THE NICARAGUAN SALT INDUSTRY

AN ASSESSMENT

[PROSPECTS FOR SALT FLUORIDATION]

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Nicaragua Fact Sheet

Land Area :	129,494 sq km (50,193 sq mi).
Population :	4.24 million (1997 estimate)
Population Growth:	3.4% per annum 1987-1996
Cities :	Managua, pop 1,500,000 Leon, pop 130,000
Urbanization:	55% of population live in towns or urban centers.
Ethnicity:	77%--------Mestizos 10%-------White 9%-------Black 4%------- Native Indian
Economy:	Formerly mixed economy undergoing extensive market-oriented structural adjustment, mainly by means of privatization of state enterprises and downsizing of public sector. Heavily dependent on foreign aid
Labor Force	1.27 million; agriculture 45%, services 10%, mnufacturing and construction 16.9%, other 28% (1985)
Per Capita Income:	U$340. per year (1992)
External debt:	U$2.8 billion (1990)
Exchange Rate	10.1 Cordobas per US$ (Feb-1998)
Fertility	5.7 live births per woman
Infant Mortality	72 per 1,000 live births (1989)
Crude Death Rate	8 per 1,000 inhabitants (1990)
Life Expectancy at Birth	62 years; (1991)
UNDP-HDI	0.583
DMFT	2.81 (1997)

1. Activity Summary

The PAHO consultant arrived in Managua at 8:30PM on Wednesday October 8th. The following day Thursday October 9th a meeting was held with the National Salt Fluoridation Committee. A meeting was then held later in Leon with the Departmental Health System or **Systema Local de Attencion Integral en Salud**, (**SYLIAS**). The Department of Leon is the area where most salt production and processing is concentrated.

The following day a tour of the two largest salt producers, **PROCOSALNIC**, and **ENISAL,** took place. This included a tour of the packaging facility and **ENISAL's** crude salt facility. A debriefing was then held with members of the National Salt Fluoridation committee.

2. Meeting with Public Health Officials:

Meeting with National Salt Fluoridation Committee

Members of the committee who were present were:

Dra. Gloria E Navas	Director de Nutricion, Ministerio de Salud, GoN.
Dra. Yemira Sequeira	Directora Salubrista, Ministerio de Salud, GoN
Dra. Alejandra Narvaez	Responsable Nacional, Ministerio de Salud, GoN
Dr. Humberto Montiel	OPS, Nicaragua
Dr. Reynaldo Aguilar	Ministerio de Salud, GoN
Lic. Anselmo Aburto	OPS, Nicaragua
Lic Arnulfo Noguera	INCAP

The consultant was updated on the state of Nicaragua's salt industry and the plans to implement salt fluoridation. In summary the following information was presented.

1. An analysis of the structure and production of the Nicaraguan salt industry.
2. A description of the present quality level of salt presented to the final consumer.
3. An update of the status of the other aspect of the salt fluoridation program, namely the background DMFT studies, the water monitoring studies and the baseline fluoride in urine studies.
4. A description of the work done, and the success achieved to date on the Salt Iodization program.
5. The plans to improve the salt quality by development of the production techniques of the salt producers.

Discussions centered on salt quality and the quality that was required to successfully fluoridate. The consensus was, that due primarily to the high moisture content in Nicaraguan salt, approximately 3-4 %, addition of fluoride could not be attempted until improvements in the salt quality took place. It was generally agreed that all other prerequisites for a sustainable salt fluoridation program were in place. Not least among these are widespread support for fluoridation from the salt producers.

Already the producers had taken some steps to improve the salt production process. Chief amongst this is that the two largest producers have taken steps to merge, and had done a technical feasibility study on their plant upgrading. They are however stymied in going further by a lack of funding.

At the wrap up meeting held the next day October 10th 1997, with the National Fluoridation Committee, the consultant gave a brief summary of the activities that had taken place. The findings were essentially that salt quality has to be improved in order to start the addition of fluoride to salt. This will involve upgrading the plant and equipment of the salt producers. The consultant expressed optimism as some of the producers themselves are recognizing the need to form alliances to improve their economies of scale and efficiency. The priority would now be to access inexpensive financing for plant and analytical facility upgrading.

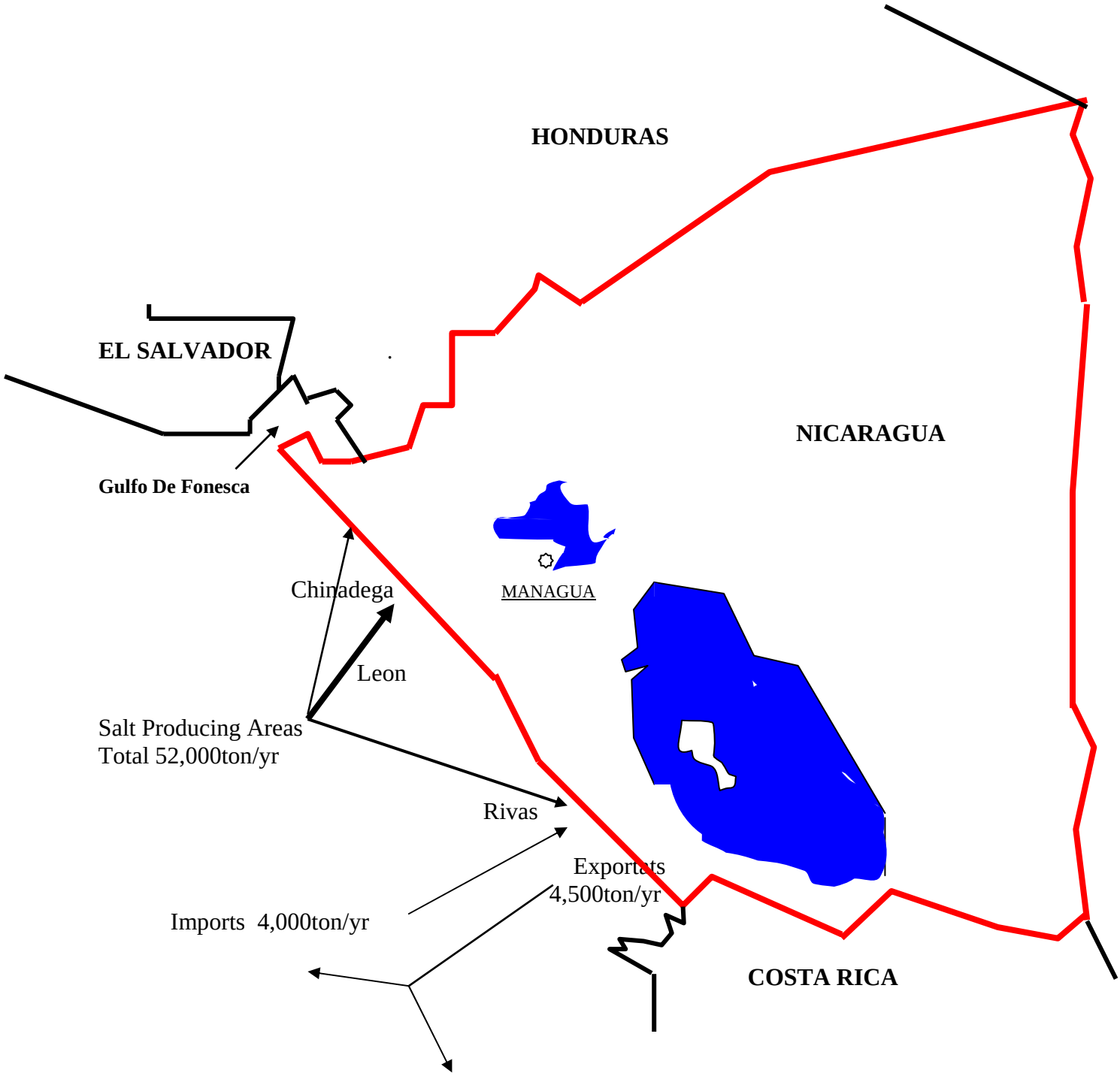
Based on these discussions and other information from players in the salt industry the flows and production of salt in Nicaragua was elucidated. This is show below in **Table 1** and overleaf in **Figure 1**.

Table 1: Annual Salt Flows and Balance for the Republic of Nicaragua (ton)

IMPORTS		PRODUCTION		CONSUMPTION		EXPORTS	
Costa Rica	4,000	Solar Salt (Sal Solar)	52,000	Household/ Domestic/ Table (Direct Human)	15,500	Honduras Costa Rica	2,000 2,500
		"Cooked" Salt (Sal Cocimienta)	500	Industrial Food/ Bakery/ Cattle. (Indirect Human)	36,500		
				Industrial Non-Food (No Human Consumption)			
TOTAL IMPORTS	4,000	TOTAL PRODUCTION	52,500	TOTAL CONSUMPTION	52,000	TOTAL EXORTS	4500
TOTAL IMPORTS + TOTAL PRODUCTION = 56,500				TOTAL CONSUMPTION + TOTAL EXPORTS = 56,500			

Salt surveys have shown that the average per capita consumption of household salt is 10 gm per person per day. This level of consumption would account for about 15,500 ton of salt per year.

Figure 1: Diagram Showing Salt Flows for the Republic of Nicaragua



Meeting with SYLAIS for the Department of Leon

The SYLAIS Leon or health administration system for the Department of Leon, is responsible for the overseeing of the salt industry in that Department from a public health perspective. At present, this involves monitoring the existing salt iodization program. Close co-ordination occurs with the salt producers, the majority of whom are located in the department of Leon.

Present at this meeting were:

Dr. Cayetano Mungia	Head of SYLIAS Leon
Members of the SYLIAS Leon	
Snr. Francisco Gallo	Part-owner of PROCOSAL
Snr. Gustavo Castillo	Part-owner of ENISAl
Dra. Alejandra Narvaez	Responsable Nacional, Ministerio de Salud, GoN
Lic. Arnulfo Noguera	INCAP

The discussion centered on the following:

a) The status of the Fluoride baseline studies of water and urine.

b) The necessity to upgrade the salt process techniques and equipment, and the difficulty in obtaining consensus among the producers to work together to do so.

c) The difficulty in obtaining financing for plant upgrading.

3. Visit to Salt Producers, PROCOSALNIC & ENISAL:

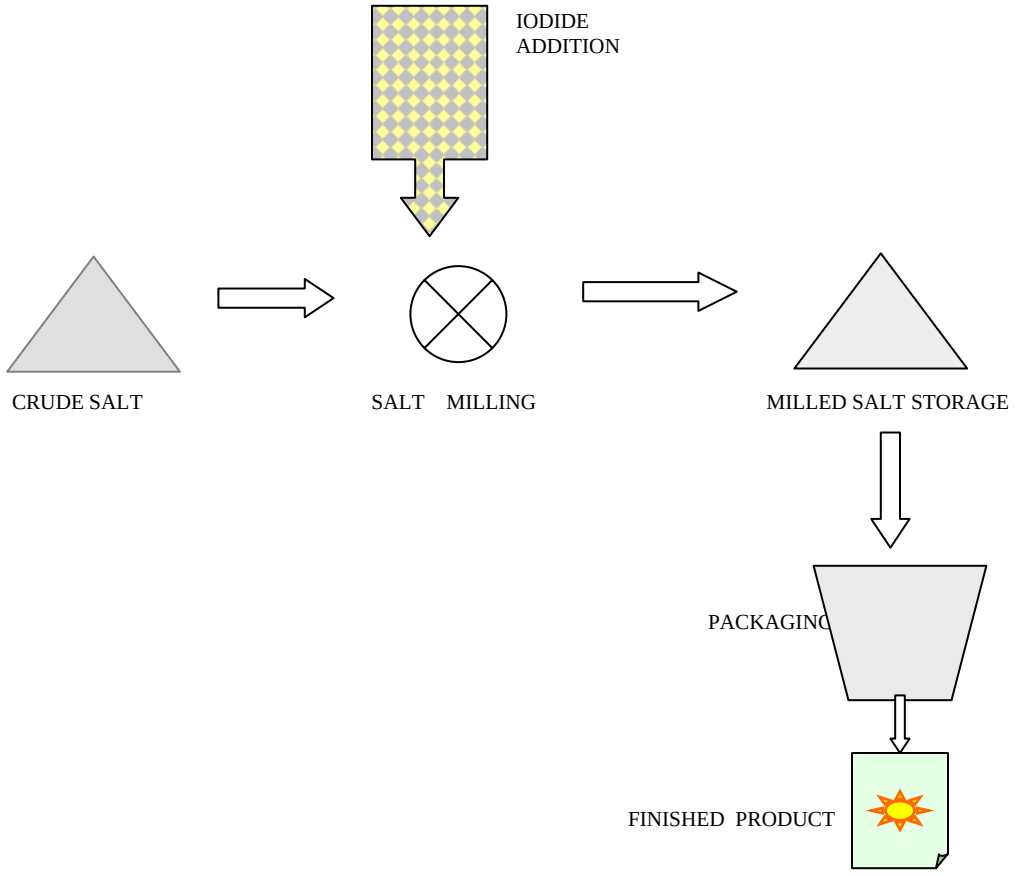
The **PROCOSALNIC** packaging facilities and the salinas of **ENISAL** were visited on Friday, October 10th, 1997. These are the two largest salt producers in Nicaragua. Together they produce about 12,000 ton per year, or 58 % of packed salt in Nicaragua.

PROCOSALNIC or **Productora y Comercializadora de Sal de Nicaragua y Cia. Ltda**., is owned equally by its four executive managers and **SALPASA** or **Salineros del Pacifico de Nicaragua,** an organization of 17 crude salt producers in the El Tamarindo area of Leon province. The president of the enterprise is **Benjamin Munoz Rojas** with the treasurer and general manager being **Francisco Jose Gallo Guerrero** and **Jose de la ruz Meza Linarte** respectively.

Their facilities consist of essentially two separate areas side by side. These are a crude salt storage area and a processing and packaging area. The crude salt storage area is a shed of approximately 100 m^2, which contains crude salt brought from the salinas. The

salt is stored in loose form as well as in 1-quintal bags. The processing area is a shed of similar size where the salt is dosed with iodine, milled, then packaged. Storage of finished product also takes place in that area. **Figure 2** below shows the process diagrammatically.

Figure 2: Diagrammatic representation of the Mill and Package salt process typically done in Nicaragua.



The crude salt is shoveled into wooden wheelbarrows and run-up a ramp and dumped into a hopper above an electrically driven hammer mill. While falling down the chute leading to the mill, iodide in the form of Yodocal is added to the salt. A calculated amount of Yodocal is added for each wheelbarrow load that is sent to the mill. This method of iodine dosification is far from ideal, as the weights of wheelbarrow loads will vary, as well as, the regularity of addition.

At this stage a qualitative check of iodide addition is normally carried out. A few drops of a mixture of sodium thiosulphate and starch indicator is added to a sample of the salt. A

blue color indicates the presence of iodine. If no color or a pale coloration is present, more yodocal is to be added to the batch of salt from which the sample was taken.

The salt that has been milled falls out of the mill and is kept in a heap on the plant floor. It is then transferred by bagged amounts to the packing tables. At the tables women use improvised scoops to put the required amount of salt in plastic preprinted bags and seal them by means of hand sealers. There is one package size for table or domestic salt. This is the "**12 onzas aproximadas**" size. Industrial salt and salt for animal consumption is packaged in 100lb or 1 quintal sacks for distribution. This salt is not processed further and is essentially crude salt.

The process at **PROCOSALNIC**, which is typical of all the salt packers, results in salt with an average moisture content of 3 to 5 %. **Table 2** below shows the typical salt quality of PROCOSALNIC and Nicaraguan packaged salt.

Table2: Typical PROCOSALNICl Packaged Salt Analysis.

DESCRIPTION	ANALYSIS WT %
Moisture	4.0
Insolubles	1.0
NaCl	94.0
Other	1.0

It should be noted that because of the majority of crude salt processors use single pond batch systems, the resulting crude salt will have high levels of chemical impurities. With these processes it is expected that calcium sulfates and magnesium chloride levels will be high.

Nicaraguan salt is packaged in one size using a variety of imaginative brand names. The **figure 3** and **figure 4** overleaf shows two of the brands packaged by **PROCOSALNIC**.

Figure 3: PROCOSALNIC's popular DELFIN & EL TORO brand

The production at **PROCOSALNIC** is in the order of 20 ton per 8-hour day. This translates to an annual production of about 7,000 ton.

Next visited was the salinas of **ENISAL** or **Empresa Nicaraguense de la Industria Salinera S.A.**. **ENISAL** is owned by 17 individuals having various proportions of shares. It is chaired and managed by **Gustavo Adolfo Castillo Medina**, a part owner of the enterprise

ENISAL is the privatized version of the formerly government owned salinas, **ENASAL** or **Empressa Nacional de la Sal S. A**. which were upgraded by Cuban designers in the 1980's. It is very well laid out and well organized. The pond construction and design gives it the potential to produce efficiently high quality crude salt. It is amenable to mechanized production methods. **ENISAL** supplies crude salt to its own packaging facility.

In the case of **ENISAL** production from their packing facility averages about 13 to 14 ton per day or about 5,000 ton annually.

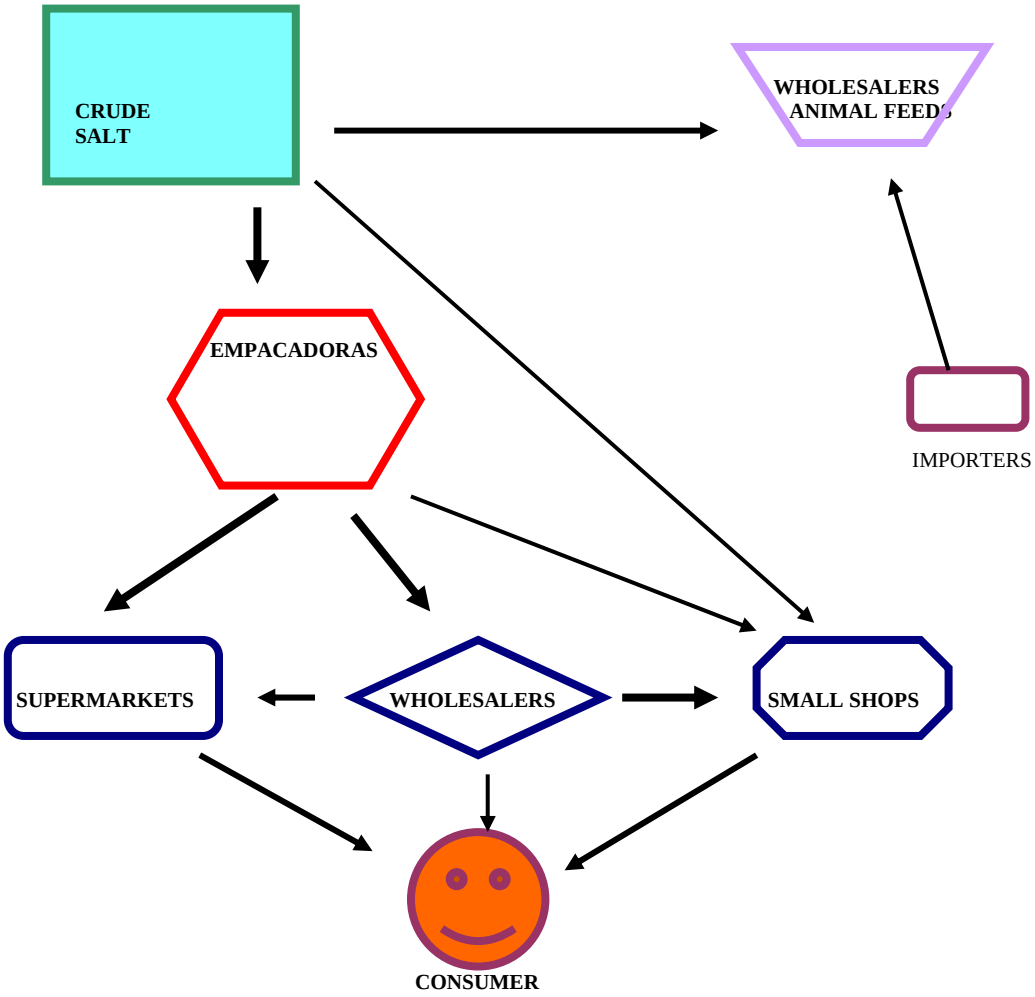
ENISAL and **PROCOSALNIC** intend to merge and construct a new salt processing facility of capacity 50 ton per day or 15,000 ton per year. It is the intention to utilize the "**lavada, molida, secada**" process to produce dry high quality salt with proper control of additives such as iodine and fluoride.

The cost of this plant has been estimated to be in the region of U$120,000. At present plans have been stalled because of the unavailability of low cost finance.

4. Salt Marketing and Distribution

The **figure 4** shown below outlines the distribution channels and marketing arrangements for salt. More study is needed to quantify the various streams. Some salt bypasses the Empacadoras and is sold directly for animal feeds and for bulk distribution at wholesalers. Salt that has been milled and packed with iodide added is sold mainly to wholesalers and supermarkets, but there is some amount of direct selling.

Figure 4: Salt Distribution Channels



5. Analysis of the Nicaraguan Situation

The Nicaraguan Salt Industry may be characterized for the main part as still utilizing traditional techniques and methods. The production process is highly artisan. The following lists the main characteristics of this industry.

1. **Operations are highly manual.**
   This is so for all areas of the operation. In the production of crude salt all tasks except for the pumping of seawater are performed manually. Although this also holds at present for **ENISAL**, they can easily convert to more efficient means of production because they have a well-designed installation. In the packaging plants although machinery is employed, all transfer points, and storage activities are manual. Only in the transportation of salt is machinery in the form of trucks or vans utilized consistently.

2. **The industry is highly fragmented, in the production of crude salt, consisting of about 175 producers.** The **Table 3** below shows the number of producers of crude salt in each production capacity cohort.

Table 3: Number of Producers Categorized by Size and Respective Production

Category of Producer	*Number of Producers*	*% of Total Producers*	*Production (ton)*	*% of Total Production*
Small < 450 t per annum	164	94.2	6219	31.4
Medium 450t to 1350t per annum	7	4.0	13815	16.2
Large > 1350 t per annum	3	1.7	31822	52.4
Total	174	100	51856	100

3. **Differentiation and consolidation among the empacadoras is beginning.**
   Although there are many producers of crude salt from small or even single pond salinas, the number of empacadoras are only 18. The empacadoras **ENISAL** and **PROCOSALNIC** together account for over 58% of packaged salt production. Their

nearest rival accounts for only 1/6 of their combined production. In addition **ENISAL** and **PROCOSALNIC** have taken almost all the steps to full merger. If this is successful they will certainly reap the benefits that larger economies of scale bring. With that as an example, other producers/empacadoras are sure to follow. See **appendix 1** for a list of empacadoras.

4. **The price of salt to the consumer is in the range of U$ 0.55/kg to U$ 0.11/kg.** The majority of local brands are priced in the medium range of U$ 0.22/kg, (U$ 0.10/lb) but there exists some local brands which sell as low as U$ 0.11/kg, (U$ 0.05/lb). Higher quality imported brands are priced at a premium selling for between U$ 0.55/kg to U$ 0.44 /kg, (U$ 0.25/lb to U$ 0.20 /lb)**.**

5. **The salt quality is below what can be considered normal by international standards**. Nicaragua producers are unable to offer local salt to the consumer at less than approximately 4% moisture. Appearance and particle size suffer from inconsistency. Package weights are normally below the declaration. Even packaging quality and final salt appearance is borderline. Although all salt for human consumption is iodized, data on precision and consistency of the iodide results were not available.

6. **Producers do not have the capacity to carry out any quantitative analysis on raw material or finished products**. There is an absence of analytical facilities at the producer level.

Most of the above listed characteristics tend to produce obstacles in the way of sustainable salt fluoridation program. For the success of a salt fluoridation program, conventional wisdom dictates that a higher level of salt quality is required. This is especially so with respect to moisture content, a dry, (<0.25 % moisture), salt being required. In addition a more advanced system of additive handling, storage, monitoring and analysis is required for the addition of fluoride to salt.

The important questions therefore are:

1st. What strategies can be used to bring Nicaragua's Salt Industry to a stage where it can begin a sustainable program of salt fluoridation?

2nd. How long will it take to be effective?

3rd. Are there alternate means of providing fluoridated salt?

Production processes will have to be improved in order to efficiently produce an acceptable quality salt. This is so for two reasons:

1. To be able to start a regime of Salt Fluoridation.
2. To be able to compete effectively with imported salt from highly efficient producers such as Mexico, Venezuela or Columbia.

In the case of Nicaragua the two largest producers have effectively merged to invest in a modern processing facility. They have commissioned feasibility studies and have a design concept of their new plant. In the assessment of the PAHO consultant there is a high level of commitment for improvement by the principals of these two entities. Their main problem is to be able to access reasonably priced financing for a project such as a new salt plant. The merged entity will require about U$120,000 to design and build a new plant of capacity 15,000 ton per year. At the present level of interest rates in Nicaragua, this project could not be considered profitable on purely financial grounds. The social benefits which will result from having better controlled iodization and the ability to fluoridate salt and thereby prevent caries and the comnicant cost of restoration should be able to make this project a case for assistance from developmental institutions. It should be mentioned that the principals have taken steps in that regard having developed a relationship with Seattle, Washington based **PATH, Program for Appropriate Technology in Health,** for this purpose.

In addition to financial obstacles, it will be necessary to offer to the players in the industry, some more exposure to, and training in, modern salt production techniques and equipment. This can be accomplished with relative ease by visiting the Venezuelan salt facilities that are models of good design and efficient operations at all levels.

6. Recommendations:

It is recommended that the following strategies be pursued.

1. That more full time effort be placed on managing the process of improving and modernizing the salt industry. This will require a multi-disciplinary committee with understanding of the social, economic and engineering issues involved.

2. That steps be taken to strengthen the existing salt producers' associations. Efforts should be made to form an umbrella group, to disseminate information and to offer suggestions for improvements and to set the stage for more producers merging and becoming more efficient.

3. That **ENISA**L & **PROCOSALNIC** be encouraged and assisted in every way possible to accelerate their merger to the new entity **ENIPROSAL**. This new entity will be the

best poised in all respects, to begin a program of salt quality improvement and the addition of fluoride.

4. That the Nicaraguan Government/ Salt Fluoridation Committee develops a strategic plan detailing to bring about the necessary changes to the salt industry in order to make fluoridated salt available to the population. This plan would involve looking at a number of scenarios.
    a) Assistance and/or soft loans to the merged ENIPROSAL entity.
    b) The encouragement of other small producers to modernize along the lines of the Venezuelan "***Micro Plants***".
    c) Importing table quality salt already fluoridated or for dosing with fluoride and packaging.

5. That PAHO develop a "Travelling Seminar " to expose the Nicaraguan Producers to appropriate developments in salt process technology.

6. That a detailed study of the salt distribution and marketing system be made.

7. That PAHO explore the possibility of obtaining funding for improvement of salt production methods and for setting up of analytical facilities for fluoride analysis.

APPENDICES

APPENDIX 1

LIST OF NICARAGUAN SALT PROCESSORS

NAME OF PACKAGER	BRANDS PACKAGED	QUANTITY PRODUCED (ton) Iodized Salt	% of TOTAL PRODUCTION
1.PROCOSALNIC	Delfin, Toro, La Carretita	6,750	32.6
2.Gustavo Castillo	ENISAL	5,175	25.0
3.Leonel Espinoza	El Provenir	2,250	10.9
4.Nicolas Rojas	San Nicolas	1,800	8.7
5.Alejandro Martinez	Argentina	1350	6.5
6.Mario Cerna	Neptuno	1350	6.5
7.Roberto Gutierrez	Macarela	675	3.3
8.Amina Cruz	La Perla	675	3.3
9.Delia Castro	San Pablo	540	2.6
10.Orlando Perez	El Triburon	450	2.2
11.Gilberto Flores	Hossana	225	1.1
12.Antonio Ocampo	San Antonio	113	0.5
13.Valentin Jiron	La Pacena	No Data	
14.Modesta Quintana	Sal Marina	No Data	
15.Luis A. Quintana	Estrella Del Sur	No Data	
16.Ernesto Yllescas	Bloque de Salineros	No Data	
17.Hnos. Torrez	El Pelicano	No Data	
18.Coop. F.P. Carrillo		No Data	
TOTAL		20,677	100

APPENDIX 2

MAP OF NICARAGUA

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