International Journal in Physical and Applied Sciences
Volume 07 Issue 11, November 2020 ISSN: 2394-5710 Impact Factor: 5.578
Journal Homepage: http://ijmr.net.in, Email: irjmss@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal

BAD EFFECT OF PLASTIC DEBRIS INTO FRESH WATER RESERVOIR FISHERIES ENVIRONMENT

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ABSTRACT

Fresh water reservoirs constitute the prime inland fishery resource of India by virtue of their vast area and huge production potential. Apart from allowing quick yield enhancement at minimal capital investment and environmental cost, fisheries development of reservoirs directly benefits some of the weakest sections of our society. The benefits accrued due to increase in yield and income generation directly contribute to improve the quality of life of fishermen. Unlike the culture systems, where the profit is accrued to a single investor or a small group of investors, in fresh water reservoir fisheries, the cake of increased yield is more equitably distributed among a large number of people, albeit as smaller slices. This, being a community- based development process, has a direct bearing on our rural populace.

Fresh water reservoirs exhibit wide variations in their morphometric physio-chemical making it difficult to develop a technology package that can be adopted uniformly in the country. Nevertheless, the researchers conducted by CIFRI over the last few decades have resulted in many guidelines, based on which the reservoir fishery managers can develop location-specific management norms. Such guidelines are more effective in case of small reservoirs where the relation between management and yield improvement is known to· be more precise compared tv the large impoundments. Since the reservoirs in India are public water bodies, targeted users of these guidelines are mainly the fishery officers of state governments and office bearers of cooperative societies across the country.

Here we are going to study the loss of fisheries due to bad impact of plastic debris in fishery culture. Then based on that next we will do the analysis of side effect of plastic debris on different fresh water reservoirs.

KEY WORDS :- Fresh water reservoir, fisheries, plastic debris,yield, inland.

INTRODUCTION

Global plastic production went from 1.5 million tonnes to more than 280 million tonnes from the 1930s to the first decade of the 2000s (with a 38 per cent growth in the last ten years). The consequences are obvious: as more plastic is used, more is thrown into the sea, directly or indirectly. Up to 12.7 million tonnes every year, according to Greenpeace.

Various shapes and forms of plastic are present in marine environments: bags, microbeads, packaging, construction coating, polystyrene containers, tape and fishing equipment. Nevertheless, research shows that approximately 80 per cent of all plastic debris present in the environment comes from dry land.

“Water depuration systems can trap plastic and fragments of various sizes through oxidation tanks or sewage sludge,” Rosalba, president of the Marevivo association, committed to defending marine environments, explains. “Nevertheless, a large portion of microplastics manage to pass through this filtration system and reach seas and oceans after being thrown into rivers".

Why are microplastics bad: effects on human health and the environment

Once these substances reach the sea, they're ingested by fauna (especially plankton, invertebrates, fish, seagulls, sharks, whales and dolphins) and can alter the food chain. According to the environmental research institution ISPRA, 15 to 20 per cent of water species that end up on our tables contain micro plastics.

Plastic swallowed by fish, shellfish and others also ends up on our tables. So the effects are also felt by humans: the pollutants released by microplastics can be ingested and absorbed by us. These can interfere with the human endocrine system and produce genetic modifications.

Most worrying are elevated concentrations of chemicals such as persistent organic pollutants (POPs) – which include polychlorinated biphenyl (PCB) and Dichlorodiphenyltrichloroethane (DDT) – whose names are determined by their toxicity and resistance to decomposition. According to the data gathered by International Pellet Watch, large quantities of PCB were detected on the northern coast of France, in the Channel, and significant traces of DDT were found on the coast of Albania. This shows that even though most plastic is concentrated in other areas of the sea, pollutants are still transported everywhere, even entering partially closed fresh water reservoir areas.

Reservoirs are classified generally as small (5000 ha), especially in the records of the Government of India (Sarma, 1990, Srivastava et al., 1985), which has been followed in this study. All man-made impoundments created by obstructing the surface flow, by erecting a dam of any description, on a river, stream or any water course, have been reckoned as reservoirs. However, water bodies less than 10 ha in area, being too small to be considered as lakes, are excluded.

OBJECTIVES OF PROPOSED WORK

1) Loss of fisheries due to bad impact of plastic debris in fishery culture.
2) Side effect of plastic debris on different fresh water reservoirs.

REVIEW OF LITERATURE

Fishing areas off the coast of Mumbai have the highest concentration of plastic waste in the country, according to a study by the Central Fisheries Research Institute (CMFRI).

The study, which covered five major fishing grounds along the country's coast, found that sites off Mumbai had 131.85 kg of plastic per square kilometre, followed by Tuticorin at 93.34 kg/sq km, Ratnagiri at 73.16 kg/sq km, Visakhapatnam at 4.95 kg/sq km, and Kochi with 1.55 kg plastic per sq km.

The researchers visited fishing landing sites between January and December (except during the monsoon) and studied fish samples, plastic debris and fishing nets to estimate concentration of plastic waste.

Plastic waste is getting into the fresh water reservoir at an alarming rate, said KV Akhilesh, scientist from CMFRI Mumbai. "Earlier, we used to see organisms trapped or entangled in plastic debris, now we can see plastic in their stomach content, which means plastic is abundantly available and increasing along coastal waters," he said.

CMFRI conducted experiments at 20 -30 metres depths and found four fish species and two shark species with plastic in their stomach. Plastic was found in the stomach of a dolphin from the waters off Gujarat and a plastic spoon in a whale shark's stomach. Species found along the Mumbai coast such as tuna, mahi , threadfins (rawas), croaker (dhoma), and two shark species, spadenose and hammerhead, had plastic in their stomach.

"Mostly, the stomach of fish is removed before consumption but the rate at which plastic is increasing, it will not take much time for micro plastic and plastic microbeads to spread to other parts of these fish. Remedial measures need to be initiated immediately, especially along the Mumbai coast," said Dr BabanIngole, head of marine biology department, National Institute of Oceanography.

Akhilesh said untreated municipal sewage is taking plastic waste into the reservoir. "By placing nets, plastic that is arriving through drainage or creeks need be sieved out. More awareness programmes in coastal areas need to be conducted along with action on ground for proper disposal of plastic," he said.

A study released in February by CMFRI of 254 beaches across 11 states and Union Territories, which share India's 7,516km coastline, found that beaches in Goa had the highest quantity of plastic debris in India with every metre of beach sand having an average 25.47g of plastic.

After Goa, 33 beaches in Karnataka were found contaminated with plastic with a concentration of 21.91g/m2, followed by 12 beaches in Gujarat at an average 12.62g/m2. The quantum of litter on Karnataka's beaches was 178.44 g/m2 and 90.56g/m2 in Gujarat.

Andaman and Nicobar Islands and Lakshadweep followed with 8.97 g/m2 and 4.37 g/m2, and the lowest average quantity of plastic litter was identified at Odisha at 0.08g/m2.

New Delhi: Plastic is a ticking time bomb. It is a threat to the earth's largest living space. Fresh water debris is the fastest growing environmental concern and when it comes to India, the country dumps about 600,000 tonnes of plastic waste into the fresh water reservoir annually. With a coastline of 7,500 kms, India faces a huge challenge in cleaning up its fresh water reservoir and meeting its commitment to eliminate single-use plastic in the country by 2022.

To help take on this mammoth mission to fight fresh water debris, India has recently announced two collaborations with Norway and Germany.

The three major water bodies of India, the Bay of Bengal, the Arabian Sea, and the Indian fresh water reservoir are overflowing with man-made pollutants that include pesticides, herbicides, chemical fertilizers, detergents, oil, sewage, plastic, among others. Reports show that 80 per cent of the ocean's pollution is plastic, which results in the deaths of thousands of ocean-inhabitants every year.

According to the report 'Pollution of the fresh water reservoir around India' by the authors S Z Qasim, from Department of Ocean Development, India and R Sen Gupta and T W Kureishy from National Institute of Oceanography, 5-6 million tonnes of petroleum and oil have been discharged in the Indian Ocean, which is around 40 per cent of the total petroleum spill in the world's waters.

New Delhi: Plastic pollution from discarded fishing gear in the Ganges River poses a threat to wildlife such as the critically endangered three-striped roofed turtle and the endangered Ganges

River dolphin, according to an international team including researchers from the Wildlife Institute of India. In the study, published in the journal Science of The Total Environment, surveys along the length of the river, from the mouth in Bangladesh to the Himalayas in India, show levels of waste fishing gear

The researchers noted that fishing nets — all made of plastic — were the most common type of gear found. Interviews with local fishers showed high rates of fishing equipment being discarded in the river — driven by short gear lifespans and lack of appropriate disposal systems, they said.

The Ganges River supports some of the world's largest inland fisheries, but no research has been done to assess plastic pollution from this industry, and its impacts on wildlife. Ingesting plastic can harm wildlife, but our threat assessment focussed on entanglement, which is known to injure and kill a wide range of marine species, said Sarah Nelms from the University of Exeter in the UK.

The researchers used a list of 21 river species of "conservation concern" identified by the Wildlife Institute of India in Uttarakhand. They combined existing information on entanglements of similar species worldwide with the new data on levels of waste fishing gear in the Ganges to estimate which species are most at risk.

There is no system for fishers to recycle their nets. Most fishers told us they mend and repurpose nets if they can, but if they can't do that the nets are often discarded in the river. Many held the view that the river 'cleans it away', so one useful step would be to raise awareness of the real environmental impacts, said Ms. Nelms.

The findings offer hope for solutions based on "circular economy" where waste is dramatically reduced by reusing materials, according to Professor Heather Koldewey, from the Zoological Society of London(ZSL). "A high proportion of the fishing gear we found was made of nylon 6, which is valuable and can be used to make products including carpets and clothing," Ms. Koldewey said. "Collection and recycling of nylon 6 has strong potential as a solution because it would cut plastic pollution and provide an income," she added.

Also Read: No Meaningful Action Taken For Cleaning Ganga Tributary: National Green Tribunal

(Except for the headline, this story has not been edited by NDTV staff and is published from a syndicated feed.)

NDTV – Dettol Banega Swasth India campaign is an extension of the five-year-old Banega Swachh India initiative helmed by Campaign Ambassador Amitabh Bachchan. It aims to spread awareness about critical health issues facing the country. In wake of the current COVID-19 pandemic, the need for WASH (Water, Sanitation and Hygiene) is reaffirmed as handwashing is one of the ways to prevent Coronavirus infection and other diseases. The campaign highlights the importance of nutrition and healthcare for women and children to prevent maternal and child mortality, fight malnutrition, stunting, wasting, anaemia and disease prevention through vaccines. Importance of programmes like Public Distribution System (PDS), Mid-day Meal Scheme, POSHAN Abhiyan and the role of Aganwadis and ASHA workers are also covered. Only a Swachh or clean India where toilets are used and open defecation free (ODF) status achieved as part of the Swachh Bharat Abhiyan launched by Prime Minister Narendra Modi in 2014, can eradicate diseases like diahorrea and become a Swasth or healthy India. The campaign will continue to cover issues like air pollution, waste management, plastic ban, manual scavenging and sanitation workers and menstrual hygiene.

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Why Ban of Plastic Is Ineffective in India

Currently in India, there is only one law that is in place – No manufacturer or vendor can use a plastic bag which is below 50 microns as thinner bags pose a major threat to the environment due to its non-disposability. The usage of plastic bags is still high as the ban is not implemented on all plastic bags.

Many big brands and vendors have started charging the customers for the polybags in order to commercially discourage them, but it is so far not been effective as there is no law or guidelines that says shopkeepers should charge money from the customers for the polybag.

National Green Tribunal in Delhi NCR introduced a ban on disposable plastic like cutlery, bags and other plastic items amid concern over India's growing waste. The ban came into effect on January 1, but till now nothing has been done by the government. As a result, the production and usage of plastic persist in large amounts and India continues to be the top four producers of plastic waste in the world.

Currently, cities including Delhi, Mumbai, Karwar, Tirumala, Vasco, Rajasthan, Kerala, Punjab and now Madhya Pradesh to name a few have the ban on the plastic bags in place. But, its enforcement and effective implementation is an issue.

According to experts, the Ganges River supports some of the world's largest inland fisheries, but no research has been done to assess plastic pollution from this industry, and its impacts on wildlife

METHODOLOGY

1. THREAT ASSESSMENT MAPPING

The Roundtable reviewed several water reservoir threat maps, which were developed from the USGS global threat assessment. The Roundtable was requested to review the threat scores for the water reservoir and reflect on how closely this aligned with their knowledge and perceptions of the state of inland fisheries in the fresh water reservoir.

1.1. FRESHWATER RESERVOIRFISHERIES THREAT ASSESSMENT

As a follow up to the Advisory Roundtable on the Assessment of Inland Fisheries, USGS and the University of Florida in cooperation with FAO have developed a fresh water reservoir-level threat map for inland fisheries. This threat map is working towards a scalable and reproducible assessment of global inland fisheries based on potential pressures on inland fisheries.

1.2. THREAT MAPPING

This threat-mapping combines global geographic information datasets, which relate to the drivers that influence inland fisheries. Diverse data types and sources were combined using geospatial modelling techniques and threat-mapping theory (Figure 1). Combining this data and using a nested modelling approach powered by supercomputers generates a composite map that is intended to provide a visual (and quantifiable) indication of the relative level of threats to inland fisheries within a fresh water reservoir.

India is blessed with vast inland water resources in the form of rivers, estuaries, natural and manmade lakes. The Inland water bodies have been divided into five riverine systems and their tributaries extending to a length of about 29,000 km in the country – Indus, Ganges, Brahmaputra, East flowing reverie system and West riverine system. All these rivers, their tributaries, canals and irrigation channels have and area of roughly 13000km. These water bodies harbour the original germplasm of one of the richest and diversified fish fauna of the world comprising 930 fish species belonging to 326 genera. The major river systems of India on the basis of drainage can be divided broadly into two major rivers systems. They are (i) Himalayan rivers system (Ganga, Indus and Brahmaputra) and (ii) Peninsular river system (East cost and West coast river system).

2. LENGTH-BASED ASSESSMENT METHODS

Two main approaches to size-based assessment of data-limited re fish populations have been tested. These include (1) the combination of simple empirical indicators and expert knowledge; and (2) the Length-Based Spawning Potential Ratio (LB-SPR) model. An overview of both these methodologies was presented, with the opportunity for questions and general discussion on theory and applications. Four international case studies using the Length-Based approaches were then presented and reviewed by the Roundtable. The national experts who had provided data for each case study were present, and this allowed reliable local insight in interpretation of the analyses and results. Discussion sessions then provided critical feedback on the approaches used in relation to the specific characteristics of each of the case studies. That allowed the elicitation of concerns, and caveats 5 in the application of both assessment approaches. The group subsequently assimilated the two case study approaches into a preliminary concept for a flexible and holistic rapid assessment framework for data-limited fisheries.

RESULT

Threat Score OfFresh Water Reservoir That SupportsInlandFisheries

Threat score	Number of water reservoir	Share of water reservoir fish catch (%)
1-3 (low)	2	<1
4-5(intermediate)	37	47
6-7(moderate)	33	38
8-10(high)	15	10
Total	**87**	**95**

Distribution Of Small-Medium-Large Fresh Water Reservoirs In India

States	Small		Medium		Large		Total	
	Number	Area(ha)	Number	Area(ha)	Number	Area(ha)	Number	Area(ha)
Haryana	4	282	-	-	-	-	4	282
TamilNadu	8895	315941	9	19577	2	23222	8906	358740
Karnataka	4651	228657	16	29078	12	179556	4679	437291
Madhya Pradesh	6	172575	21	169502	5	118307	32	460384
Andhra Pradesh	2898	201927	32	66429	7	190151	2937	458507
Maharashtra	-	119515	-	39181	-	115054	-	273750
Gujrat	676	84124	28	57748	7	144358	711	286230
Bihar	112	12461	5	12523	8	71711	125	96695
Orissa	1433	66047	6	12748	3	119403	1442	198198
Kerala	21	7975	8	15500	1	6160	30	29635
Uttar Pradesh	40	218651	22	44993	4	71196	66	334840
Rajasthan	389	54231	30	49827	4	49386	423	153444
Himachal Pradesh	1	200	-	-	2	41364	3	41564
northeast	4	2239	2	5835	-	-	6	8074
west Bengal	4	732	1	4600	1	10400	6	15735
Total	**19134**	**1485557**	**180**	**527541**	**56**	**1140268**	**19370**	**3153366**

Loss of Fish Production In Different Categories Of Fresh Water Reservoirs In India

State	Small Fresh Water Reservoirs			Medium Fresh Water Reservoirs			Large Fresh Water Reservoirs			Pooled		
	Number	Production(t)	Yield (kg/ ha)	Number	Production(t)	Yield (kg/ ha)	Number	Production(t)	Yield (kg/ ha)	Number	Production(t)	Yield (kg/ha)
Tamil Nadu	52	760	48.50	8	269.0	13.74	2	294.0	12.66	62	1323.0	22.63
Uttar Pradesh	31	168	14.60	13	156.0	7.17	1	50.0	1.07	45	374.0	4.68
Andhra Pradesh	37	2224	188.00	29	306.0	22.00	3	800.0	16.80	69	4330.0	36.48
Maharashtra	6	72	21.09	12	313.0	11.83	4	794.0	9.28	22	1179.6	10.21
Rajasthan	78	970	46.43	17	599.7	24.47	2	120.0	5.30	97	1690.0	24.89
Kerala	7	118	53.50	2	17.3	4.80	-	-	-	9	135.0	23.37
Bihar	25	22	3.91	3	7.2	1.90	1	0.8	0.11	28	30.0	0.054
Madhya Pradesh	2	24	47.26	20	624.9	12.02	3	1184.0	14.53	25	1833.1	13.68
HimachalPradesh	-	-	-	-	-	-	2	1453.0	35.55	2	1453.0	35.55
Orissa	53	349	25.85	6	163.0	12.76	3	925.0	7.62	62	1437.0	9.72
Total	291			110			21			422		
Average			**49.90**			**12.30**			**11.43**			**20.13**

Less Fish Production Trends InFresh Water Reservoirs in India

State	Number	Production (t)	Average Yield (kg/ha)
Tamil Nadu	52	760	48.50
UttarPradesh	31	168	14.60
Andhra Pradesh	37	2224	188.00
Maharashtra	6	72	21.09
Rajasthan	78	970	46.43
Kerala	7	118	53.50
Bihar	25	22	3.91
Madhya Pradesh	2	24	47.26
HimachalPradesh	-	-	-
Orissa	53	349	25.85
Average			**49.90**

Physico-Chemical Features Of Indian Fresh Water Reservoirs

Parameters	**Overall range**	**Productivity**		
		Low	**Medium**	**High**
Ph	6.5-9.2	<6.0	6.0-8.5	>8.5
Alkalinity(mg 1)	40-240	<40.0	40-90	>90.0
Nitrates(mg 1)	Tr.-0.93	Negligible	Upto 0.2	0.2-0.5
Phosphates (mg 1)	Tr.-0.36	Negligible	Upto 0.1	0.1-0.2
Specific conductivity (umhos)	76-474		Upto 200	>200
Temperature °C	12.0-31.0	18	18-22	>22
		(With minimal stratification :I.e,>5		
B.Soil				
pH	6.0 - 8.8	<6.5	6.5-7.5	>7.5
Available P (mg/100g)	0.47-6.2	<3.0	3.0-6.0	>6.0
Available N (mg/100g)	13.0-65.0	<25.0	25-60	>60.0
Organic carbon (%)	0.6-3.2	<0.5	0.5-1.5	1.2-2.5

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DISCUSSION

The fresh water reservoirof river system supports a large number of commercially important fish species including major carps (Labeo. rohita: L.Calabasu, Catlacatla and Cirrhinusmrigala), minor carps (Labeofimbriatus; L.bata; Cirrhinus. reba), catfishes (Wallago. attu ;Mystus. aor; M.tengara, Clarias. batrachus; Heteropneustesfossilis), cluipeiods, murrels (Channa species), feather backs (Notopterus. notopterus; N.chitala), mullets (Mugil corsula), fresh water eel (Anguilla) and prawns (Macrobrachiummalcolmsonii; Palaemon. Lamarii). Apart from these fishes, the others like Pangasius; siloniasilondia; Gudusiachapra; Bagasius. bagasius; Eutropichthys. vacha are also found in the river system.

The commercial fisheries in this zone are non-existing due to spares population, inaccessible terrain and poor communication between fishing grounds and landing centres. The fish yield has been declined over the years due to 1) sandification of the river bed (upto Patna) which reduced the rivers productivity due to blanket effect, (2) marked reduction in the water volume on account of increase sedimentation, (3) increased water abstraction and (4) irrational fishing. In spite of this, the river system is contributing nearly about 89.5% of the total fish seed correlation of India.

Fishing gears used:

The principal gears used in river system are dragnets, cast nets and bag nets.

It originates in Doolai hills near Nasik in North Western Ghats. This river system is a part of East coast of pennensular river system, with a length of 1465 km covering the states like Maharastra, Andhrapradesh and Madhyapradesh. It has the primary tributaries like manjira, Wainganga; Subtributaries like paingunga and wardha and minor tributaries like maner and sabari. It drains into Bay of Bengal. It has a total catchments area of over 315,980 sqkm.

Fresh Water reservoir of river System:

It is the largest river systems of the world, having a combined length (including tributaries) of 12,500 km. It originates from Gangotri in the Himalayas at a height of about 3129 km above the sea level. After origin it drains the southern slopes of the central Himalayas. Ganga passes through UP, Bihar, some parts of Rajasthan, M.P. and west Bengal and finally joins to the Bay of Bengal. It has a large number of tributaries and 'Yamuna' river is one of the major tributaries of this system, which is about 1000 km long. The other tributaries are – Ram Ganga. Gomti, Ghaghra, Gandak, Kosi, Chambal, Betwa and Ken. Furthermore; it has numerous lakes, ponds and Jheels, both perennial and seasonal areas. It has a total catchment area of 9.71 lakh sq. km and receives an annual rainfall of 25-77 inches.

Physico-Chemical Characteristics:

i) Temperature range - 16.70C in January – 31.50C in June to sept.
ii) PH - 7.4 during June to August and Maximum 8.3 during January to May.
iii) Turbidity - 100 ppm in January; 1100-2170 ppm during July to September.
iv) Do2 - 5.0 to 10.5 ppm during January to February while in monsoon 2.00ppm (July-Sept.)
v) Co2 - 0.6 ppm -10.0ppm
vi) Chloride - 4.0 -35.4 ppm
vii) Phosphate - 0.05-021ppm
viii) Nitrates - 0.08-0.22ppm

ix) Silicates - 4.0-20.3ppm
x) Carbonates - 1.0 – 12.0 ppm

Physico-Chemical characteristics:

i) Temperature - 27.5 to 36.40C
ii) PH - 7.2 to 8.3
iii) Do2 mg/L - 1.26 -18.2
iv) Co2 - 0.0 – 6.6 ppm
v) Bicarbonates - 45.8 -192-2ppm

An intelligent management strategy has to take cognizance of key parameters such as hydrology, fish stocks and dynamics of their population together with regulatory measures for fishing. Observance of closed seasons and setting up of fish sanctuaries has proved their efficacy in the faster recovery of impaired fisheries.

CONCLUSION

In conclusion, plastics offer considerable benefits for the future, but it is evident that our current approaches to production, use and disposal are not sustainable and present concerns for wildlife and human health. We have considerable knowledge about many of the environmental hazards, and information on human health effects is growing, but many concerns and uncertainties remain. There are solutions, but these can only be achieved by combined actions. There is a role for individuals, via appropriate use and disposal, particularly recycling; for industry by adopting green chemistry, material reduction and by designing products for reuse and/or end-of-life recyclability and for governments and policymakers by setting standards and targets, by defining appropriate product labelling to inform and incentivize change and by funding relevant academic research and technological developments. These measures must be considered within a framework of lifecycle analysis and this should incorporate all of the key stages in plastic production, including synthesis of the chemicals that are used in production, together with usage and disposal. Relevant examples of lifecycle analysis are provided by Thornton (2002) and WRAP (2006) and this topic is discussed, and advocated, in more detail in Shaxson (2009). In our opinion, these actions are overdue and are now required with urgent effect; there are diverse environmental hazards associated with the accumulation of plastic waste and there are growing concerns about effects on human health, yet plastic production continues to grow at approximately 9 per cent per annum (PlasticsEurope 2008). As a consequence, the quantity of plastics

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