caste division, untouchability and ritualism in

to work as a maid in the upper-caste family of Namdev, one of the most revered of the Bhakti poet-saints. While within this household, she continued to serve Namdev, both as a servant and as his devotee. Janabai wrote over three hundred poems focusing on domestic chores and the restrictions facing her as a low-caste woman.

Muktabai or Muktai was a saint in the Varkari tradition who wrote forty-one abhangs. She was born in a Deshastha Brahmin family, the last of the four children of Vitthal Govind Kulkarni and Rukmini, a pious couple from a village near Paithan on the banks of the Godavari. Vitthal lied about his marriage to be initimated into sanyas. When found out, the couple was excommunicated from the caste. Later Vitthal and Rukmini ended their lives, hoping their children would be accepted into society after their death. The orphaned children had to resort to begging, but all four went on to contribute abhangs and commentaries on the Gita. Her most popular abhanga is *Tātīche Abhanga* (The Song of the Door).

Lalla or Lal Ded was one of the earliest Kashmiri mystic poets of the fourteenth century. She refused to stay confined to domestic tyranny and its power hierarchy. She adopted a famous Kashmiri Shaiva saint as her spiritual guide, and became an ardent devotee of Shaivism. She was also a yogini, a mendicant ascetic, who wandered about preaching the yogic doctrines as the best means of ultimate absorption into the Supreme. The true saint, according to her, was, 'the servant of all mankind through his humility and loving kindness'. She did not believe in the efficacy of external observances, ritualism, or idol worship. She insisted on the performance of duty for duty's sake.

Mirabai, or Mira, a Bhakti poet of the fifteenth century, is said to have been born into a ruling Rajput family. Mirabai's poetry tells of her vision of Lord Krishna when she was a child; from that point on Mira vowed that she would forever be his bride. Despite her wishes, she was married to Prince Bhoj Raj of the Rajput kingdom of Mewar at a young age. Her husband died after some years. The hostility increased as Meera refused to commit sati. She neither wore the mourning garb, nor followed any of the customs expected of a royal woman grieving a lost husband. Instead she claimed that now she was free to devote herself completely to the worship of Krishna. Mira's devotional practices became increasingly intense. She often sang and danced herself into ecstasies, even in public places like temples. News about her spread all over India and she soon attracted a following of devotees from all social groups and castes. She became the foremost exponents of the Bhakti movement and a remarkable example of feminism in India.

Conclusion

Thus, we may conclude that all over Medieval India had an atmosphere of immense discrimination, with patriarchy held in the highest regard. Women sought Bhakti to move out the restricted domestic spaces and oppose patriarchy and Brahminical hegemony. The rejection of the power of the male figure that they were tied to in subordinate relationships became the terrain for struggle, self-assertion and alternative seeking.

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A STUDY ON THE HEALTH AND NUTRITION EDUCATION FOR WOMEN

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Abstract

Health is a common theme in most cultures. Health plays a vital role in our lives. In context to women's health it is a valuable asset for them. Women have a special role in healthy nutrition of the population. The woman breastfeeds the newborn baby and prepares meals for members of her family. Women employees in food manufacturing, trade, public catering, health care and education account for the majority. In addition, public health depends upon women's understanding of healthy nutrition issues. Women, therefore, play a key role in implementing a healthy nutrition policy, both in the family and in society as a whole. In most Indian household the women of the house eats last, after feeding the whole family. Though there are more illiterate women than men, we find that women learn more quickly and respond more rapidly. So, women need health and nutrition education for the development of society. Health and nutrition education aims at enabling women and men both to gain control over the determinants of health and health behaviour and the condition that affect their health status. This paper analyses the significance of health education to women and thus to society.

Keywords: health, women, nutrition, education.

Introduction

Health is a prerequisite for human development and is an essential component for the wellbeing of the mankind. The common beliefs, customs, practices related to health and disease in turn influence the health of the human beings. Health can be regarded as a state of mental, social and economic wellbeing and not the mere absence of disease. Health is a function, not only of medical care, but also of the overall integrated development of society – cultural, economic, educational, social and political. Therefore, to have sound health, the other depending factors are also to be looked into.

Health is one of those terms which most people find it difficult to define although they are confident of its meaning. Therefore, many definitions of health have been offered from time to time, including the following:

Webster: "The condition of being sound in body, mind or spirit, especially freedom from physical disease of pain".

Oxford English Dictionary: "Soundness of body or mind; that condition in which its functions are duly and efficiently discharged". "A condition or quality of the human organism expressing the adequate functioning of the organism is given conditions, genetic and environmental".

Perkins: "A state of relative equilibrium of body forms and functions which results from its successful dynamic adjustment to forces tending to disturb it. It is not passive interplay between body substance and forces impinging upon it but an active response of body forces working toward readjustment".

WHO definition: The widely accepted definition of health is that given by the World Health Organization (1948) in the preamble to its constitution which is as follows – "Health is a state of complete physical, mental and social wellbeing and not merely an absence of disease or infirmity". In recent years, this statement has been amplified to include the ability to lead a "socially and economically productive life".

Health Problems of Indian Women

The health of Indian women is intrinsically linked to their status in society. Research on women's status has found that the contributions Indian women make to families often are overlooked, and instead they are viewed as economic burdens. There is a strong son preference in India, as sons are expected to care for parents as they age. This son preference, along with high dowry costs for daughters, sometimes results in the mistreatment of daughters.

Indian women, further, have low levels of both education and formal labour force participation. They typically have little autonomy, living under the control of first their fathers, then their husbands, and finally their sons. All of these factors exert a negative impact on the health status of Indian women. Poor health has repercussions not only for women but also their families. Women in poor health are more likely to give birth to low weight infants. They also are less likely to be able to provide food and adequate care for their children. Finally, a woman's health affects the household economic well-being, as a woman in poor health will be less productive in the labour force.

Many of the health problems of Indian women are related to or exacerbated by high levels of fertility. Utter Pradesh, the most populous state in India, has a total fertility rate of over 5 children per woman. On the other hand, Kerala, which has relatively high levels of female education and autonomy, has a total fertility rate under 2. High levels of infant mortality combined with the strong son preference motivate women to bear high numbers of children in an attempt to have a son or two survive to adulthood. Numerous pregnancies and closely spaced births erode a mother's nutritional status, which can negatively

   i)   stresses the complex web of interrelationships that determine mental health and that the factors that determine health operate on multiple levels.

   ii)   goes beyond the biological and the individual.

   iii)   acknowledges the crucial role of the social context.

   iv)   highlights the importance of justice and equality in determining mental well being.

Gender configures both the material and symbolic position women occupy in the social hierarchy as well as the experiences which condition their lives. Understood as a social construct, gender must be included as a determinant of health because of its explanatory power in relation to differences in health outcomes between men and women. These asymmetries are manifested not only in terms of differential susceptibility and exposure to risks - for example vulnerability to sexual violence, but also, fundamentally, in the power of men and women to manage their own lives, to cope with such risks, protect their lives and influence the direction of the health development process. This balance of power has generally favoured men and relegated women to a subordinate, disadvantaged position.

A gendered, social determinants model offers the only viable framework for examining evidence on all relevant factors related to women's mental health. From this perspective, public policy including economic policy, socio-cultural and environmental factors, community and social support, stressors and life events, personal behaviour and skills, and availability and access to health services, may all be seen to exercise a role in determining women's mental health status.

The importance of gender differences in mental health is most graphically illustrated in the significantly different rates of major depression experienced by women compared with men. The need to focus on ill health and morbidity has also been emphasized in the area of women's health. Health related data that is solely bio medically based cannot adequately inform an understanding of the morbidity experienced by women. As mortality rates decline, it becomes increasingly critical to address physical and psychological morbidity, increase satisfaction with health care services and improve quality of life, if improvements in women's health are to be achieved.

The tools currently in use to measure health status exacerbate this difficulty by themselves having a gender bias. Reducing morbidity is an essential prerequisite to the improvement of women's mental health. As women in many countries are approximately twice as likely as men to experience depression and it is the most prevalent psychiatric disorder any significant reduction in the overrepresentation of women who are depressed would make an important contribution to lessening the global burden of disease. Women's mental health is a significant public health issue.

The promotion of women's mental health, like health promotion in general, relies on establishing a process composed of a variety of possible elements that singly or together enable women as individuals or members of their communities to increase control over the determinants of their mental health and thereby be in a position to improve their health status and health outcomes. A strong inverse relationship exists between social position and physical and mental health outcomes. Adverse health outcomes are two to two

role in influencing all health related sectors to see that their policies and actions are in congruence with the national health objectives. It has to play a key role of an advocacy so that people are motivated and play effective role in educating and adapting sound health practices. Thus, it is well said that "Health is beauty", as beauty is only a by-product of good health. So, let's wake up and enter into the adventure and remember that Health is a fundamental Human Right.

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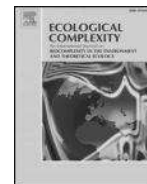
Dynamics of plant mosaic disease propagation and the usefulness of roguing as an alternative biological control

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A B S T R A C T

In this research article, an epidemiological model is formulated for mosaic disease considering plant and vector populations. Plant host population has been divided into three compartments namely healthy, latently infected and infected ones, and vector population is divided into two compartments: non-infective and infective vectors. The system possesses three equilibria: plant-only, disease-free and endemic equilibrium. Plant-only equilibrium is always unstable; disease-free equilibrium is stable when the basic reproduction number, R_0, is less than unity and unstable for when it crosses unity, and ensure existence of an endemic equilibrium which may be stable or can undergo a Hopf bifurcation. Finally, impulse periodic roguing with varied rate and time interval is adopted for cost effective and eco-friendly disease control and future direction of agriculture management. The dynamics of the impulsive system has also been analysed. Detailed numerical simulations are employed to support the analytical results. We found that roguing is most cost effective and useful management for mosaic disease eradication of plants if applied at proper rate and interval.

1. Introduction

Plant viruses are an important constraint to crop production worldwide especially in developing countries (Fereres et al., 2000; Thackray et al., 2000; Waterworth and Ahmed, 1998), in several cases, causing large-scale damage to crops resulting in whole regions going out of production. Examples include cocoa swollen shoot in Ghana (Owusu, 1983; Thresh and Owusu, 1986) and banana bunchy top in Australia (Allen and Barnier, 1977; Thresh et al., 1988). Most plant viruses are vectored by arthropods (Nault, 1997) (for eg. whitefly) and the vector activity and behaviour, especially in relation to virus transmission; and these are important determinants for dispersion and outbreak of disease (Spence, 2001).

Mosaic disease is an emerging and epidemic disease that affects the productivity of different plants such as *Cassava*, Tomato etc. including biofuel crop *Jatropha curcas*. *J. curcas* is a small woody plant belonging to the family Euphorbiaceae and can grow on marginal land in tropical and subtropical regions and produces seeds containing up to 30% oil contents. It serves as biodiesel feed stock and has high economic importance for overcoming future fuel crisis (Gao et al., 2010). Like many other plants, *Jatropha* is also affected by the mosaic virus. There are also reports of *Jatropha* plants being affected by the cucumber mosaic virus (Raj et al., 2008). Mosaic virus is a type of plant virus

that causes the leaves of plants to have spotted and speckled look. This virus can move frequently in the environment and its spreading is mainly dependent on the abundance of vector whitefly (Basir et al., 2018; 2017) i.e. spread of the virus is highly vector-density dependent. A single whitefly is sufficient to infect a host plant but transmission of the disease increases when numerous infective whiteflies scatter and feed on host plants. Besides this, whiteflies are tremendously productive; after coming into contact with any part of the host plant (around the home or garden), they will voluntarily roam and try to attack any other immediate adjacent vegetation (Gao et al., 2010; Venturino et al., 2016). Normally whiteflies need three hours feeding time to procure the virus and a latent phase of eight hours. It requires only about ten minutes to contaminate the young leaves. Symptoms seem to appear in the infected plants after a latent period of three to five weeks (Fargette et al., 1994).

Propagation of a virus is specifically dependent upon several factors including (but not limited to) host plant density, incubation time duration and infection pattern. It ultimately affects the intensity of overall yield and quality decline, price of final product and farming efficiency (Tang et al., 2010). Effective control measures must be aimed at decreasing virus incidence and that too must be economically justified (cost effective). When dispersion of a disease exceeds a certain threshold value (Tang et al., 2010), any single control measure alone

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$$\frac{dx}{dt} = rx\left[1 - \frac{x+l+y}{K_1}\right] - \lambda xv,$$

$$\frac{dl}{dt} = \lambda xv - \alpha l - ml,$$

$$\frac{dy}{dt} = \alpha l - (\delta + m)y,$$

$$\frac{du}{dt} = bu\left[1 - \frac{u+v}{K_2}\right] - \beta yu,$$

$$\frac{dv}{dt} = \beta yu - dv, \tag{1}$$

with initial condition:

$$x(0) > 0, \ l(0) > 0, \ y(0) > 0, \ u(0) > 0, \ v(0) > 0. \tag{2}$$

The region of attraction is given by:

$$\mathcal{D} = \{(x, l, y, u, v) \in \mathbb{R}_+^5 : 0 \le x + l + y \le B_1, \ 0 \le u + v \le B_2\}, \tag{3}$$

where, $B_1 = \max\{x(0) + l(0) + y(0), K_1\}$, $B_2 = \max\{u(0) + v(0), K_2\}$, i.e. all solutions of the system (1) that start in $\mathcal{D}$ are uniformly bounded and remains in $\mathcal{D}$.

3. Equilibria and their stability

The model system (1) has three equilibria, namely, plant-only equilibrium $E_a(K_1, 0, 0, 0, 0)$, disease-free $E_0(K_1, 0, 0, K_2, 0)$ and endemic equilibria $E^*(x^*, l^*, y^*, u^*, v^*)$, where

$$l^* = \frac{(\delta + m)y^*}{\alpha}, \quad y^* = \frac{\alpha r x^*(K_1 - x^*)}{rx^*(m + \delta) + r\alpha x^* + K_1(m + \alpha)(\delta + m)},$$

$$u^* = \frac{d(m + \alpha)(\delta + m)}{\alpha \lambda \beta x^*}, \quad v^* = \frac{(m + \alpha)(\delta + m)y^*}{\alpha \lambda x^*},$$

and x^* is the positive root of the cubic,

$$P_1 x^3 + P_2 x^2 + P_3 x + P_4 = 0, \tag{4}$$

with

$$P_1 = \alpha r \beta K_2 > 0,$$
$$P_2 = b r K_2(m + \delta + \alpha) - \alpha r \beta K_2 + b r (m + \alpha)(\delta + m)\lambda^{-1},$$
$$P_3 = b(m + \alpha)(\delta + m)[K_1 K_2 \alpha \beta \lambda - rd(m + \delta + \alpha) - \alpha \beta r](\alpha \beta \lambda)^{-1},$$
$$P_4 = -bd K_1(m + \alpha)^2(\delta + m)^2(\alpha \beta \lambda)^{-1} < 0. \tag{5}$$

Following theorem ensures the existence of feasible endemic equilibrium.

Theorem 1. *Let*

$$\Delta = 18 P_1 P_2 P_3 P_4 - 4 P_2^3 P_4 + P_2^2 P_3^2 - 4 P_1 P_3^3 - 27 P_1^2 P_4^2. \tag{6}$$

be the discriminant of (4). Now, if $\Delta > 0$, and either $P_2 > 0, P_3 > 0$ or $P_2 < 0, P_3 < 0$, then equation (4) has a single positive root. If $\Delta > 0$ and $P_2 < 0$, and $P_3 > 0$, then Eq. (4) has two positive roots.

3.1. Stability of equilibria

Stability of any steady state $E(x, l, y, u, v)$ is determined by the eigenvalues of the Jacobian J_E evaluated at that steady state,

$$J_E = \begin{bmatrix} r(1 - \frac{2x+l+y}{K_1}) & -\frac{rx}{K_1} & -\frac{rx}{K_1} & 0 & -\lambda x \\ -\lambda v & & & & \\ \lambda v & -(\alpha + m) & 0 & 0 & \lambda x \\ 0 & \alpha & -(m + \delta) & 0 & 0 \\ 0 & 0 & -\beta u & b - \frac{2bu+v}{K_2} - \beta y & \frac{-bu}{K_2} \\ 0 & 0 & \beta u & \beta y & -d \end{bmatrix}$$

At the disease-free equilibrium, E_0, two roots are $-r < 0, -d < 0$

and rest of the roots satisfy

$$\xi^3 + L_1 \xi^2 + L_2 \xi + L_3 = 0, \tag{7}$$

where $L_1 = (\alpha + \delta + 2m + d) > 0$, $L_2 = d(m + \delta) + d(\alpha + m) + (\alpha + m)(\delta + m) > 0$, and $L_3 = d(\alpha + m)(m + \delta) - \alpha \beta \lambda K_1 K_2$.

Let us define the basic reproduction number, R_0, as follows

$$R_0 = \frac{\alpha \beta \lambda K_1 K_2}{d(\alpha + m)(m + \delta)}. \tag{8}$$

Then, we have the following theorem which characterise the stability of E_0.

Theorem 2. *Disease free equilibrium E_0 is stable if $R_0 < 1$ and unstable otherwise, undergoes a forward bifurcation at $R_0 = 1$, giving rise to a feasible co-existence equilibrium E^*.*

Remark 1. It is important to note that R_0 depends on δ and m, hence, they are important parameters in the eradication of infection. At the same time, taking a limit of $\alpha \to \infty$ gives

$$\lim_{\alpha \to \infty} R_0(\alpha) = R_0^\infty \equiv \frac{a \lambda \beta K_1 K_2}{d(m + \delta)}.$$

Note that R_0 is monotonically decreasing with increasing m, this suggests that eradication of mosaic disease, as represented by a stable disease-free steady state E_0, is only possible if $R_0^\infty < 1$, and one of the available means to achieve this is by increasing roguing (the rate of removal of infected plant).

Characteristic equation at E^* becomes of degree five in ξ

$$\xi^5 + A_1 \xi^4 + A_2 \xi^3 + A_3 \xi^2 + A_4 \xi + A_5 = 0 \tag{9}$$

with

$$A_1 = \frac{rx^*}{K_1} + \alpha + 2m + \delta + \frac{bu^*}{K_2} + d > 0,$$

$$A_2 = \frac{r\lambda v^* x^*}{K_1} + \frac{rx^*(\alpha + m)}{K_1} + \frac{rx^*(\delta + m)}{K_1} + (\alpha + m)(\delta + m) + \frac{rbu^* x^*}{K_1 K_2}$$
$$+ \frac{bu^*(\alpha + m)}{K_2} + \frac{bu^*(\delta + m)}{K_2} + \frac{b\beta y^* u^*}{K_2} + \frac{drx^*}{K_1} + d(\alpha + 2m + \delta)$$
$$+ \frac{dbu^*}{K_2} > 0,$$

$$A_3 = \frac{r\alpha \lambda v^* x^*}{K_1} - \frac{r\lambda(\delta + m)v^* x^*}{K_1} + \frac{(\alpha + m)(\delta + m)rx^*}{K_1} - \lambda \alpha \beta x^* u^*$$
$$- \frac{rb\lambda v^* u^* x^*}{K_1 K_2} + (\alpha + m)\frac{rx^*}{K_1}\frac{bu^*}{K_2} + \frac{rx^*}{K_1}(\delta + m)\frac{bu^*}{K_2}$$
$$+ (\alpha + m)(\delta + m)\frac{bu^*}{K_2} - \frac{rx^*}{K_1}\frac{bu^*}{K_2}\beta y^* + (\alpha + m)\frac{bu^*}{K_2}\beta y^*$$
$$+ (\delta + m)\frac{\beta y^* bu^*}{K_2} - \frac{rd\lambda v^* x^*}{K_1} + \frac{r(\alpha + m)dx^*}{K_1} + \frac{(\delta + m)drx^*}{K_1}$$
$$+ d(\alpha + m)(\delta + m) + d\frac{rx^*}{K_1}\frac{bu^*}{K_2} + d(\alpha + m)\frac{bu^*}{K_2} + d(\delta + m)\frac{bu^*}{K_2},$$

$$A_4 = -\frac{rx^*}{K_1}\lambda x^* \alpha \beta u^* - \lambda x^* \lambda v^* \alpha \beta u^* - \lambda v^* \alpha \frac{rx^*}{K_1}\frac{bu^*}{K_2} - \lambda v^*(\delta + m)\frac{rx^*}{K_1}\frac{bu^*}{K_2}$$
$$+ \frac{rx^*}{K_1}(\alpha + m)(\delta + m)\frac{bu^*}{K_2} - \lambda x^* \alpha \beta u^* \frac{bu^*}{K_2} + \lambda x^* \alpha \beta u^* \beta y^* - \frac{rx^*}{K_1}\lambda v^* \frac{bu^*}{K_2}\beta y^*$$
$$+ \frac{rx^*}{K_1}(\alpha + m)\frac{bu^*}{K_2}\beta y^* - \frac{rx^*}{K_1}(\delta + m)\frac{bu^*}{K_2}\beta y^* + (\alpha + m)(\delta + m)\frac{bu^*}{K_2}\beta y^*$$
$$+ \frac{rx^*}{K_1}\lambda v^* \alpha d - \frac{rx^*}{K_1}\lambda v^* d(\delta + m) + d\frac{rx^*}{K_1}(\alpha + m)\delta + m) - d\frac{rx^*}{K_1}\lambda v^* \frac{bu^*}{K_2}$$
$$+ d\frac{rx^*}{K_1}(\alpha + m)\frac{bu^*}{K_2} + d\frac{rx^*}{K_1}(\delta + m)\frac{bu^*}{K_2} + d(\alpha + m)(\delta + m)\frac{bu^*}{K_2},$$

$$A_5 = -\lambda x^* \alpha \beta u^* \frac{rx^*}{K_1}\frac{bu^*}{K_2} - \lambda x^* \lambda v^* \alpha \beta u^* \frac{bu^*}{K_2} + \lambda x^* \alpha \beta u^* \beta y^* \frac{rx^*}{K_1}$$
$$+ \lambda x^* \lambda v^* \alpha \beta u^* \beta y^* - \beta \lambda \alpha v^* y^* \frac{rx^*}{K_1}\frac{bu^*}{K_2} - \frac{rx^*}{K_1}\lambda v^*(\delta + m)\frac{bu^*}{K_2}\beta y^*$$
$$+ (\alpha + m)(\delta + m)\beta y^* \frac{rx^*}{K_1}\frac{bu^*}{K_2} - d\lambda v^* \alpha \frac{rx^*}{K_1}\frac{bu^*}{K_2}$$
$$- d(\delta + m)\frac{\lambda r v^* x^*}{K_1}\frac{bu^*}{K_2} + d(\alpha + m)(\delta + m)\frac{rx^*}{K_1}\frac{bu^*}{K_2}.$$

According to Routh–Hurwitz conditions, (9) has roots with negative

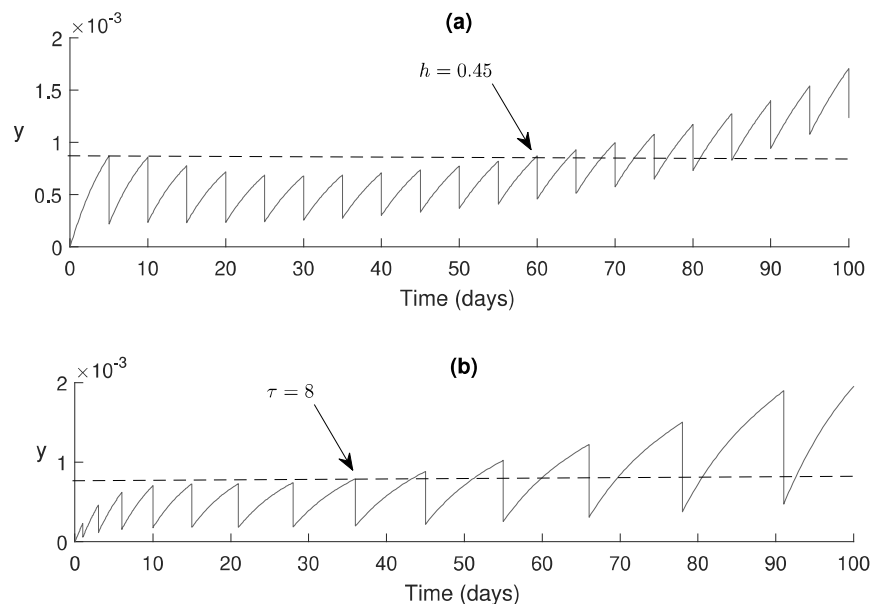**Fig. 8.** Effect of roguing: (a) Effect of roguing with varying roguing interval τ i.e. τ is changing each iteration. Initially $\tau = 1$, then increase by 1 in each iteration, (b) with varying roguing rate h. Initially $h = 0.75$, then it is reduced by 0.025 in each iteration.

cultivated plants) is important and best effective method for plant disease eradication. In agriculture, roguing refers to the act of identifying and removing plants with undesirable characteristics from agricultural fields. Rogues are removed from the fields to preserve the quality of the crop being grown. But for agriculture, roguing should be maintained at rate that maximizes the crop production rate as well as minimize the disease infection rate and also cost effective. So, for that purpose, the effect of roguing on system is thoroughly studied by means of four ways: (1) by changing roguing interval (τ) at fixed roguing rate as example intervals of 10, 15, 20 days; (2) by changing roguing rate h at fixed roguing interval namely $h = 0$, 0.25, 0.5, 0.75 etc.; (3) by changing roguing interval (τ) at increasing order such as 1, 2, 3, 4 days etc. That means in every time roguing interval time should be increased by 1 day from the previous; (4) by changing roguing rate (h) in decreasing order from starting rate 0.75 at early stage of disease management. That means during successive roguing attempts, roguing time should be decreased by 0.025 from the previous.

6. Discussion and conclusion

In this research article, a mathematical model has been formulated to study the dynamics of plant mosaic disease and its possible biological control by applying roguing for cost effective maximization of crop yield. From an ecological and economical point of view, a holistic model incorporating maximized crop yield while minimizing the hazards of chemical pesticides is required. This model can help in understanding the range of effects for implementing alternative eco-friendly control strategies, which in this case is impulsive roguing.

Here the basic reproductive number R_0 is used as a parameter for understanding the stability of the model at disease free situation. When $R_0 < 1$, the system seems to achieve disease free condition and is stable. For $R_0 > 1$, the disease free equilibria is unstable and system becomes endemic. The endemic equilibrium undergoes Hopf bifurcation through periodic oscillations for the critical values of λ. So, first and foremost, the effects of major controlling factors such as disease transmission rate (λ), vector infection rate (β) etc. on the dynamics of the system have been studied.

From the above study, it can be concluded that disease transfer rate, vector growth rate and vector infection rate are inversely related to

infection rate. So, if these concerned rates increase beyond their threshold values then the system become unstable even at a low infection rate. Not only that, it also becomes difficult for the system to return back to stability, or more specifically to achieve the disease free equilibrium point. So, from a practical applicability point of view, it can be said that for maximum crop yield the goal should be fixed to maintain minimum disease transfer rate, vector growth rate and vector infection rate in addition to minimum infection rate. All these rate parameters are mostly controlled and modified by use of pesticides.

In the second part of this study, impact of another useful biological control method – roguing and its effect on agricultural field are studied in detail. Here two important parameters of this control method, namely, time interval and roguing rates are very crucial with respect to cost effective maximum crop production, since roguing rate is directly related to crop production rate but inversely related to production or cultivation cost and on the other hand, opposite results are depicted in case of time interval for roguing. So, the primary goal should be to balance between crop yield and production cost. For that purpose, effect of roguing time interval at fixed roguing rates as well as effect of different roguing rates at fixed time interval on plant and vector densities have been studied numerically.

From the above study it is clear that crops have maximum yield at considerably higher roguing rates as well as lower time interval for the same. But, since disease infection rate depends on densities of vector and pest population, roguing process with a constant rate and at constant time interval is not appropriate to maintain disease free situation for the whole duration of crop life cycle. Variations in these two parameters should be studied for maximum incidence to maximum eradication of mosaic disease in agricultural field. During maximum incidence the roguing rate should be higher and time interval should be lower but the interval time should be increased at ascending order during disease eradication process. From this study it can be seen that at higher time interval ($\tau = 8$ days) and also at comparatively lower roguing rate ($h = 0.45$) the system reaches stability point and considerably maximum crop yield in contrast to previous case is achieved.

Cost effectiveness is brought about by applying roguing at lower rates and with higher time intervals. It can be concluded from the observations that a disease free stable system can be achieved when roguing is applied at an interval of $\tau = 8$ days and at a rate of $h = 0.45$

which brings about the maximum cost effectiveness for crop production.

It can be concluded from the current study that roguing method is most cost effective and useful management of mosaic disease eradication in plants if proper rate and interval of roguing can be determined. This approach can be applied for other plant virus eradication management in economically valuable crops namely Cassava, *Jatropha*. So, the proposed model can be useful for agriculture researchers and workers. They can utilize the model to help predict the behavior of the epidemic and its management. This model can also be used for predictions and may encourage plant and insect researchers to gather the data necessary for the model. With availability of data collected from field, the parameters can be modified to fit any particular situation that may subsequently result in eradication of the disease.

Acknowledgements

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কল্পনাবাড়ীনগর পশ্চিম বর্ধমান থেকে প্রকাশিত দ্বি-মাসিক পত্রিকা

আজকের

বোধন

মন বোঝায় না, মন জোগায়

আজকের যোধন

(বর্ধমান জেলা লিটল ম্যাগাজিন সংঘের সদস্য)

সম্পাদক
বাসুদেব মণ্ডল

সহ-সম্পাদক
**কালাচাঁদ ঘোষ, রমাকান্ত মণ্ডল,
নমিতা ভট্টাচার্য, সমীর প্রসাদ, সুজিত মণ্ডল**

আমাদের কথা

প্রতি বছরের মতো এবছরও আমরা ছয়টি সাধারণ সংখ্যা এবং চারটি বিশেষ সংখ্যা প্রকাশ করব–এই আশা ও ভরসাকে সামনে রেখে আমাদের এই বাংলা নববর্ষের বিশেষ সংখ্যাটি প্রকাশিত হল। আর আমরা আশা রাখলাম যে,—প্রতিটি সংখ্যার মত এই সংখ্যাটিও পাঠক বর্গকে মুগ্ধ করবে এবং আনন্দ প্রদান করবে।

Hemanta Bala Devi : An Emancipated Woman in 20th Century Bengal.

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Hemanta Bala Debi is no stranger to the readers' of Bengali literature. After the publication of Ninth volume of letters in 1964, the curiosity about the recipient of the letter was awakened by many. The words of Rabindranath's heart are profound beliefs, philosophy of life, and discussion of castetism of Hindu- Muslim relations. Politics, even the intimate thoughts of particular moments of his mind, have long been published in the pages of the longest letters. The letter of the ideology wasthirty-seven years old, the mother of two, the husband, the mother- in-law, the father-in-law, the bride of one of the noble enlightened families.

Early life : Hemanta Bala Devi was born in the year 1894 at 26-Bechu Chatterjee Street, Kolkata. Her father, Brajendra Kishore Roy Chowdhury a land lord of Gouripur at Maymonsingha, and mother Ananta Bala Devi were liberal and admirer of poet Rabindranath Tagore. As a first child, she was developing very well and independently. The way the daughters of that times were celebrated in the conservative surroundings, the neighbourhood, Hemanta Bala's fact was much more than that. Seeing Hemanta Bala's written 'Nijerkatha' (Owns words), she went to Bhagalpur with her father and went on to 'dholoke'. Even, she used to taking flower in the garden with her father. Like the boys, chalking in her hand is the day of Saraswati Puja. While travelling to Madhupur with her father, gave him the bat, wicket and leg-pad to Hema. She used to play cricket with boys. At one time Bengalarir's vow, cooking spell like her free movement was as false as she was. She used to lie in the form of 'babu', acting master etc. She earned the character of modern 'Tom Boy'.

Advocacy in Hemanta Bala was a special part of her special love affair. She liked the beauty of girls in Brahma household. She used to cry bitterly to her mother, especially in the energetic spots. Natural beauty attracts her most. Grandiose Durgapuja create more question in her mind. She never realized that, how can see accept the idol as Maa Durga? So, she asked several types of questions and her mother reduke her. She used to ride palanquin at the time of Vijaya Dashami and this marginal behaviour compelled her to think as equal as her father.

From very childhood she wrote several types of poetry, songs etc. She wrote several types of essays on different idols. After a very movement when she initiated in Vaisnava Dharma, she wrote many songs of God Radhakrishna, ordered by her Srithakur and Sreema. She wrote versatile notes and journals about her religious concept, named as 'Satyabani Devi'. She wrote 'Urbashi', 'Mohila', 'Mohilamahal', 'Ghoroya', 'Golpobharati' etc. She also wrote essays, short stories with her own. It is unfortunate that, her works were in vain because more remain in rough sketch.

Before marriage she heard that Rabindranath set-up a school named 'Brahmacharya', where the wicked children became good. She started her study in Gouripur but at that time she was seven only. Her teacher was Gurudas Chakravarty. Her tyrannous work revealed her childhood and her works "Nijer Katha" (Owns voices) established her words. She wrote,—"ঐ শিক্ষক মহাশয়ের কাছে পড়ুবার সময় একটা জিনিসের দিকে দৃষ্টি পড়ে আমার পড়ার বাধাত হত বলে সেটি তিনি সরিয়ে রাখেন। পরে অনেক আকুতি-মিনতির পর সেটি যখন আমি ফিরে পাই। পরের দিন দিন না তার পরের দিন, এবং সম্পূর্ণ নিজের করে পাই, তারও পরে, এবং তার পরে ভেগে দেখি, ওর রহস্যতে করতে পারি কিনা—তখনও বহুদিন দূরে রহস্য ও হয়রানত কোথায় চলে গেছে। বত্রিশ হয়েছে মোটা কাঁচের গোলাকৃতি একটা কাচভাঙা। তার ভিতরে নাল, সাদা, সবুজ নানা বর্ণের মত চমত বৈজাবর্ষি করে থাকে।"

Married Life : Hemanta Bala got married at the age of ten with Brajendrakanta, son of the land lord of Rongpur and nephew of Jagadindranath Roy, king of Nator. From her in-laws she had a distant relation with Tagore family. The relationship between Hemanta bala Devi and Rabindranath Tagore was grandfather and granddaughter. Hemanta

This is not only girlhood character but also her curiosity of that time phrase.

Bala had a troubled married life, starting from age of ten to end of her life. Married in a traditional zamindar family, her movement was restricted in the andar mahal only. The born rebel Hemanta Bala could not adjust with her husband.

At the age of fifteen years she became mother and the age of twenty she took initiation in vaishnav dharma from a sadhu, name Kishorananda. By then she was separated from her husband. For some period of time separation and again reunion continued throughout her life. From her 'teen' she was familiar with Tagore's writings but after her Guru's death Hemanta Bala became more closer to Tagore's writings and took refuge in Tagore. In her restless mental situation she read "Jogajog", "Sheser Kobita" and identified herself with the heroin Kumu of "Jogajog" (Tagore's Novel). Not only Hemanta Bala could see a lot of resemblances with 'Kumudini'. Not only in literature but also in real life she would think of a lot of Kumudinis in our society. Even, we come to know about Hemanta Bala's liberated self in her various works and literary practices. Though, Hemanta Bala was not educated in general sense of the term, she was educated in a special sense and openness of her mind and love for literature finally made her a poet and a writer.

Came under the influence of Rabindranath Tagore : "Puranodiner Katha" (The voices of old era of Hemanta Bala) which was written by Hemanta Bala. There has she also discussed about her birth, childhood memories, marriage and marriage life, cultural activities, religious matter etc. In the second chapter, named "Rabindrasmriti" introduced us the first meeting between Rabindranath and Hemanta Bala, several events of her life. Apart from those the essay entitled "Rabindranath O Harokumari Pici Maa" disclosed the secret meeting between Rabindranath & Hemanta Bala Devi, which was very interesting and funny. In the end of this chapter, "Amar Moner Katha" (Owns Voices of Hemanta Bala) we discovered the character of Hemanta Bala, who was very open minded practical in life and free from any religious orthodoxy.

While engrossed in reading the Tagore's writings, Hemanta Bala found solace and there grew a desire in her to write letters to Tagore to get acquainted with him. Tagore was famous for replying letters of his admirers and this proved to be true in Hemanta's case also. She received reply

within a few days. Then started flow of letters from both sides. Tagore wrote 264 letters Tagore to Hemanta Bala, and may be a greater number of letters from Hemanta Bala to Tagore. Hemanta Bala was one of the four women recipients of Tagore's large number of letters. The others are Indira Devi, Ranu Adhikary, later she became Lady Ranu Mukharjee and Rani Mahalanbish. These exchange of letters between two lasted for eleven years. Starting from 1930 to 1941 the last days of Tagore. From these letters we find different sides of the myriad minded poet.

These letters were mostly on religious issues. Hemanta Bala was a staunch Hindu a devotee of vaisnava faith, believer and follower of all kinds of rituals. On the other hand, Tagore was against all ritualism. A liberal man his religion was the religion of man, a true lover of humanity. The letters between two opposite characters are interesting. Some letters are humorous, and personal in nature, some letters are related with the critics of Tagore. The first four letters of Hemanta Bala carry her pseudonym 'Jonaki' and 'Daksha Bala'. And interestingly in santiniketan these were kept in 'Pagla file'. Gradually, poet realized the potentiality of Hemanta Bala and the letters of 'Pagla file' were shifted to another file "Hemanta Bala and Rabindranath correspondence".

Hemanta Bala was neither a family member of Tagore nor a devotee in the strict sense of the term at the beginning. But, gradually through exchange of letters and meetings she came closer to Tagore. Descriptions of her meetings with Tagore show the condition of the then Hindu society. Her reminiscences of meeting with Tagore were really interesting and hilarious. From this correspondence the religious idea of Tagore becomes clear and distinct. His revolt against untouchability pomp and grandeur of Hindu worship are clearly expressed. Hemanta Bala's debate with Tagore was interesting. But more interesting is the transformation of a woman under 'Purdah' and her blooming into a flower. At the end of her life she turned to be a non-believer of any ritualistic orthodox religion. In her lonely days in the last lap of her life in Puri (Swarnachol) her only companion was Tagore's 'Geetabitan' and 'Santiniketan'. We find in her letters and appeal to poet to be her 'Guru', show her the path of realization. We know that Digambari Devi (wife of Prince Dwarakanath Thakur) was a fully devoted Vaisnava. And considering this trail we can see the influence of Vaisnava

religion on Rabindranath. On the other hand, Hemanta Bala Devi is an indoctrinated Vaishnava devotee. Rabindranath Tagore was not only 'Jiban Devota' of Hemanta Bala Devi. But she was highly influenced by his Idealism. She established 'Rabibortika' (a Centre for practicing literature & music) to spread Tagore idealism thought out the nation. We can see find all these aspects in their letters. Even, Hemanta Bala wants to free from all kinds socialistic burden. She was informing these own words to Rabindranath. We can see her many letters which are send to Rabindranath. One of these is,—"অর্থাৎ আমি এ পৃথিবীতে নিজে নীচা, ঠাকুরকে বড়, —তোমাকে ভক্তি করব না, পাছে তোমার কাছে আপনা আপনি ছোট ছোট হয়ে যাই, তোমাকে পাই না—, গান, আমার শক্তি বৃথা সকল। এমনি তুচ্ছ নিয়ে নিজেই শুধু গ্লানী তার মধ্যে নিজেকে মান করেছে। নিজেরে কোথায় কিছুই করে তোমা রাখা তার নিষ্ঠি।"[2]

We also know that the crisis time of Hemanta Bala after death of Rabindranath from their letters. She depicted the picture of her life which was full of poverty, though she was daughter and daughter-in-law of rich land lord. We came to know about her last days of life which was pathetic. Through reading their letters, the prominent feature which we can stress is the conflict of ideas of Tagore and the ideas of Hemanta Bala Devi. One that is constructed by society and other which is self-judgment of Hemanta Bala Devi that grew up within herself. We have a particular belief in an ideology that is guided by the person. For this context, each woman has an individual religious belief which is inherent in her. For this reason, she can differ herself to other. But in the patriarchal system of our society, this inherent quality of woman is considered as valueless. However, the main focus of my argument is that the creative ideas of woman are cramped by the rules and regulation that is created by patriarchy. So, we don't allow their own thoughts rather we are imposing the rules and laws that already created by our society. So, we can say that this kind of system is a very obstructive to woman's emancipation and also equally harmful to their empowerment, capability and development. Above all this subject matter focuses the point of paralysed condition of woman in society.

It is not true that the patriarchal system of our society is responsible for absence of all-round development and empowerment of woman.

because, so many countries where development of woman had not been possible in spite of matriarchy of those country. The similar picture of woman's development does not found still in India where matriarchy is going on. So, I will discuss about this issue elaborately to my research work. Here, I am talking about the relevance of exchanging letters between Rabindranath and Hemanta Bala. Because, Hemanta Bala is a woman who belongs to the category of an ordinary woman. In this context like an ordinary woman of our society, sometimes she accepts all the barrier and restriction of societal norms. Most of the times she rejected to accept the rules and restrictions imposed upon her. Those rules became obstruction to her, she can't freely express her personal view. In this context we can differ her from other woman. She was free minded and freely expressed her opinion without any hesitation. But it is very interesting to point out that she was not radical thinker or autocratic. She was self-guided and was not orthodox free to accept the others' view and opinion. We know that there are three levels of power of women's development. Firstly, in the stage of maidenhood she acquires the potential accumulation of power. Then comes womanhood where we noticed development of their power. At the last stage they achieve the realization of motherhood and where they flourish their power. From this perspective we can judge Hemanta Bala Devi explored her through self-development among these three levels. It is very clear that Hemanta Bala Devi (1894-1976) came at the ultimate level of women's empowerment relating to societal norms and barrier religion–literature. And thus, she came to the very close proximity of Tagore.

In spite of being daughter-in-law and daughter of a land lord, she had to face many struggles in life and has to cross the hardship of life. So, as per as she can be considered the pioneer of woman emancipation. Neither she was confined within curtain system nor was she truly entrapped into familial bonding. She became bride in early childhood, was devotee in womanhood and the last stage of her life, the religious curiosity made her restless. And she began to lead her life like a nun. We can portray the picture of women's condition of the the then society through her way of life. Side by side devotion in literature pursuit in music and love towards birds are the subject matter which will be another important focal point of my research. So, the main point of my research is the empowerment,

respect, the all-round development of woman which traditionally comes from the last two and half decades of centuries. Hemanta Bala Devi is pioneer of this kind of tradition.

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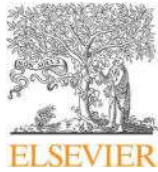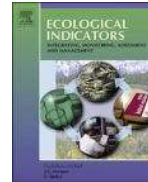
Environmental factors as indicators of dissolved oxygen concentration and zooplankton abundance: Deep learning versus traditional regression approach

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ABSTRACT

Presence of optimal levels of dissolved oxygen (above critical level of $4.5\,\mathrm{mg\,L^{-1}}$) and presence of zooplankton community are indicators of good water quality of an aquatic ecosystem and also of the health of the same. Reservoirs being artificially created water bodies present hybrid systems containing features of both lotic and lentic systems and thus have unique organization that are representative of both rivers and lakes. Since any reservoir is primarily a fresh water system, presence of a large array of zooplankton (diverse community structure) implies its good health and also presence of optimal dissolved oxygen levels supports sustenance of life. In this study, artificial neural network modelling approach has been utilized to predict the level of dissolved oxygen and zooplankton abundance in the Bakreswar reservoir and their variation in relation to the environmental factors. Use of neural network modelling is exceedingly capable of determining correlation among apparently non correlated environmental data and in the current study these are capable of accurately predicting the variations in the levels of dissolved oxygen as well as the abundance of zooplankton. From this study, it has been observed that chemical factors like productivity, nitrates, salinity, pH, phosphates, total dissolved solids, etc. are mostly responsible for control of dissolved oxygen and zooplankton variation at certain points of the study site (stations 1 and 3) whereas at other points (station 2) physical factors like solar radiation, humidity, etc. are more effective. These models are capable of finding the important environmental controllers of such variations and prove to be a powerful alternative to traditional approaches like multiple regression analysis.

1. Introduction

Purposefully designed artificial water bodies like dams and reservoirs create hybrid ecosystems that collectively present combined qualities of two characteristically diverse (lotic and lentic) systems (Kennedy, 1999; Soballe et al., 1992). Three different aspects of reservoirs – the physical, chemical and biological subsystems (Straškraba and Tundisi, 1999) work in unison to maintain a healthy system that serve not only the primary objective of fresh water supply to irrigational fields, but also provide other ecosystem services including drinking water supply, generation of hydroelectric power, area for stock and culture fishery, provisioning for recreational opportunities and also flood control. Thus exhaustive research should be focused on managing proper health of these aquatic resources that can implement environmentally sound and feasibly concrete management practices (FAO, 1995; Li et al., 2010).

Quantification of ecosystem health is not something that can be easily achieved by focusing research in any one direction. In order to successfully determine the health of any ecosystem, different indicators like system indices (system robustness, resilience, organization, species distribution patterns, eco-exergy content, etc. obtained from study of trophic structure, spatial patterns of variation of biological components and influence of environmental factors on the various subsystems of any ecosystem, etc.) present various results that can be used to successfully decipher the ecosystem status – its health (Banerjee et al., 2018, 2017b; Connell, 1963; Hull et al., 2000; Jørgensen, 1986; Rakshit et al., 2017; Scharler et al., 2018; Ulanowicz, 1986; Venturino et al., 2016; Williams, 1976). A multitude of distinctive elements can be used as system health

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indicators including for example important chemical factor like dissolved oxygen (DO) content of the water body or biological aspect like the abundance of zooplankton in the same and so on.

Oxygen is one of the primary requirements of life without which, it would be impossible for aerobic organisms to survive. For aquatic heterotrophic organisms, dissolved oxygen (DO) is the only source of oxygen and this acts as a vital factor not only in life sustenance but also in regulating their metabolic activities and subsequent trophodynamics (Hull et al., 2008, 2000). *DO* is a critical variable in evaluating water quality in lakes, reservoirs or any fresh water system. Low *DO* concentrations of water bodies directly affect abundance of fish and other organisms thus altering ecological balance. Frequent occurrences of hypoxia due to sudden lowering of *DO* have caused significant reduction of fishery harvests, toxic algal blooms and loss of biotic diversity (Howarth et al., 2000; Paerl, 1988). The minimum level required is 4.8 mg L^{-1} (critical level of *DO*) to mark any water body as healthy (EPA, 2000; Gürel et al., 2005). Below this level, adverse effects comes into play ultimately affecting biological, ecological as well as economical processes as well (Breitburg, 2002; Nelsen et al., 1994) with disruption in their proper functioning. *DO* level in an aquatic system is regulated by two key processes which are – (i) production (photosynthesis by phytoplankton, aquatic macrophytes and periphyton) and (ii) consumption (respiration by aerobic communities, biological and chemical oxygen demand, organic matter mineralization etc.). Environmental (physical and chemical) factors like water *pH*, atmospheric and water temperature, salinity, atmospheric exchange and also hydrodynamic water column processes contribute to the maintenance of dissolved oxygen levels (Hull et al., 2008; Mandal et al., 2012; Sallam and Elsayed, 2018; Smith and Piedrahita, 1988; Tuchkovenko and Lonin, 2003). The controlling processes are summed up in the following conceptual diagram – Fig. 1.

Similarly, the presence of a healthy assemblage of zooplankton community (having diverse composition and abundance) is another suitable indicator of water quality (Karjalainen et al., 1996; Moss et al., 1997; Muylaert et al., 2006). Zooplankton in most cases occupy the second trophic level in an aquatic food web and serve as the main link of energy transfer from producers to the higher trophic level heterotrophs (Deivanai et al., 2004; Ismail and Mohd Adnan, 2016; Santos-Wisniewski et al., 2006). Zooplankton show vertical as well as horizontal distribution alongside diel migration patterns that can be attributed to several factors including solar radiation, species assemblage

and various other environmental factors as mentioned above (Cisewski et al., 2010; Dini and Carpenter, 1992; Lampert et al., 2003; Lienesch and Matthews, 2000; Vijanen et al., 2009). In addition to showing quick responses to changes in the environment, variations in community structure (relative abundance of species in a community) can be observed in response to changes in physico chemical factors also (Gannon and Stemberger, 1978). Previous reports suggest that different zooplankton groups are good indicators of eutrophication, acidification of water body as well as turbidity of lakes and reservoirs (Attayde and Bozelli, 1998; Burns and Galbraith, 2007; Pinel-Alloul et al., 1990; Sousa et al., 2008). Increased nutrient inflow can result in eutrophication of water bodies thus resulting in phytoplankton bloom. However, zooplankton communities present in the water body can act as top-down controller feeding on phytoplankton thus decreasing chlorophyll-*a* concentration and enhancing water transparency (Yang et al., 1998). Consequently, the study of abundance of zooplankton groups and relating this to the controlling effects of environmental factors provides much insight into organization of the aquatic system (Sehgal et al., 2013). Fig. 2 below summarizes the conceptual framework of zooplankton abundance control in an aquatic ecosystem.

Several authors have till date used various methods for the study in variations of *DO* (Mandal et al., 2009; Prasad et al., 2014; Scavia et al., 2003; Singh et al., 2009; Wu et al., 2000; Zhao et al., 2007) and species abundance in different systems using a multitude of techniques (Geraldes and Boavida, 2004; Haury et al., 1991; Lienesch and Matthews, 2000). Traditional methodologies like spatial pattern analyses of community structure and dynamic modelling of particular aspects can provide useful insights to various facets of the system concerned but often fail to correlate the large number of controlling environmental factors to the same (Chakrabarty et al., 2017; Connell, 1963; Sarkar and Pandey, 2015; Williams, 1976).

Since the proper introduction of mathematical modelling in limnology, a growth surge has been observed in the use of ecological modelling and various forms of its application (Jørgensen, 1999). Over the years, mathematical modelling has evolved considerably. Some very complex and highly evaluative modelling approaches are capable of adapting to ecosystem changes in response to forcing functions and can modify and evolve to incorporate those changes (Jørgensen and Bendoricchio, 2001). Artificial neural network (ANN) modelling approaches have gained popularity particularly during 2000–2006 along with structural dynamic models and also individual based models
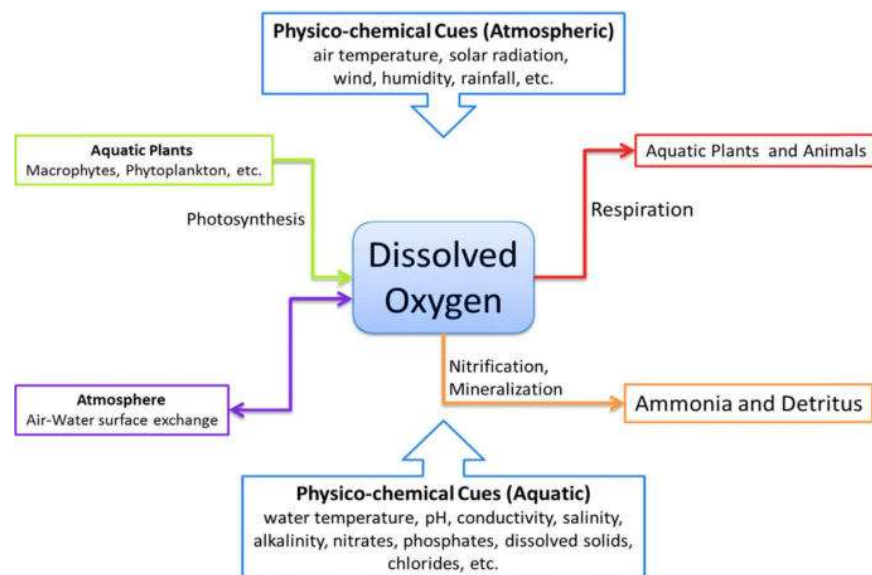
Fig. 1. Conceptual diagram of different processes maintaining the level of dissolved oxygen in the water column.
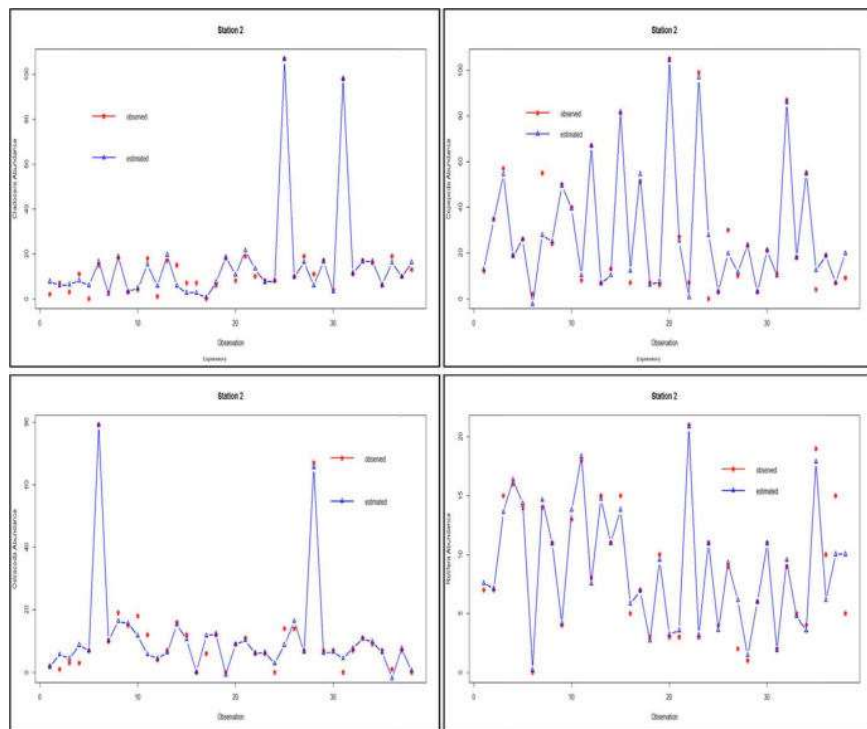
Fig. 6b. Comparisons between model outputs (blue triangle) and observed values (red star) for Zooplankton abundance of S2. The plots represent (clockwise from top left) Cladocera, Copepoda, Rotifera and Ostracoda abundance respectively with the X-axis showing the number of observations and Y-axis shows zooplankton count. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)
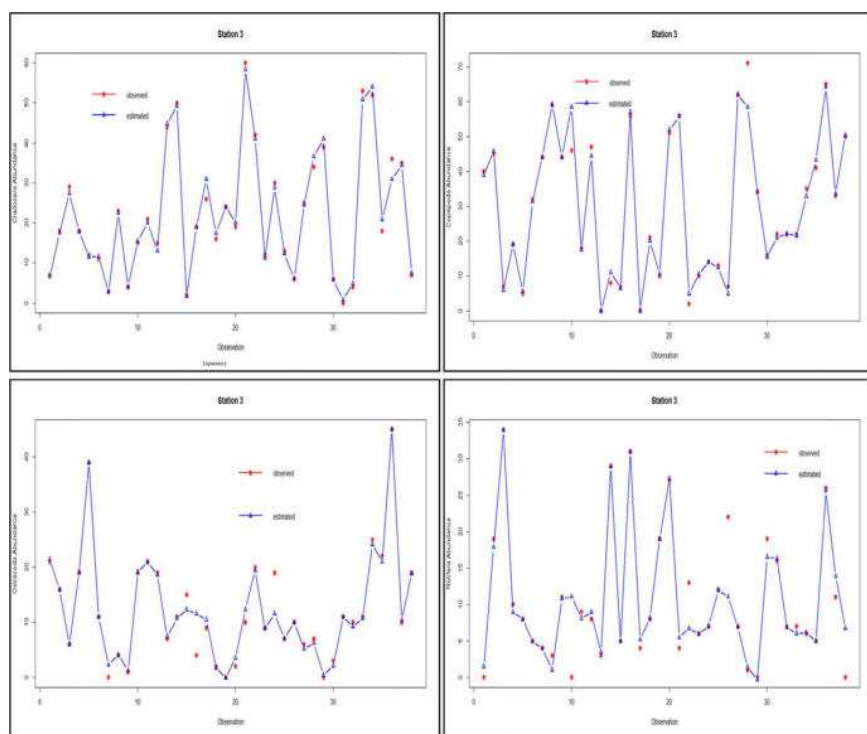
Fig. 6c. Comparisons between model outputs (blue triangle) and observed values (red star) for Zooplankton abundance of S3. The plots represent (clockwise from top left) Cladocera, Copepoda, Rotifera and Ostracoda abundance respectively with the X-axis showing the number of observations and Y-axis shows zooplankton count. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

the variation in ranking of each independent (predictor) factor in the control of *DO* and zooplankton. The most important factors are found to be productivity, biological oxygen demand, phosphates, nitrates, salinity, *pH* etc. thus implying a chemical control of the reservoirs water quality and these observations are in agreement with previous observations as well (Banerjee et al., 2015; Chakrabarty et al., 2017; Hujare, 2008; Tarkan, 2010).

S1 and S3 are situated further away from the reservoir dam and the water level here faces lowering during warm summer time and subsequently increases in the monsoon (Banerjee et al., 2015). This leads to an increased presence of turbidity and also increased concentration of different chemical attributes like *Nit-N*, *TDS*, S_{AL}, *Phos-P* etc. following increased evaporation of water in the dry seasons and shallow water depth in these two stations (Hujare, 2008; Medudhula and Samatha,

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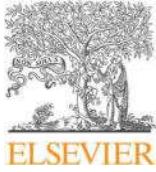
An approach towards quantification of ecosystem trophic status and health through ecological network analysis applied in Hooghly-Matla estuarine system, India

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ABSTRACT

The structure and function of food web of Hooghly-Matla estuarine system (HMES) including Sundarban mangroves is studied to assess the health of the system. HMES, provides shelter and make a home to many economically important shell and fin fishes. This estuary is exposed to various threats such as increasing salinity, deterioration of soil fertility and productivity, pollution and loss of biodiversity. Ecological network analysis (ENA) is applied for the HMES to model the trophic flows in 22 ecological compartments using Ecopath (a software for network analysis), integrating ecological data for the 2013–2015. ENA is performed, including a set of indices, keystoneness and trophic spectrum analysis to describe the contribution of the 22 groups to the HMES functioning. Results show that 22 compartments of the HMES including primary producers (trophic level TL 1) to the top consumers (elasmobranch, TL 3.5), the ecotrophic efficiency ranges from 0.016 to 0.989. Small demersal fishes, prawns, shrimps and crabs are the most exploited groups of this ecosystem. Herbivory and detritivory ratio is 1:1 indicating relative absence of top predators and low maturation level. Maturity of the system, organization, relative order and disorder within the system, diversity of flow of material among compartments and overhead of the system has been assessed. Biomass over Total system throughput ratio (*TB/TST*), Total primary production over total respiration ratio (*TPP/TR*), Total primary production over biomass (*TPP/TB*) and system omnivory index (*SOI*) indicate the moderate maturity level of the system. The HMES trophic network has a moderate recycling level (FCI = 12.99%), a high total system throughput (TST = 22976.03 tonnes $km^{-2} yr^{-1}$) and a low ascendency (A = 25799 tonnes $km^{-2} yr^{-1}$), but a relatively low connectance (CI = 0.27), high internal relative ascendency (A = 29.6%) and a high omnivory index (OI = 0.203), indicating that this estuary is immature but relatively organized and complex, with strong production. HMES has some unique features in comparison to similar functioning geographically close estuaries or estuaries with similar environmental characteristics. System robustness and exergy are also estimated to assess ecosystem health and compared with other tropical systems. From a holistic point of view, present study conveys fundamental information and categorizes the status of the system.

1. Introduction

Estuaries along with its vast biodiversity support extensive fisheries causing disproportionately high economic values (Blaber et al., 2000) and most extensively modified and threatened ecosystems on earth (Costanza et al., 1997; Blaber et al., 2000). Estuarine system endows with abundant food supply for organisms of different trophic levels (Schelske and Odum, 1962; Teal, 1962; Odum, 1968; Nixon, 1980) and refuge from predation for juveniles of several fish and invertebrate species (Robertson and Blaber, 1993; Paterson and Whitfield, 2000). Estuaries serve as important sites for fish, both as nursery and reproduction grounds and also migration routes. Functioning of estuaries

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engrosses complex interactions among the components of the ecosystem. The estimation of material or energy flow through diverse compartments of the system and efficiency of energy assimilation, transfer and dissipation provides an essential insight to reveal the structure and function of the system (Baird and Ulauowicz, 1993). Application of thermodynamic and network oriented indicators to coastal systems could have a powerful tool to assess ecosystem health and maturity (Vassallo et al., 2006). This study attempts to summarize and integrate existing trophic structure and to depict a larger picture of interactions among biological components and their functions in the ecosystem using a mass-balanced model of HMES.

Stability of the estuarine system comes from the availability of resources for its components and trophic interactions among these components (Polis and Strong, 1996). Thus, information on material flow and trophic structure are fundamental for the understanding of the persistence of these communities through time (Polis, 1994; Polis and Strong, 1996). A good number of detailed food web studies have been done for lakes (Chea et al., 2016; Vander Zanden and Vadeboncoeur, 2002), rivers (Jepsen and Winemiller, 2002) and even large open ocean areas (Davenport and Bax, 2002; Sherwood and Rose, 2005) and also in estuaries (Lobry et al., 2008; Scharler and Baird, 2005; Baird et al., 2004a; Wolff et al., 2000). Generally, estuaries are in stressed condition due to anthropogenic activities (Diaz and Rosenberg, 2008; Blaber et al., 2000). There is still scope in detailing relationships between species and among the estuarine community specially, in tropics as a whole. Inspite of prevalent estuarine systems in tropics, there are only few of studies food web including network analysis (Patrıcio et al., 2004; Scharler and Baird, 2005; Mohamed et al., 2005). Under this circumstance, we study one important tropical estuarine system emphasizing on the system health. Health of an ecosystem is related to its fundamental attributes, functioning, maturity and stability. These factors are dependent on the complexity of the system which, in turn, dependent on the trophic interactions of the food web.

ENA, a cluster of algorithms, with holistic approach towards ecosystem analysis to unravel several system properties is described in detail by Ulanowicz (1986, 2004), Wulff and Ulanowicz (1989) and Kay et al. (1989). Several studies have been carried out exploring various aspects of ecosystem functioning using ENA; such as, trophic models of the exploited benthic ecosystem (Ortiz and Wolff, 2002), evaluation of environmental and anthropogenic stress and use of these indices for ecosystem health management (Tecchio et al., 2015), trophic structure, function, efficiency and productivity among ecosystem types (Blomberg and Montagna, 2014), impact of the top predators of the system (Lercari et al., 2015), species relationships by energy transfers, trophic fluxes, and assimilation efficiency (de Mutsert et al., 2012), effect of stress on the structure and functioning of food web (Baeta et al., 2009), general status and development trends (Duan et al., 2009), assessment of nutrient supply and habitat structure (Scharler and Baird, 2005; Baird et al., 2004b) etc. Ecopath model using ENA was first applied by Christensen and Pauly (1992) to evaluate the maturity among 41 aquatic ecosystems through 31 attribute parameters provided by the statistics analysis. Ecopath is steady-state trophic model which evokes transfer of material or energy within the components of ecosystems (Brey, 2012).

The tidal freshwater areas of estuaries have received little attention in ecological research although they are often heavily stressed by environmental impacts. Significant degradation and loss of coastal wetlands have been observed due to the establishment of increasing human populations near lagoons, gulfs and bays (Entsua-Mensah, 2002; Ibe and Sherman, 2002; Scheren et al., 2002; Wolanski et al., 2004). The Sundarbans, the lush mangrove vegetation between India and Bangladesh, is a unique ecosystem with high biodiversity including the HMES which is one of the most important estuarine systems in south-east Asia. HMES has been declared as World Heritage Site by UNESCO in 1985 and in 1989, a Biosphere Reserve in India which carry out a variety of ecosystem services. Litterfall of mangroves supplies the detritus,

nutrients and regulates the productivity and is the home for many economically important shell and fin fishes. Research on HMES have focused on the biogeochemical cycles (nitrogen and carbon), carbon flux, phytoplankton assemblage, water quality assessment and mangrove litterfall dynamics and fish faunal assemblage (Mukherjee et al., 2013; Roshith et al., 2013; Roy et al., 2012; Hossain et al., 2012; Dutta et al., 2012; Choudhury and Pal, 2011; Mukhopadhyay et al., 2006; Ray and Straskraba, 2001). Few works describing partly or whole estuarine area explaining the present condition of the system have been done (Ray et al., 2000; Ray, 2008; Ullah et al., 2012). Fishery in this area is at a stake due to over exploitation, the catch per unit effort (CPUE) and overall system health is declining as an invariable outcome (Dutta et al., 2016; Rakshit et al., 2017). Major ecological problems in this area are - increasing soil and water salinity, subsequent deterioration of soil fertility and productivity, pollution of soil and water ecosystem and loss of biodiversity. Human society interaction with environment is intense and natural resource consumption to the extent of overexploitation is quite common here. Huge discharges of untreated domestic and industrial effluents, from nearby industries are the major cause of water pollution at this site. Alterations to and removal of mangrove vegetation over time has become another threat. This environmentally and economically important area can step towards an uncertain future if proper solutions are not taken into consideration. Therefore, the objective of this study are (1) construct a steady-state trophic model of HMES to reveal the trophic interactions among the compartments within this system through ENA, (2) analyze the ecosystem maturity and trophic functioning using an ecosystem characterization index resulting from network analysis, (3) to assess the health of this ecosystem.

2. Method

2.1. Study site

The HMES, the first deltaic offshoot of the Ganges lies approximately between 21°31′–23°20′ N and 87°45′–88°45′ E. This tropical coastal estuary with its lush mangroves is shared between two countries – India and Bangladesh. The Indian part of HMES is shown in Fig. 1. The area considered for the study is from Diamond harbour to the coastal areas of Bay of Bengal along coastline of West Bengal state of India. Data on fish catch has been collected from fishing stations of Diamond harbor, Kakdwip, Namkhana, Bokkhali, Frasergunj.

2.2. Overview of ecopath model

A potential key to understand ecological complexity is to apply ecosystem approach which considers all species in the system, the food web along with all flows and processes. The static modelling approach has been considered using Ecopath as a tool to understand the food web of the system, taking important functional groups from each of the trophic level. Static modelling approaches employ a series of linear equations to estimate values of all flows taking place in a system, which can then be analyzed with ENA indices. Ecopath is modelling software which captures a static mass balanced snapshot of the whole system (Christensen and Pauly, 1993; Christensen et al., 2005). The algorithm of Ecopath is based on parameterization of the two master equations known as:

(1) Production = catch + predation + net migration + biomass accumulation + other mortality;
(2) Consumption = production + respiration + unassimilated food,

It can be simplified and expressed as follows (Christensen et al., 2005):

Table 3
System attributes and important ratios of HMES.

Parameters	Value	Unit
Sum of all consumption	9468.333	t/km²/yr
Sum of all exports	1346.267	t/km²/yr
Sum of all respiratory flows	6032.349	t/km²/yr
Sum of all flows into detritus	6129.079	t/km²/yr
Total system throughput	22976.03	t/km²/yr
Sum of all production	10702.32	t/km²/yr
Mean trophic level of the catch	2.347	
Calculated total net primary production	9160	t/km²/yr
Total primary production/total respiration	1.51848	
Net system production	3127.651	t/km²/yr
Total primary production/total biomass	28.28844	
Total biomass/total throughput	0.01409326	/year
Total biomass (excluding detritus)	323.8072	t/km²
Throughput cycled (excluding detritus)	759.41	t/km²/yr
Predatory cycling index	7.09	% of throughput without detritus
Throughput cycled (including detritus)	2984.02	t/km²/year
Finn's cycling index	12.99	% of total throughput
Finn's mean path length	3.114	
Ascendency	25799.0	flowbits
Overhead	61478.3	flowbits
Developmental capacity	87277.2	flowbits
Average mutual information	1.123	
Shanon's diversity index	3.799	

pedigree routine for the EwE model. The current model has a pedigree index of 0.567 with a measure of fit 3.0 which shows that the model is reliable with a high level of confidence.

3.3. Ecosystem properties and ENA indices

The statistics routine of Ecopath and flow indices list all the eco-system attributes (Christensen et al., 2005; Lindeman, 1942; Ulanowicz, 1986) for the HMES in Table 3. The total system throughput of the estuarine ecosystem has reached 22,976.03 t km⁻² y⁻¹, of which 41.20% derived from consumption, 5.85% from exports and 26.25% from respiration with 26.67% eventually flowing into detritus. The values of ascendancy and overhead are 29.6% and 70.4% respectively for HMES (Table 3).

3.4. Ecosystem health assessment

3.4.1. Robustness
For HMES, the robustness curve demonstrates that the robustness value for the system is near the apex ("window of vitality", Ulanowicz et al., 2009) if we compare that with the hypothetical curve.

3.4.2. Exergy
Table 5 (see appendix) lists the relative β values for different organisms proposed by Jørgensen (1997). It is applied to calculate the exergy of the system. Using the β values listed in Table 5 and the tonnes km⁻² biomass in Table 2 following exergy of the each compartment of the system is obtained expressed as g detritus equivalents m⁻² (Appendix 1, Table 5). Total exergy of the system is 20192.16315 gm detritus equivalents m⁻² and specific exergy is 58.05563783.

4. Discussion

4.1. HMES trophic structure

Salient features of ecosystem such as maturity, organization, fundamental processes involved with material and energy transfer can be determined by static modelling of a system using Ecopath as a tool. In the current study, data obtained from published literature with models having similar consumer organisms (Mustafa, 2003; Ullah et al., 2012;

Vivekanandan et al., 2003; Mohamed and Zacharia, 2009) and also from direct field observations. Pedigree index and the associated 't' measurement reveals the uncertainty of the data used for the model and the results are quite acceptable when compared to the pedigree value of other Ecopath models. Additionally, the model also makes out the importance to bridge in data gaps and highlights the requirement to progress knowledge about specific parts of the system. For instance, the microbial and microphytobenthos compartments, which could be imperative for the trophic structure and symbolize high biomass (Abarca-Arenas and Ulanowicz, 2002; Rybarczyk et al., 2003), are not measured in the model. In spite of the problem of merging bacteria with detritus, bacteria is allocated to the detritus compartment here, as suggested by Christensen and Pauly (1992) and practiced by numerous authors.

All the eleven fish groups in HMES having the total biomass 50.94 tonnes km⁻² y⁻¹ and shows EE values towards the higher range (> 0.5). Five fish groups have trophic level higher than 3. High predation pressure of the top predators poses a high exploitation rate to the middle trophic layer, such as zooplankton, prawns, benthic herbivore having EE values 0.951, 0.95, 0.814 respectively. This highly exploited middle layer gives less grazing pressure to the primary producers level as evident from low EE values of this level. This exerts top down effect in the system. The high exploitation of fish groups due to fishing pressure in this region because of high market value of this resource and this region serves as one of the most economically important export stations in south-east Asia. Though mangroves have the largest individual biomass among all the other components of the estuarine trophic structure, is not utilized in efficient manner by the consumers as evident from EE values. It may be due to the difficulty of successful utilization of live individuals (Christensen et al., 2005). It might also be an indication of non-availability of their predators in the ecosystem or in the model. Though crabs feed on the fallen leaves of the mangroves and the dead and decayoing parts mainly contribute to the detritus pool of the system (Mukherjee et al., 2013). EE value implies low exploitation of some fish groups (small demersal, medium demersal) which belong to the higher trophic levels. This may be due to the fact that export of these groups (via fishing) is not beneficial to the fishermen and is thus unusual.

High predation pressure of top predators (mostly by many fish groups) exerts on middle trophic groups. Due to top-down effects the biomass of these middle groups decrease and in turn the biomass of primary groups (lower trophic levels) increase. However, external pressure such as overfishing on top predators balances this condition and maintains the normal functioning of this system.

In present study, it is specified that both gazing pathway as well as detrital pathway are almost equally important in this estuary (consider the similar EE values for primary producers (except mangroves) and the detritus group). This fact is to some extent contradictory to most available literature where the detrital pathway is of higher importance (Fig. 3). But the transfer efficiencies (TE) varied greatly between the successive trophic levels. The initial values of TEs increase from TL-II to TL-III, towards the higher trophic levels. The TE between trophic level 1 (TL-I) and trophic level 2 (TL-II) of ecosystems is higher whereas, much food is available for TL-III. TE from primary producers is 8.8% whereas from detritus is 8.6%. TE put forward an example of low herbivore transfer efficiencies, higher efficiencies on trophic level 3 and lower efficiencies at the higher levels. Most of the production may not be originated from phytoplankton but also from the mangroves whose energy is only available to its consumer after decaying into detritus (Patrício and Marques, 2006). This kind of TE has already been seen in different systems (Christensen and Pauly, 1992; Baird and Ulanowicz, 1989). The mean transfer efficiency among different trophic levels of the ecosystem is 8.6% in our study, slightly lower than the 10% proposed by Lindeman (1942), but lying within the acceptable range of EE values reported in the published literature (Libralato et al., 2008; Pauly and Christensen, 1995). Among all groups of HMES, the maximum primary production is required by medium benthopelagic fish, followed

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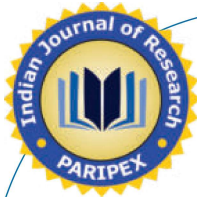
| ORIGINAL RESEARCH PAPER	Physical Education
ECONOMIC IMPACT OF SPORTS ON SOCIETY	**KEY WORDS:** Economic impact, Sports, Society.

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ABSTRACT

Sports and Physical activity is linked solely to the sport at schools, colleges, universities and leisure activities, undermining its contribution to a number of other processes and activities. For example, sport is closely linked to education, tourism, health and entertainment. Each of the above has made up a major role in the national economy. Entertaining people during their time off from work as always been a primary role of both participation and spectator sports. Although in the past sport entertainment was usually casual & relaxed, today's sport is often organized, mechanized, marketed and administered as a business. Commercial interest influenced virtually every decision in sports. Events are rated by television audience share, tickets sales, website hits, concession sales, sponsor revenue and media coverage. Wins and losses are important because they influence all of these standards of measurement. As sport in growing more into business, the corporate model is entering into the organization of every sport entity and governing body. Athletes are encouraged to provide their services for the good of the larger entity, to contribute to the bottom line. Coaches are becoming the supervisors of athletes who are sometimes asked to go against their personal choices for the better good of the team or organization. As the sports industry in growing in economic power, it is also attaching commercial interests who could benefit from that power by influencing its organization. As the industry is developing, the role of the athlete is becoming to serve the organization.

INTRODUCTION:

Sports economic is a discipline of economics focused on its relationship to sports. It covers both the ways in which economists can study the distinctive institution of sports and the ways in which sports can allow economists to research many topics, including discrimination and antitrust law. The theoretical foundations of the discipline are heavily based on micro economics. Sports economics modules offer a range of transferable and specific skills that can be applied to a range of role opportunities, particularly in the ever growing sports and leisure industries, local government & tourism. Sports economics possesses substantial experience in economic consulting to the sports industry, with specific knowledge of the economic impact of facilities, event, and teams so considering the publicity and scrutiny surrounding such studies, it is imperative to select a firm that not only has substantial experience, but also has a reputation for consistently providing an accurate assessment of economic impact. Economists and scientists have widely studied the sports role in economic growth as well as the importance of sport for people's physical activity promotion. However in the light of the growing role of sport in economic processes, it is necessary to do an in depth study for theoretical aspects of sports economics. Many people love sport. Thus, sports economics provides an opportunity to analyze some key economic concepts can be used to analyze and understand the role that economics incentives play in determining the behavior of controlling bodies, leagues, clubs, players, fans, sponsors, the media and government.
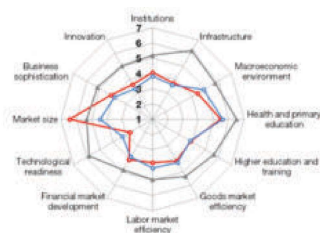
HISTORY OF SPORTS ECONOMICS:

Throughout human history, many societies has used sport as form of public entertainment. However never before has commercial sports been as pervasive as it is in contemporary industrial society. Money is the motivator of athletes. Players and owners give their primary allegiance to money rather than to play. Playing for high monetary stakes is existing for funs too. Television money dictates schedules, the timing of time outs, and even controls what sport casters say. Super athletes can become millionaires.

Modern sport is corporate sport. The original purpose of sport –

pleasure in the activity has been lost in the process. Sports has become work. Sports has become the product of publicity agents using super hyper methods. Money has superseded the content as the ultimate goal.

Eitzen's statement emphasizes the notion that commercialization has changed sport dramatically. We will focus on four topics.

1) The factors contributing to the emergence and growth of commercial sport.
2) The effects of commercialization on the form and content of sport.
3) The legal status and incomes of athletes.
4) The owners and sponsors of commercial sports we know that whenever any sport is converted into a form of commercial entertainment, success depends on its man's appeal. Although spectators are adverse group with a variety of motives underlying their attachments to sport, their interest in any sports event are usually related to a combination of three factors:

(I) The uncertainty of the event's outcome,
(ii) The risk or the financial rewards associated with the involvement of the athletes and
(iii) The display of excellence or heroics by the athletes. In other words, when spectators refer to a 'good game' they are usually referring to one in which the outcome was in doubt until the very end of the consist, one in which the stakes were so high that the athletes were totally committed to end engrossed in the action, or one in which there were a number of excellent or heroic performances.

When an event is characterized by all three of these factors it is likely to be discussed and remembered for a long time. It spectators are attracted by uncertainly, high stakes, and noteworthy performances, the commercialization of sport is bound to create certain changes.

This fact has led to the question of whether commercialization corrupts sport or whether it simply changes sport in ways that make it available to a greater number of players and spectators.

IMPORTANCE OF ECONOMICS IN SPORTS

Now-a-days sports are evaluated in terms of gate receipts and revenues from the sale of concessions, licensing fees, merchandise, and media rights. Games and events are evaluated in terms of market share, ratings points, and advertising potential. Athletes are evaluated in terms of endorsement potential and on-camera image, their very popularity may depend on their ties to

corporate names and logos. Stadiums, teams and athletic events now are named are larger corporations rather than historical figures and places with local meaning. Corporate interests influence everything from the choice of team colours to the times events are scheduled and the ways they will be covered by the media. In fact, media companies own a growing number of sport teams and sponsor more and more events. Sports are now corporate enterprises, integrally tied to marketing concerns and processes of global capitalist expansion. The names of transnational corporations have become synonymous with the athletes, events, and sports that provide pleasure in peoples live.
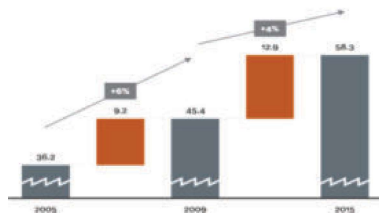
Seven Sectors of the Sports Economy

National income accounting provides the framework for the suggested analysis, consistent with the National Accounts. It allows for a division of the sports economy into these seven sectors.

Consumers – including the personal or household sector. This shows mainly sports related expenditure, like spending on sports clothing and footwear.

Commercial sport sector – including sports good manufacturers and retailers. We classify companies such as Nike and professional football clubs in this sector.

Commercial non-sport sector – including suppliers for the production of sport-related goods and services. This sector includes companies that don't provide a sport product, but assist through the supply of inputs or revenue for production.

Voluntary sector – including non-profit making sport organizations such as amateur clubs run by their participants. Identifying the income and expenditure flows towards voluntary clubs is an important element in the economic assessment.

Local Government – including income from local government sport facilities, sports-related grants from central government and rates from the commercial and voluntary sector. It expenses wages for labour and grants to the voluntary sector.

Central Government – including taxes grants and wages on sport related activities.

Twelve ways of sports – make a positive impact.

a. Economic Impact
b. Jobs
c. National Unity
d. City Pride
e. Role Models
f. Helping Kids Get Active
g. Employment Outlook
h. Community Relations
I. Make a Wish
j. Honoring Heroes
k. Team & Player Foundations
l. Emotion

Effects of Sports on Indian Economy over the past two decades there has been increased competition among cities, regions and countries to host mega sporting events. Therefore Government and other proponent's of major sporting events usually seek to back up their claims of the event providing an economic boost by commissioning an economic impact statement.

Hosting a sport event has revealed a number of benefit in our communities and of those benefits, some reasons like increasing community visibility, positive psychic income, and enhancing community image are all common and acceptable postulations. Economic impact in sporting events can be defined as the net change in an economy resulting from a sport event and the change is caused by activity involving the acquisition, operation, development and use of sport facilities and services which in turn generate visitor's spending, public spending, employment, opportunities and tax revenue. In study of economic impact expenditure can be categorized as direct, indirect and induced effects.

Economic Benefits of Promoting Sports

Sports is divided into play, game physical activity, medical treatment, rehabilitation & competition targets everyone & everybody, regardless of gender, age, religion, race, social status teaches ethics, discipline fair play, pride, dignity & honor. It is a source of fun, enjoyment, recreation & relaxation. It is a tool for democracy, freedom & equality encompasses the entire population of a nation. It is like religion, the opium of the people induces a sense of patriotism & unity. It is a prime factor in decreasing chances of heart disease, Alzheimer & Parkinson's, Reduces mental instability. As sport as a concept is quite vast, it is not very easy to define it, yet an academic definition on which all would agree, is that sport is a form of involvement, it is a recreational activity, a social institution and a cultural product. In short, sport is a social phenomenon that brings together peoples and nations under unity, patriotism and moral values.

CONCLUSIONS:

In current scenario economic impact studies have become standard operating procedure for supporters of public funding for sports events. It has led to acceptance of their findings by the government and public due to their prevalence with no critical evolution. Entertaining people during their time off from work has always been a primary role of both participation and spectator sport. Although in the past sport entertainment was usually casual and relaxed, today's sport is often organized, mechanized, marketed, and administered as a business commercial interests influence virtually every decision in sports. Events are rated by television audience share, tickets sales, concession sales, sponsor revenue and media coverage. Wins and losses are important because they influence all of these standards of measurement. As sport is growing more into a business, the corporate model is entering into the organization of every sports entity and governing body. Athletes are encouraged to provide their services for the good of the larger entity, to contribute to the bottom line; coaches are becoming the supervisors of athletes, who are sometimes asked to go against their personal choices for the better good of the team or organization.

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