MAPPING OF SEAWEED RESEARCH: A GLOBAL PERSPECTIVE

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ABSTRACT

Seaweed is an important crop, which contributes to the national economy and society at large. The seaweed research is studied by systematic analysis and the flow of literature productivity is mapped using CD-ROM version of ASFA database over the period of nine years, 1988-1996. The study is analyzed on the quantum of research output, most productive institutions globally as well as India in terms of publications. This paper also analyses the choice of the journals, authorship pattern, and their productivity. Source and subject wise distribution of seaweed research literature are explored.

1. Introduction

Seaweeds are primitive non-flowering plants without true root, stem and leaves. The seaweed product contributes a significant amount of minerals, protein, iodine, bromine, vitamins and many bioactive substances. It constitutes one of the commercially important marine living renewable resources. They are used for the production of phytochemical components which are widely employed as gelling, stabilizing and thickening agents in many industries like food, confectionary, pharmaceutical, dairy, textile, paper, paint, varnish, etc. Seaweeds are used in different parts of the world as feed for farm animals [1] and fertilizer for various land crops. In India, seaweed is used as manure for coconut plantation either directly or in the form of compost in coastal areas of Tamilnadu and Kerala. There are several medicinal properties of Seaweeds [2].

Seaweeds grow abundantly in South Australia, Japan, South Africa, Northeast Pacific and Mediterranean regions. Among the tropical areas, rich algal flora occurs in the west Central Pacific, Caribbean and Southern India. The United States has the northern hemispher's most diversified algal vegetation with more than 10000 species of marine algae which have been reported all over the world. Seaweed trade is not prominent at global level, in some countries like Japan, China, Korea, USA,

European Countries and India but its contribution to foreign currency earning is vital to the national economy. India has a coastal line of about 7,500 km and its total of about 6,000 tons (drywt) of alginophytes and agarophytes are exploited from the natural seaweed beds mostly from south Tamilnadu coast [3]. As a number of seaweed industries are coming up every year, there is an increasing demand for the seaweeds. Hence, commercial scale cultivation of seaweeds is necessary for uninterrupted supply to the industries. This interest is being driven by a variety of factors including considerable attention to increasing awareness of the economic importance of seaweeds; the seaweed industry has emerged to develop seaweed culture through proven technology of cultured seaweed production in global level [4].

Arunachalam [5] analyzed quantitatively life science research literature in India, which indicated a ranking of journals, authorship pattern, growth rate, etc. This present paper aims at mapping of seaweed research in global level over the nine-year period 1988-1996. The study is intended to examine the following objectives:

- Quantum of research output in seaweed.
- Choice of journals in research publication.
- To identify the most productive institutions in terms of publication.
- To assess the country wise productivity of seaweed literature
- To find out the authorship pattern in the field
- To assess the source wise distribution of publications
- To identify the scattering of subjects

2. Methodology

To probe the above objectives of the study, CD-ROM version of ASFA was selected as a source of data since its coverage is comprehensive worldwide, which includes the field of Fisheries and Aquatic Sciences. The search was made using the keyword "Seaweed*". The various data i.e. author, affiliation, source of document, year of publication, document type were downloaded and the bibliographic records were converted into a database and analyzed using Excel and MS Word.

3. Analysis

3.1. Year Wise Distribution

Chronological distribution of sea weed research literature covered by ASFA 1988-1996. Here the years indicate that the CD-ROM years and not the year of publication. Fig. 1 represents details of distribution during the above period with 3125 records. It is evident that the 405 (12.96%) papers were covered during the period of years 1981-1987. The year 1987 recorded the highest number of papers i.e. 252 (8.06%) and 16 (0.5%) records were displayed without the year of publication.

Among the total articles published, 2704 (89.53%) papers are research articles during years 1988-1996. Maximum number of articles published in 1993 was 433 (13.54%), followed by 364 (11.65%) in 1992, 317 papers (10.14%) in 1995, 316 (10.11%) papers in 1990, 313 (10.02%) in 1991; and 311 (9.95%) papers in 1994. In 1988 and 1989, 296 (9.47%) and 254 (8.13%) papers respectively were published and the year 1996 has the very low publication i.e. 100 papers, which is 3.2% of the total published articles.

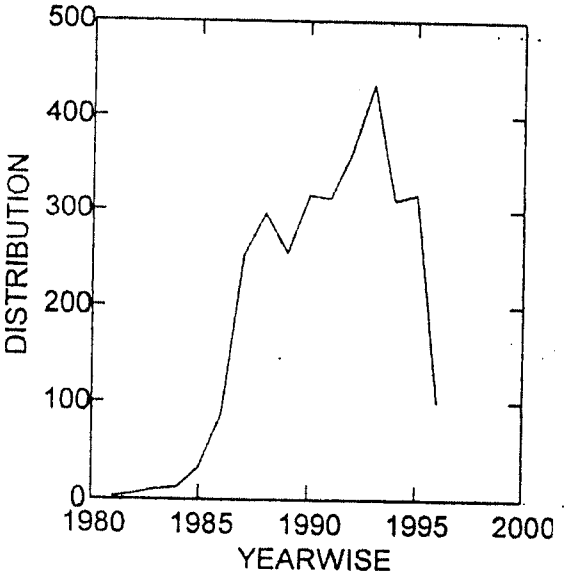

Fig.1 Year wise distribution of Seaweed research literature

3.2 Geographical Distribution

Table 1 reveals the research contribution by 86 countries. Among them USA has contributed maximum of 439 papers, followed by Japan with 308 papers and 2nd Place. China has occupied third rank and it has produced 219 papers. The significant Seaweed research where Indian scientists have published 183 papers thus holding fourth rank form the total number of distribution of literature. France has produced 169 papers. Chile, Canada, UK and Spain have produced between 137-104 papers and occupied the 6th to 9th ranks respectively. Australia has produced 85 papers to have the 10th rank. Other countries fall with in the frequency of occurrence with 1031 occupying the 40th rank. 286 records were not displayed in the field in ASFA database.

Table 1 - Country wise productivity of Seaweed literature during 1988-1996

Sl. No	*Name of the Country*	*Rank*	*No.of Frequencies*
1	USA	1	439
2	Japan	2	308
3	No displayable fields		286
4	China	3	219
5	India	4	183
6	France	5	169
7	Chile	6	137
8	Canada	7	136
9	UK	8	113
10	Spain	9	104
11	Australia	10	85
12	Mexico	11	73
13	Philippines	12	70
14	South Africa	13	60
15	Italy	14	57
16	Brazil	15	54
17	Sweden	16	49
18	Korea	17	46
19	New Zealand	18	45
20	FRG	19	43
21	Norway	20	42
22	Russia	21	36
23	Netherlands	22	33
24	Israel	23	28
25	Pakistan	24	25
26	USSR	25	22
27	Argentina	26	20
28	Thailand	27	19
29	Egypt	28	15
30	Indonesia	29	14
31	Greece	29	14
32	Denmark	30	12
33	Malaysia	30	12
34	Fiji	31	10
35	Venezula	32	9
36	Belgium	33	8
37	Taiwan	33	8
38	Finland	34	7
39	Portugal	35	6
40	Yugoslavia	36	5

41	West Indies	36	5
42	Switzerland	36	5
43	Eire	36	5
44	Morocco	36	5
45	Turkey	36	5
46	Estonia	37	4
47	Romania	37	4
48	Kenya	37	4
49	Singapore	37	4
50	Cuba	37	4
51	Slovenia	38	3
52	Peru	38	3
53	Ukraine	38	3
54	Monaco	38	3
55	Colombia	38	3
56	Ireland	39	2
57	Jamaica	39	2
58	Senegal	39	2
59	Latvia	39	2
60	Sri Lanka	39	2
61	Tunisia	39	2
62	Venezuela	39	2
63	Germany	39	2
64	Iceland	39	2
65	Tanzania	39	2
66	St.Lucia	39	2
67	Puerto Rico	39	2
68	Ukrine	40	1
69	Ecuador	40	1
70	Croatia	40	1
71	Costa Rica	40	1
72	Bangladesh	40	1
73	Yemen	40	1
74	Ambon	40	1
75	British West Indies	40	1
76	New Caledonia	40	1
77	Bermuda	40	1
78	Mozambique	40	1
79	Kuwait	40	1
80	Jordan	40	1
81	Saudi Arabia	40	1
82	Lithuania	40	1
83	Lipi	40	1
84	Madagascar	40	1
85	Poland	40	1
86	Recife Pernambuco	40	1
87	Qatar	40	1
		Total	**3125**

3.3 Authorship Pattern Of Seaweed Research Literature

Fig. 2 indicates that the maximum number of two authored articles i.e. 922 (31%) and single authored articles 882 (28%), followed by three authors 628 (20%), four authors 328 (10%) and five and above as 287 (9%). Corporate authors contributed 32 (1.02%) and others contributed 46 (1.47%) articles. It is observed that there is a decreasing trend towards collaborative authorship.

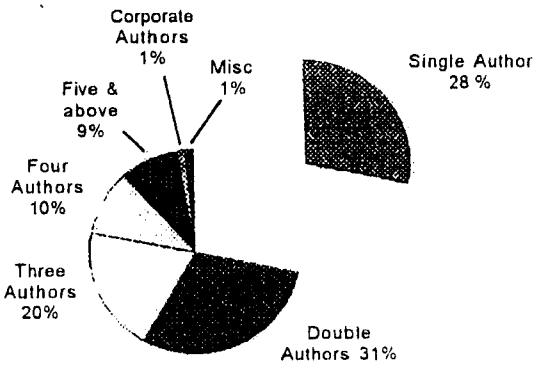

Fig.2 Authorship Pattern

3.4 Authorwise Frequencies

It is observed that 12 papers were contributed by only one author, followed by an author who contributed 8 papers. Two authors published 7 papers each, and also both contributed 6 papers. Three authors published five papers each. Eight authors

contributed 4 papers each. There are 43 who contributed 3 papers each. It is noted that 2 paper contribution is reported by 164 authors and also identified that single paper contribution constitutes 2502 of the total authors. Here the importance has been given to the first author only and further it reveals that from among the 2726 of the total authorship, 882 articles were single authored with contribution of one paper each during the study period **(Table 2)**

Table 2 - Author wise distribution of Seaweed literature.

Sl.No.	Name of the authors	Number of authors	Distribution of Papers	Total Distribution	Rank
1	Trono, -G.C.Jr	1	12	12	1
2	Carefoot, -T.H.	1	8	8	2
3	Hurtado-Ponce, -A.Q	1	7	7	3
4	Kajimura, -M.	1	7	7	3
5	Munda, -I.M.	1	6	6	4
6	Taw, -N.	1	6	6	4
7	Santelices, -B.	1	5	5	5
8	Yu,-S.;Pedersen, -M	1	5	5	5
9	Chapman, -A.R.O.	1	5	5	5
10	Crouch, -I.J.; Van-staden, -J.	1	4	4	6
11	Santelices, -B.; Varela, -D	1	4	4	6
12	Yoshie,-Y.; Suzuki,-T.; Hirano,-T	1	4	4	6
13	Russell,-G.	1	4	4	6
14	Bird,-K.T.	1	4	4	6
15	Dawes,-C.J.	1	4	4	6
16	Magne,-F.	1	4	4	6
17	Vasquez,-J.A.	1	4	4	6
18	43 Authors	43	3	129	7
19	164 Authors	164	2	328	8
20	2502 Authors	2502	1	2502	9
	Total	**2726**		**3125**	

3.5 Source Wise Distribution

The analysis of the source wise distribution of Seaweed literature in the **Table 3** indicates 8 different forms. It is evident that 2040 (65.3%) paper were published in the form of journal articles. The Proceedings with 768 (24.58%), and Book or book chapters with 192 (6.14%) are placed in the second and 3rd rank respectively. Reports 50 (1.6%) followed by Conference Reports 15 (0.48%), Theses 0.35% and Patents 0.26% occupied very low frequencies **(Fig. 3)**.

Table 3 -Source wise distribution of Seaweed research literature

Sl.No.	Sources	Rank	Frequencies	% Frequencies	Cumulalative % Frequencies
1	Journal article	1	2040	65.30	65.30
2	Proceedings	2	768	24.58	89.88
3	Books	3	192	6.14	96.02
4	Reports	4	50	1.60	97.62
5	Conference Reports	5	15	0.48	98.1
6	Thesis/ Dissertation	6	11	0.35	98.45
7	Patent	7	8	0.26	98.71
8	Others		41	1.31	100.00

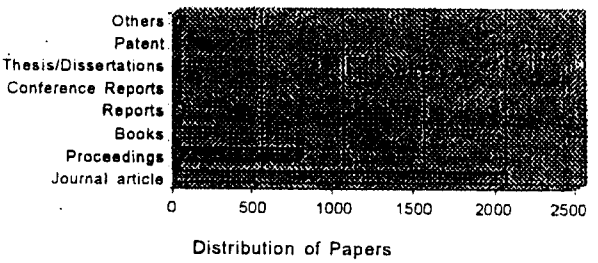

Fig.3 Source wise distribution of Seaweed Literature

3.6 Ranking of Journals

Looking at Seaweed research productivity on the basis of the ranking of journals, the researchers have published 2040 journal articles and used 459 journals to publish their work. However, the number of journal articles and precentage are given in Table 4. In addition to ranking them specially in the field of research it was observed that the individual papers in the multidisciplinary journals like *Science, Nature, Proceedings of Indian National Science Academy* were also subsequently been identified. The impact value of the above journals indicated here is in no way related to the present ranking.

A list of top ranking of journals is given in the **Table 4** according to their frequencies. The first rank is occupied by the journal titled '*Botanica Marina*' with a frequency of 184 (9.02%) followed by *Journal of Applied Phycology* with 125 (6.13%) papers occupying 2nd rank. The '*Journal of Experimental Marine Biology and Ecology*' published 73 (3.58%) papers. 72 to 36 papers with 5th to 10th rank were of one journal each category publication. The '*Marine Biology*' and '*Gayana-botany*' published 32 (3.14%) papers each. '*Hydrobiologia*' and '*Transaction of Oceanology and Limnology*' published 17 papers each. 16 (1.57%) papers each were published in '*Phycology*' and '*Ecology*'. Three journals published 15 (2.21%) papers each and 3 journals published 11 papers each. Four papers each were published in 24 journals. Three papers each were published in 37 journals. The research front shows 95 journals published 2 papers each and only one paper each was published by 222 journals.

Table 4 -Ranked list of Journals

Sl.No.	Name of the Journal	Rank	No.of Journal	No.of Papers Published	Total No.of Papers	Percentage	Cumulative Percentage
1	*Botanica Marina*	1	1	184	184	9.02	9.02
2	*J.Appl. Phycology*	2	1	125	125	6.13	15.15
3	*J.Phycology*	3	1	92	92	4.15	19.66
4	*J.Exp.Mar. Biol. & Ecology*	4	1	73	73	3.58	23.24
5	*Bull.Jap.Soc.Scientific Fisheries*	5	1	72	72	3.52	26.76
6	*Phycologia*	6	1	55	55	2.69	29.45
7	*Pytochemistry*	7	1	46	46	2.25	31.70
8	*Indian J.Mar.Science*	8	1	45	45	2.21	33.91
9	*Chinese J.Mar.Drugs*	9	1	41	41	2.01	35.92
10	*Mar.Ecol.Prog.Series*	10	1	36	36	1.76	37.93
11	*Marine Biology*	11	2	32	64	3.14	41.07

12	*Gayana-Botany*						
13	*Oebalia*	12	1	27	27	1.32	42.39
14	*Aquaculture*	13	1	26	26	1.27	43.66
15	*British Phycological Journal*	14	1	25	25	1.23	44.88
16	*Bull. Korean Fish.Society*	15	1	24	24	1.17	46.05
17	*CIENR mar*	16	2	22	44	2.16	48.22
18	*Phykos*						
19	*Oceanology Limnology*	17	1	21	21	1.03	49.24
20	*Trans. Oceanology & Limnology*	18	1	17	17	0.83	50.07
21	*Hydrobiology*	19	2	16	32	1.57	51.64
22	*Japanese J.Phycology*						
23	*Ecology*						
24	*Aquatic Botany*	20	4	15	60	2.94	54.58
25	*European J.Phycology*						
26	*J.Zhanjiang Fish.coll.,*						
27	*Marine Science*	21	1	14	14	0.68	55.26
28	*Marine Pollution Bulletin*	22	1	13	13	0.64	56.01
29	*Bull.Natl. Fish. Dev.Agency, Korea*	23	2	11	22	1.08	57.08
30	*J.mar.Biol.Assn.India*						
31	*South African J. Botany*	24	2	10	20	0.98	58.06
32	*Rev.Chile Hist.Nat.*						
33	*Bamidgeh*						
34	*Phycological Research*						
35	*Oecologia*	25	6	9	54	2.65	60.71
36	*Philippines Science*						
37	*J.Zhanjiang Fish.coll.,*						
38	*Stat.-Bull.-NAFO*						
39	*Invest.Pesq.BARC*						
40	*Biota*						
41	*Mahasagar*	26	4	8	32	1.57	62.28
42	*Crustaceana*						

43	*Comp.Biochem,-Physiol.-A*						
44	*CMFRI Spl.Publication*						
45	*Fisheries Science*	27	5	7	35	1.72	64.01
46	*Bulletin of Marine Science*						
47	*Journal of Fish.Biol*						
48	II Journals	28	11	6	66	3.24	67.24
49	9 Journals	29	10	5	50	2.45	69.60
50	24 Journals	30	25	4	100	4.90	74.50
51	37 Journals	31	37	3	111	5.44	79.94
52	95 Journals	32	95	2	190	9.31	89.24
53	222 Journals	33	222	1	222	10.88	100.00
				459	2040	100	

3.7 Organisation Wise-Globel Level Distribution and Ranking

Among the 1466 institutions, Central Salt and Marine Chemical Research Institute, India is at top rank and it has contributed 48 papers; the Institute of Oceanography of China contributed 46 papers, and again from India the Central Marine Fisheries Research Institute, Cochin India occupied the third rank i.e. 28 papers. IFREMER, France punlished 25 papers and having 4th rank. Marine Science Institute, University of Philippines published 24 papers. Two institutions contributed 22 papers each. The University of North Carolina, USA published 19 papers and National Institute of Oceanography, Goa, India contributed 17 papers. Central Marine Science Research, University of North Carolina and South East Asian Fisheries Development Centre (SEAFDEC), Philippines published 16 papers each. Three institutions have contributed 15 papers each. Zhanjihjang Fisheries College, China published 14 articles with 11th rank. Institute of Marine Bioscience, NRC, Canada and CAS in Marine Biology, Annamalai University, India contributed significantly to the Seaweed research with 13 papers each. Department of Biology, University of South Florida, USA contributed 12 papers. Three institutions i.e. Chile, Japan and Brazil contributed 11 each. Seven institutes published 10 papers each. Ten organizations contributed 9 papers each with 16th rank. Four Institutions published seven papers each with 18th rank. 20 institutions published 6 papers each with 19th rank. 33 organizations contributed 5 papers each. 42 organizations published 4 papers each. 86 instituions contributed three papers each. 197 institutes published two papers each. There are 1032 institutions that published one paper each with 24th rank **(Table 5)**.

Table 5

Organization wise global level distribution and Ranking

Sl. No.	Name of the Organization	No.of Institutions	No.of Papers Published	Total No.of Papers	Rank
1	Cent. Salt and Mar.Chem.Res. Inst., India	1	48	48	1
2	Inst. Oceanol., Acad. Sin., People's Rep. China	1	46	46	2
3	Cent.Mar.Fish. Res.Inst., India	1	28	28	3
4	IFREMER, France	1	25	25	4
5	Mar.Sci.Inst., Univ.Philippines, Philippines	1	24	24	5
6	Dep.Physiol.Bot., Univ.Uppsala, Sweden	2	22	44	6
7	Dep. Ecol., Fac. Ciene. Biol., Chile				
8	Univ. North Carolina at Chapel Hill, Inst. Mar. Scei., USA	1	19	19	7
9	NIO, Dona Paula, Goa 403 004, India	1	17	17	8
10	Cent.Mar.Sci.Res., Univ.North Carolina, USA	2	16	32	9
11	Aquacult. Dep., SEAFDEC, Philippines				
12	Inst. Invest. Oceeanol., Mexico	3	15	45	10
13	Shandong Mar. Cult.Inst., Qingdao, People's Rep. China				
14	Isr. Oceanogr. and Limnol.Res., Natl. Inst. Coceanogr., Israel				
15	Zhanjiang Fish.Coll. People's Rep. China	1	14	14	11
16	Inst.Mar.Biosci., Natl. Res.Counc. Canada	2	13	26	12
17	Annamalai Univ., Cent.Adv.Study Mar.Biol., India				
18	Dep.Biol., Univ. South Florida, USA	1	12	12	13
19	Dep.Oceanol., Univ.Concepcion, Chile	3	11	33	14
20	Dep.Food Sci.and Technol.,Tokyo Univ.Fish.,Japan				
21	Inst.Biocience. e CEBIMar, Univ. Sao Paulo, Brazil				

22	Bot.Dep., Univ. Cape Town, South Africa				
23	Cent.Etud.Oceanogr. et Biol.Mar.,CNRS, France		10	70	15
24	Dep.Biol.Mar., Univ.Catolica Del Norte, Chile				
25	Dep.Bot., Univ. Karachi, Pakistan				
26	Lab.Mar.Biochem., Coll.Agric.Vet.Med., Nihon Univ., Japan	7			
27	Dep.Mar.Biol., Univ. Groningen, Netherlands				
28	Dep.Ecol., Fac Ciene.Biol., Pontificia Univ. Chile				
29	Dep.Bot., Andhra Univ., Waltair-530 003, India				
30	Lab.Ficol., Dep.Bot., Esc.Nac.Cienc.Biol., Mexico				
31	Dep.Zool., Univ. British Columbia, Canada				
32	Hokkaido Inst. Public Health, Japan				
33	Dep.Biol.Sci., Simon Fraser Univ., Canada				
34	Fac.Fish., Nagasaki Univ., Japan				
35	Coll. Pharm., Oregon State Univ., USA	10	9	90	16
36	Lab.Biol.Mar., Fac.Sci.et Tech., Univ. Nantes, France				
37	Dep.Biol.Sci., Univ. California, USA				
38	Harbor Branch Found., USA				
39	4 Institutions	4	8	32	17
40	14 Institutions	14	7	98	18
41	20 Institutions	20	6	120	19
42	33 Institutions	33	5	165	20
43	42 Institutions	42	4	168	21
44	86 Institutions	86	3	258	22
45	197 Institutions	197	2	394	23
46	1032 Institutions	1032	1	1032	24
47	No displayable fields	.....	..	285	....
		1466		3125	

3.8 Institution Wise Productivity in India

Leading Indian R&D and Academic institutuions have significantly contributed to seaweed research with 183 papers. Their works indexed in ASFA (1988-1996) are revealed in Table 6. There are three Research and Development organizations with top 3 ranks i.e. CSMCRI, Bhavnagar has published 48 papers, CMFRI, Cochin contributed 28 papers with second rank. The NIO, Goa has 19 papers published. Andhra University and Annamali University contributed 13 papers each. CAS in Botany, University of Madras published 8 papers. VOC College, Tuticorin published 6 papers. Krusadai Marine Biological Station, Mandapam contributed four papers. Two institutions contributed 3 papers each. 9 institutions published 2 papers each. 19 institutions contributed single paper each.

Table 6
Institution Wise Productivity in India

Sl. No.	*Name of the Institution*	*No.of Papers Published*	*Overall Rank*
	I-RESEARCH INSTITUTIONS		
1	Cent.Salt and Mar. Chem.Res.Inst. Bhavnagar 364 002, India	48	1
2	Cent.Mar.Fish.Res.Inst., Cochin-682 031, India	28	2
3	NIO, Dona Paula, Goa 403 004, India	19	3
4	Kursadai Mar. Biol.Stn., Mandapam 623 518, India	3	7
5	BARC, Environ. Surv.Lab., TAPS, Health Phys.Div., Trombay, Bombay 400 085, India	2	8
6	Cent.Food Technol. Res.Inst., IND-570013 Mysore, India	2	8
7	MPEDA, Cochin 682015, India	2	8
8	BOBP, Post Bag No.1054, Madras 600018, India	1	9
9	Cent.Inst. Brackishwat. Aquacult., 12, Leith Castle St., Santhome, Madras 600028, India	1	9
10	Estuar.Biol.Stn., ZSI, Berhampur, Orissa 760005, India	1	9
11	Indian Inst. Sci., Dep.Org.Chem., Bangalore 560012, India	1	9
12	Nuclear Power Corp., Colaba,Bombay 400005, India	1	9
13	Off.Superintend Fish., Bhavanagar364001, India	1	9
14	Cellulose Products of India Ltd., Madurai-625006, India	1	9
15	Space Applications Centre, Ahmedabad 380053, India	1	9
		112	

ACADEMIC INSTITUTIONS			
16	Andhra Univ., Dep.Bot., Waltair 530003, India	13	4
17	Annamalai Univ., Cent.Adv.Study Mar.Biol., Parangipettai, Tamil Nadu, India	13	4
18	C.A.S in Botany, Univ.Madras, Guindy Campus, Madras -600025, India	8	5
19	Dep. Bot., VO Chihdambaram Coll., Tuticorin 628008, India	5	6
20	Baddavanipeta, Urlam-532425, Srikakulam (Dist.), A.P., India	3	7
21	CSR Sarma Coll., Ongole 523001, India	2	8
22	Dep.Biosci., Mangalore Univ., Mangalagangotri 574199, India	2	8
23	Dep.Bot., S.N.Coll., Quilon India	2	8
24	Dep. Bot., Univ. Delhi, Delhi 110007, India	2	8
25	Dep.Pham.Sci., Andhra Univ., Visakhapatnam 530003, India	2	8
26	Fish. Coll., Tuticorin-8, India	2	8
27	Sch.Chem., Andhra Univ., Visakhapatanam 530003, India	2	8
28	CAS in Botany, Univ.Calcutta,35, Ballygunge Circular Rd., Calcutta 700019, India	1	9
29	Cochin Univ. Sci.and Technol., Fac.Environ.Stud., Cochin 682016, India	1	9
30	Dep.Biosci., Saurashtra Univ., Rajkot 360005, India	1	9
31	Dep.Bot., Univ.Burdwan, Golapbag, Burdwan 713104, India	1	9
32	Dep.Bot., Utkal Univ., Bhubaneswar 751004, Orissa, India	1	9
33	Dep.Chem., Indian Inst. Technol., Bombay-400076, India	1	9
34	Dep.Mar.Living Resour., Andhra Univ., Visakhapatnam 530003, India	1	9
35	Dep.Aquatic Biol and Fish., Univ.Kerala, Beach P.O. Trivandrum 695007, India	1	9
36	Osmania Univ., Hyderabad 500007, India	1	9
37	P.G.Dep.Aquacult., O.V.C.Campus, O.U.A.T., Bhubaneswar 751003, India	1	9
38	Post Grad.Org.Chem.Lab., Government Coll., Rajahmundry 533105, India	1	9
		67	

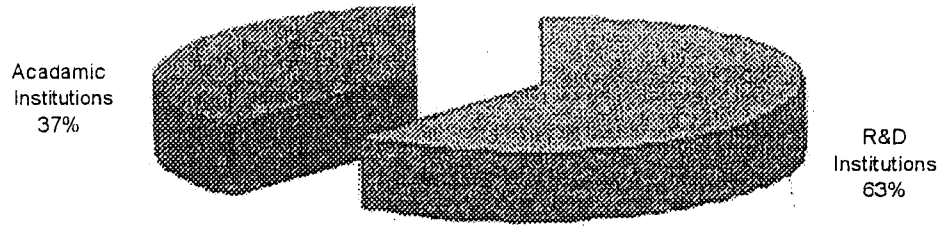

Fig.4 Contribution of Indian Institutions

Fig.4 reveals that the Indian Research Organizations have contributed more than academic institutions i.e. 112 (63%) papers by R&D establishments and 67 (37%) papers contributed by Academic Institutes.

3.9 Subject wise Distribution of Seaweed Literature

The analysis pertaining to subject wise distribution of items has been done on the basis of ASFA-Thesaurus index. Table 7 reveals the subject wise distribution of literature viz. Seaweed Culture 688 (22.02%) papers, Seaweed Products 514 (16.45%), Seaweed Production 43 (1.37%), Seaweed resources 29 (0.92%), Seaweed industry 23 (0.74%), Seaweed Statistics 13 (0.42), Commercially important Seaweed 3 papers, Seaweed Exploitation and Seaweed Meal with 2 papers each. 1808 papers published are classified as 'Others'.

Table7-Subject wise distribution of Seaweed literature

Sl.No.	Subjects	Distribution of Papers	Percentage	Cumulative Percentage	Rank
1	Seaweed culture	688	22.02	22.02	2
2	Seaweed Production	43	1.37	23.39	4
3	Seaweed Resources	29	0.92	24.31	5
4	Seaweed Exploitation	2	0.06	24.37	9
5	Seaweed Industry	23	0.74	25.11	6
6	Commercially important Seaweed	3	0.10	25.21	8
7	Seaweed Products	514	16.45	41.66	3
8	Seaweed Statistics	13	0.42	42.08	7
9	Seaweed Meal	2	0.06	42.14	9
10	Miscellaneous	1808	57.89	100.00	1
	Total	3125	100.00		

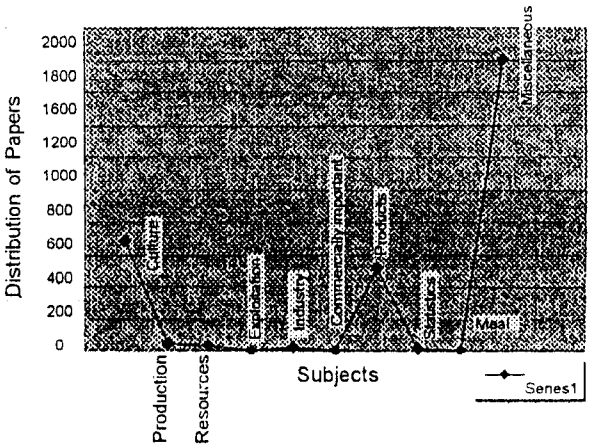

Fig.5 Subjectwise Distribution of Seaweed literature

4. Discussion and Conclusions

Marine Science journals have different audience and their study sheds considerable light on the broadly defined seaweed research as sub-discipline. As pointed out by Jayashree and Arunachalam [6], several Indian Institutions are bringing out journals of their own. These journals publish many of the papers but their works, did not have wider readership. Since, countrywide productivity of sea weed literature in India is having 4th rank, its authors frequency reached 7th rank. The institution wise research output the CSMCRI, and CMFRI-India reached with in top three ranks. The trend has been the same for other countries also.

The study emphasizes the need for the database to follow a time limit. Here the years indicate the ASFA disc years 1988-1996 and not the year of the publication of the individual papers. Out of 3125 records 405 papers were covered during the period 1981-1987. The study also identified that fields of some of the records were not displayable. The input centre may take all efforts to enter all possible entries.

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