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THE SOCIO-ECONOMIC EFFECTS ON ADOPTION OF AQUACULTURE TECHNOLOGIES AMONG FISH FARMERS IN ANAMBRA STATE, NIGERIA

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ABSTRACT

The study investigated the effect of socio-economic factors on the adoption behaviour of aquaculture operators. A combination of purposive and multi-stage sampling technique was used to select 12 blocks, 20 circles and 40 cells from the 4 ADP zones in the state for the study. Data were collected with the aid of structured questionnaire through interview schedule from 144 randomly selected respondents and analysed with descriptive and inferential statistical tools. The result showed that aquaculture is dominated by homestead (74.8%) small-scale operators within the ageing workforce of 41-55 years with low youth and women participation. Sampled respondents have a total of 306 fish ponds measuring 21,226.8m^2 capable of producing more than 21 thousand tonnes of fish. Despite 67.6% aggregate adoption of technologies, low experience (51.1%) and weak economic motive (28.4%) affected investment and fish productivity. Technologies that recorded high adoption are culture system (94.4%), use of oxygen bag (91.7%), feeding time (91.0%), pond system (84.7%) and water quality management (83.4%). Variables such as sex, marital status, education and membership of association were not significantly associated with adoption of technology except type of association (p=0.00). Analysis of PPMC (p>0.051) reaffirmed that aquaculture production is not significantly associated with poverty reduction (0.323) among operators. By implication, social assets are weak to support economic growth and development of aquaculture among fish farmers. Therefore, economic motive and access to production resources in terms of appropriate technology application, sensitization, training, effective extension delivery and credit facilities are required to increase strength and opportunities for economic benefit.

Key words: socioeconomics, aquaculture, adoption, Nigeria.

INTRODUCTION

The policy trust of National Economic Empowerment Development Strategy (NEEDS) is alleviation of poverty, employment creation, economic empowerment, wealth creation, value restoration and sustainable livelihood for the people. In Nigeria, the concern for poverty reduction is to improve human well-being, social opportunities, economic conditions and a healthy national environment as enshrined in the Millennium Development Goals (MDG) of the United Nations. Studies carried out by Sinkaiye and Jibowo (2005), Akinbile and Ndaghu (2005) showed that various strategies have been adopted at individual, group and national levels to alleviate poverty in Nigeria. Citing Bene and Hecks (2005), fisheries offer a key entry point to reach millions of poor people of African including Nigeria to assist in increasing peoples income, improving the nutrition and health of families and becoming active agents of economic development and social change.

Fishery aquaculture has the potential of achieving the goals of NEEDS by its mainstreaming in poverty reduction programmes like National Poverty Eradication Programme (NAPEP), State Economic Empowerment Development Strategy (SEEDS), National Directorate of Employment (NDE) and integration into rural development projects is essential to meet the set target of self-sufficiency in fish production for nutritious food supply and drastically reduce fish importation. According to World Fish Center (2006), Asia experience confirmed the positive impact of aquaculture in countries like China, Vietnam, Philippines, Bangladesh, and India. The studies of Ugwumba and Ugwumba (2003), Dada (2004) and Food and Agricultural Organization (FAO) (2005) showed that aquaculture potential constitute 75% of 923,768km2 of land mass and 14million hectares of inland freshwater, but less than 1% is utilized for fish production. Between 1991 and 2003, the calculated aquaculture production is minimal with an average of 5.6% contribution to local fish production as shown in figure 1 below. It further reveals that aquaculture is dwarfed by fish importation and captures fisheries. From year 2000, fish importation of 557,884 metric tonnes valued at #24, 106,653,730.00 billion out pace local production to become the main source of fish supply up to date in the country. This is an indication of poor exploitation of aquaculture resources capable of producing over 3million tonnes fish from 25% of potential to meet domestic demand and excess for export.

Revising the trend of fish importation requires capitalizing on adoption of aquaculture technologies to strengthen production to increase fish food security and economic growth at individual and national levels. To achieve this, the National Institute for Freshwater Fisheries Research (NIFFR), in 1999, introduced aquaculture technologies to fish farmers for adoption as shown in the NIFFR extension guide series Nos. 1-11. Adoption of technologies or innovations is the decision to continue to use technologies (Rogers and Shoemaker, 1971). Adoption justifies the economic value of technology as product of research in production. In support of this, New Partnership for African Development (NEPAD) (2005), Moehl (2005) and Gupta (2006) agree that applying proven technologies will increase production of small-scale operators that constitute 80% of global fish farmers.

As noted by Yahaya (2003) and Oladele (2005), socio-economic issues are crucial factors that influence adoption of technologies. In the same view, Townsley (1998) asserted that understanding of interaction existing between economic and social issues have a profound influence on the way innovations are perceived and accepted. Townsley further added that in developing countries, improvement expected through the introduction of technologies and rising of production levels have not materialized. This reflects the situation in Nigeria agricultural sector particularly in aquaculture sub-sector of fishery. Recognizing

this fact, FAO (1995) document on code of conduct for responsible fisheries recommended research studies on social and economic aspects of fisheries to generate data for on going monitoring, analysis and policy formulation. In the same view, Abba and Anazodo (2006) noted that an economy may grow but may not be developed because poverty, unemployment, and inequalities continue to persist due to absence of technological and structural change. This occurs when social systems are weak to advance economic benefit to the people.

Various surveys and reports established that Anambra state have potentials for freshwater aquaculture growth and development. Adikwu (1999) showed that 963 fish ponds measuring 513 hectares exist in the state, NIFFR (2002) survey reveals that the state has 3 lakes, 4 reservoirs, and 7 inland rivers excluding river Niger, while FAO (2004a) report confirmed the existence of 3 feed producers/mills. Studies by Sule *et al* (1995) and Sule *et al* (2001) established high volume of fish inflow from Lake Chad basin in Borno state and Kanji Lake in Niger state both in the northern part of the country to Anambra state. This is an indication of high value for fish in the diet of the people. In 2001 and 2002, aquaculture accounts for 1,750 (16.6%) and 1,814 (19.1%) metric tonnes of fish production in the state respectively. High pace of urbanization, commercial market and entrepreneurship of the people are opportunities that will support commercial aquaculture practice to grow and develop in the state. Therefore, effort directed towards improving aquaculture production in the state will be useful to create jobs, income, supply nutritious fish food, increase internal revenue base of the state and livelihood of the rural poor.

Based on this, investigation on social and economic variables interaction is an entry point to determine how social assets support adoption of technologies to achieve economic benefit and poverty reduction among operators. Therefore, the broad objective of the study is to determine the extent of interaction between social and economic variables contribution to adoption of technologies among fish farmers. The specific objectives were to (1) determine level of aquaculture technology adoption among fish farmers in the state. (2) ascertain socio-economic variables associated with adoption of technologies. (3) assess aquaculture contribution to poverty reduction among operators.

Study Area and Methodology

Anambra state is among the 17 states in the south east that account for 77% of fish farms in Nigeria according to (FAO, 2004a). It is located in the southeast agro-ecological zone with 4.18 million people in 2006 provisional census figure. The State shares boundary with 5 other states; Imo and Rivers in the south, Delta in the west, Kogi in the north and Enugu in the east. Anambra state is grouped into four administrative zones by the Anambra State Agricultural Development Programme (ADP) namely Awka, Aguata, Onitsha and Anambra zones.

The four ADP zones were divided into 21 blocks, 83 operational circles, and 120 cells. State ADP has 92 village extension agents is covering 5,100 ADP contact farmers and 212,798 farm families as shown in the report of National Agricultural Extension Research and Liaison Services (NAERLS) and Project Co-coordinating Unit (PCU) (2001). A combination of purposive and multi-stage sampling technique was used to select 12 blocks, 20 circles and 40 cells for the study as shown below. Out of the 21 blocks in the 4ADP zones, 3 blocks were purposively selected in each zone to get 12 blocks for study. From 83 operational circles, 5circles were chosen out of the selected blocks to get 20 circles. While, 10 cells each was picked from the selected circles to get 40cells out of 120 cells.

Population of the study comprises 420 aquaculture farmers identified from the list of 5,100 ADP contact farmers. Finally, 12 fish farmers (36 per ADP zone) were randomly selected from the list of 420 to get a sample size of 144 as respondents. Data were collected with the aid of structured questionnaires through interview schedule between May and August 2005. Descriptive tools of mean, frequency, percentage and inferential tools of chi-square and PPMC were used to present and analyse the data.

RESULTS AND DISCUSSION

Table one deal with fish farming characteristics as obtained in the study area. As shown in the table, only 23.6% of the respondents grew fish as a primary livelihood activity compared to 76.4% for secondary occupation. In the State, fish farming is practiced as an income generating activity, which will affect motivation, investment, productivity and economic benefit to the operators in the area. Aquaculture as a livelihood activity is gradually increasing though at infancy stage in the state.

Response on experience showed that 51.1% of the respondents have less than five years experience whereas 36.8% had between 6 to 10 years. The trend is the same in Ogun State where 13.75% have above 10 years experience (Olopade *et al,* 2005). Experience is a risk management factor considered to be low among 51.1% of the fish farmers. Ridler and Hishamunda (2001) agreed that new farmers in aquaculture are at a higher risk compared to experienced farmers.

On financing of fish farming operation, 76.4% use personal savings while 23.6% borrowed from formal and informal credit institutions. Access to micro-credit facilities is an opportunity to empower fish farmers to invest in profitable aquaculture. This is supported by Yahaya and Olajide (2005) on positive impact of NACB financial beneficiaries among farmers in Oyo State.

About 28.4% of the respondents are into fish farming for the purpose of profit making/commercial whereas majorities (71.6%) are for dual purpose of household food security and income. This is contrast to the findings of Olopade *et al* (2005), FAO (2000b), Dey *et al* (2002) but agreed with Ifejika and Ayanda (2006). Growing of fish for dual purpose of sales and consumption is a weak motivating factor for profitable aquaculture business, which has consequences on investment, fish yield and personal attribution (ability & effort) for success

In the State, sampled respondents have total number of 308 ponds measuring 21,226.8m^2 capable of producing more than 21 thousand tonnes of fish. Mean pond size is 159.6m^2 and mean pond number 2. All the fish farmers operate at small-scale level dominated by 83.3% homestead pond of 100m^2. The finding is in agreement with Olopade *et al* (2005) and Ezenwa *et al* (2003) on classification of aquaculture scale of practices in Nigeria. However, Morhl (2005) noted that purpose and motivation are critical for viable or commercial fish farming regardless of size of operation.

The table further reveals that 72.2% practiced intensive and semi-intensive aquaculture compare to 27.8% for extensive system. Kusumastano *et al* (1996) established that internal rate of return is highest on semi-intensive level followed by intensive systems. Farmers practicing semi-intensive and intensive aquaculture have propensity to reap economic benefit to improve living standard. Both systems require technology, training and knowledge supported with ability and effort within the person to succeed.

Data in Table 2 showed the result of selected personal characteristics of the fish farmers in Anambra state. Aquaculture is dominated by ageing male (90.3%) within the age of 41-55 years (45.8%) with average age of 47. This is consistent with the findings of Asian Productivity Organization (2001), Ifejika and Ayanda (2006) and Olopade *et al* (2005). By implication, youth's involvement (29.9%) in fish farming is low and poses a threat to fish food supply in the future. Also, low women (9.7%) participation is traceable to lack of access to productive resources of land, capital as well as apathy due to low sensitization. Townsley (1998) attributed this to gender inequality. Majority (87.5%) are Christians, which is social assets and strength to form association for economic benefit among members. This is in agreement with the findings of Fawole and Fashina (2005). Response on marital status shows that 86% are married. Banmeke and Olowu (2005) reported the same trend. By implication, most of the fish farmers have family responsibility that needs financial commitment.

The table further reveals that 51.4% have household size of 1-4 whereas 34% of the respondents had 5-8 household size. This confirms that fish farmers have dependants and family responsibilities. Yahaya and Oladeji (2005) observed the same trend among small-scale farmers in Oyo State. A reasonable number of the fish farmers (54.9%) have tertiary education, secondary (34.09%) and 11.1% are illiterates. The level of educational attainment is sufficient to support adoption of technology through information sharing and distribution. This is consistent with Ridler and Hishamunda (2001). Over 60% of the respondents belong to an association while 34.7% do not belong to any group. On type of association, only 28% belong to fish farmers association and 30.6% are into co-operative societies. This indicates that fish farmers associations in the State need to be strengthened to support information dissemination among members. Ridler and Hishamunda (2001) noted that fish farmers associations promoted fishery industry in Costa Rica and Chile.

Response in the Table 3 shows adoption behaviour of fish farmers in Anambra state. Aggregate adoption level is 67.6% compared to no adoption by 32.4%. As evidence in table 1, low experience by 51.1% of the adopters will affect proper application of recommended practices among fish farmers. Sevilleja (2000) established that adoption is supported by experience among tilapia farmers in Philippines. About 10.6% are not aware of technologies, followed by heard but never use (18.4%) and rejection after use (2.8%). Oladele (2005) confirmed that extension contact is foremost factor responsible for discontinuance of technology among crop farmers in southwestern zone of Nigeria. Out of 15 aquaculture technologies examined, respondents claimed high adoption on 12 technologies while low adoption was recorded on 3 technologies. Aquaculture technologies with high adoption are culture system (94.4%), use of oxygen bag (91.7%), feeding time (91.0%), pond system (84.7%), water quality management (83.4%), and use of conventional feed (89.6%), exotic/hybrid fish species (77.1%) and fertilizer application (75.7%). Claim on technologies adoption is enough to support high fish yield and economic benefit to operators. This is subject to intensity of technologies usage in production. Technologies observed to have low adoption are pond site selection (7.6%), fish species combination (16.7%) and hatchery fingerling supply (44.4%). It implies that fingerlings supply, poly-culture and pond construction are threats confronting fish farmers in the State, which need attention of subject matter specialist, training and extension delivery to overcome.

According to table 4, aquaculture contribution to well-being of the operators is considered to be poor in the State. Most of the respondents (64.3%) claimed negative contribution of aquaculture to poverty reduction whereas 35.7% affirmed positive contribution. This is a prove of low fish yield/productivity, economic benefit derived by operator's which is attributed to weak effort and investment in commercial aquaculture. In Philippines, the reverse is the case among tilapia farmers that recorded high profit (90%) and income (81%) as

established by Sevilleja (2000). Areas that received high attention among the fish farmers in poverty reduction are housing (63.9%), health (50.0%), paying school fees (47.9%) and food security (45.1%). Low priority areas are farm expansion (3.5%), transportation (25.7%) and information (27.1%). Priority areas are in line with the finding of Sinkaiye and Jibowo (2005) on gender practical needs for participating in poverty alleviation programmes in Kwara State. Akinbile and Ndaghu (2005) and Adereti (2005) studies confirmed low priority given to aquaculture as a coping strategy. Low contribution of aquaculture to poverty alleviation is a confirmation of weak motive for economic benefit, inappropriate application of adopted technologies as well as inadequate fish food security and poor nutrition due low fish yield.

As shown in the Table 5, only type of association (0.00) is associated with adoption of technologies. Other personal characteristics (sex, marital status, education and membership of association) have no significant relationship with adoption of technologies. The result is in contrast to positive association established by Fawole and Fashina (2005) and Adereti (2005). Positive association of type of association confirms the importance of fish farmers association as social assets necessary for economic growth through information dissemination to members. The no significant association of education with adoption proves that fishery extension delivery in terms of information sharing and distribution is weak and ineffective in the State.

PPMC result confirmed that poverty reduction (0.323); age and household size are not significantly correlated with adoption. By implication, consumption level is higher than economic motive, hence, low investment in technologies and productivity due conservative attitude of the aged fish farmers.

CONCLUSION AND RECOMMENDATION

The outcome of the study revealed that aquaculture is dominated by ageing male operating at small-scale level. As a livelihood activity, fish farming is growing but at infancy stage with low participation of youths and women. Despite 67.6% adoption, the motive for profit making and farming experience in aquaculture is low among operators. Also, social assets were found to be weak to support economic growth of fish farmers. Therefore, transforming factors such as training, practical demonstration of technologies, knowledge, as well as access to micro credit facility, extension delivery and technology availability are required to serve as opportunities to support aquaculture growth and contribution to poverty reduction in Anambra State of Nigeria.

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TABLE 1: Percentage Distribution of Respondents fish farming characteristics (n = 144)

Variable	Frequency	%
Occupation		
Primary occupation	34	23.6
Secondary occupation	110	76.4
Purpose		
Consumption only	25	17.4
Sales/profit only	41	28.4
Both	78	54.2
Experience in year		
➢ 5 years	75	51.1
6 – 10 years	53	36.8
Above 10 years	16	12.1
Source of finance		
Personal savings	110	76.4
Informal credit institution	22	15.2
Formal credit institution	12	8.4
Pond size		
➢ 100m^2	120	83.3
101 – 500m^2	3	2.1
501 – 1000m^2	21	14.6
Total pond size	21,226.8m^2	Mean 159.6m^2
Pond Number	308	Mean 2
Culture system		
Extensive	40	27.8
Semi intensive	27	18.7
Intensive	77	53.5

TABLE 2: Percentage Distribution of Respondents selected Socioeconomics Characteristics (n=144)

	Frequency	%
Age		
25 - 40	46	29.9
51 – 55	66	45.8
56 – 70	31	23.6
Above	1	0.7
Sex		
Male	130	90.3
Female	14	9.7
Religion		
Christian	126	87.5
Tradition	18	12.5
Marital status		
Married	124	86
Single	8	5.6
Divorced	2	1.4
Widow	6	4.2
Separated	4	2.8
Household size		
1 – 4	74	51.4
5 – 8	57	39.6
9 – 12	12	8.3
13 – 16	1	0.7
Educational		
No formal education	16	11.1
Primary	13	9
Secondary	49	34.1
Tertiary	66	45.8
Membership of Association		
Yes	94	65.3
No	50	34.7
Types of Association		
Esusu	16	11.1
Co-operative	44	30.6
Farmers group	30	20.8
Fish farmer	4	2.8
No group	50	34.7

TABLE 3: Percentage Adoption of aquaculture technologies by Respondents

Technologies	Not aware %		Hear but Never use %		Used and Stopped %	Still using %
Pond site selection	133	(92.4)	0	(0)	0 (0)	11 (7.6)
Pond system	6	(4.2)	11	(7.6)	5 (3.5)	122 (84.7)
Culture system	1	(.7)	5	(3.5)	2 (1.4)	136 (94.4)
Culture practice	9	(6.3)	46	(31.9)	3 (2.1)	86 (59.7)
Fertilizer application	9	(6.3)	25	(17.4)	0 (0)	109 (75.7)
Feeding time	4	(2.8)	7	(4.9)	2 (1.4)	131 (91.0)
Use of conventional feed	6	(4.2)	8	(5.6)	1 (.7)	129 (89.6)
Pond water depth	1	(.7)	17	(11.8)	26 (18.4)	97 (67.4)
Fish species combination	16	(11.1)	98	(68.1)	6 (4.2)	24 (16.7)
Hatchery fingerlings	5	(3.5)	69	(47.9)	6 (4.2)	64 (44.4)
Use of exotic fish species	8	(5.6)	24	(16.7)	1 (.7)	111 (77.1)
Stocking ratio/density	18	(12.5)	47	(32.6)	1 (.7)	78 (54.2)
Cultivable fish species	6	(4.2)	21	(14.6)	5 (3.5)	112 (77.8)
Water quality management	12	(8.3)	12	(8.3)	0 (0)	120 (83.4)
Use of oxygen bag	1	(.7)	9	(6.3)	2 (1.4)	132 (91.7)
Aggregate adoption	15	(10.6)	26	(18.4)	4 (2.8)	98 (67.6)

TABLE 4: Contribution of aquaculture to poverty reduction

Variables	No		Yes	
	Frequency	%	Frequency	%
Paying school fees	75	52.1	69	47.9
Health Services	72	50.0	72	50.0
Food Security	79	54.9	65	45.1
Purchasing Power	101	70.1	43	29.9
Transportation	107	74.5	37	25.7
Information	105	72.9	39	27.1
Savings	103	71.5	41	28.5
Housing	52	36.1	92	63.9
Expansion of farm	139	96.5	5	3.5
Aggregate contribution	833	64.3	463	35.7

TABLE 5: Chi – square and PPMC analysis on adoption of technologies

	Chi-square		
Variables	X^2	df	P-value
Sex	1.54	2	0.92**
Marital status	4.73	4	0.31**
Education	4.09	8	0.84**
Type of association	15.45	15	0.00*
Membership of association	1.85	3	0.60**
PPMC	r	p	
Poverty	0.083	0.323**	
Age	0.33	0.691**	
Household size	-0.075	0.369**	

*** Not significant, * significant at 0.05*

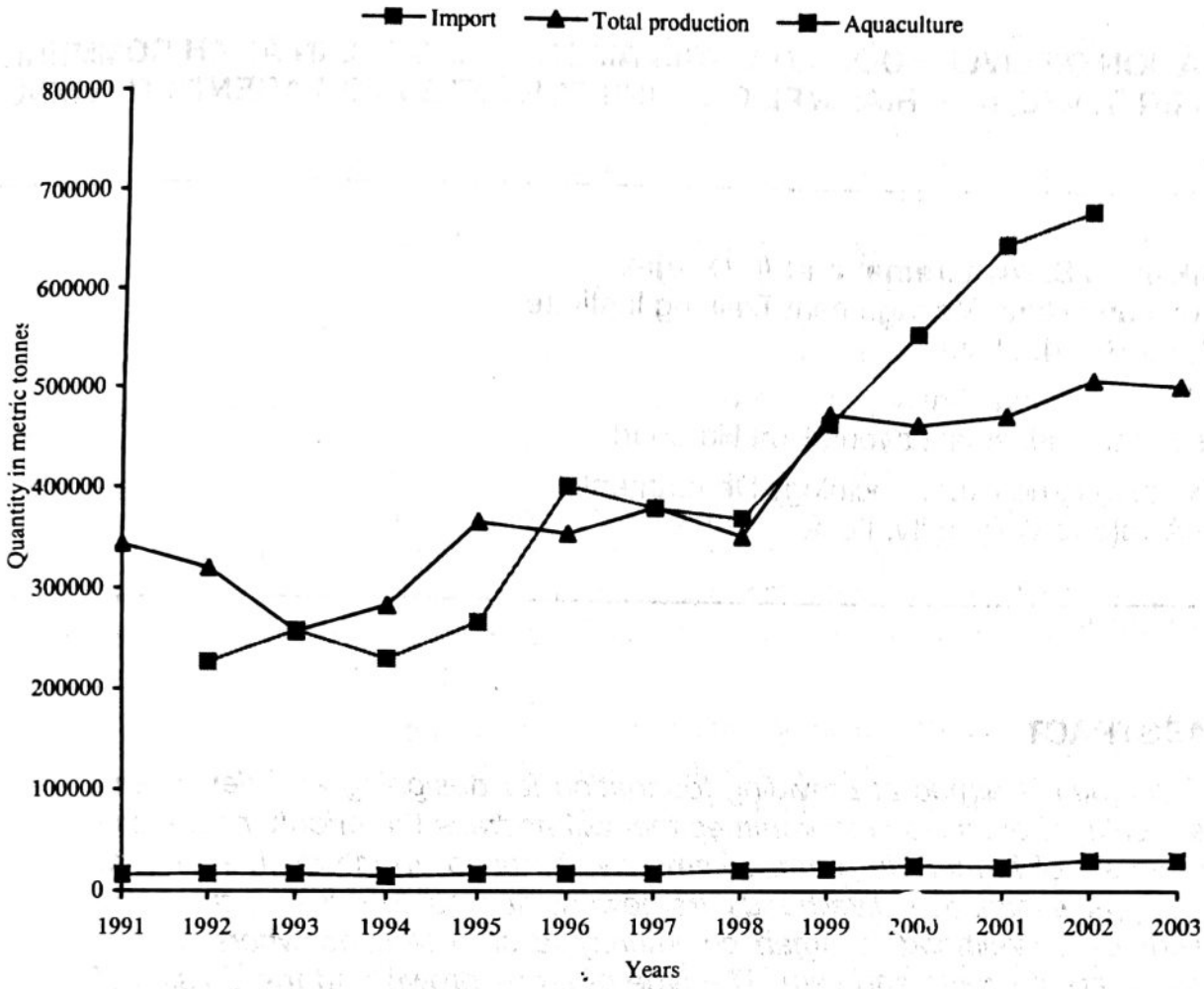

Figure 1: Fish production, imporation and aquaculture
Source:FAO 1999,2000a,2001,2004b and Dada 2004
Fish importation data for 1991 & 2003 not available