

PROJECT REPORT TO
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DEVELOPING A PROCESS
FOR AUTOMATED TUNA
HEAD MEAT RECOVERY

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ABSTRACT OF THE FINAL REPORT

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Developing a process for Automated Tuna Head Meat Recovery

Abstract of the Consolidated Final Report

- Type of contract:** Co-operative research project
- Total cost:** 695 kECU **EC contribution:** 345 kECU or 49,6%
- Commencement date:** 01-04-99 **Duration:** 2 years
- Completion date:** 01-04-01
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I. Introduction and objectives

Tuna heads are by-products from the canning of tuna meat. The heads contain meat, which is currently not used to any extent for human consumption. No machines are available to remove the meat, and manual removal is not economically feasible. This project aimed at developing an automated prototype machine, which can remove the meat from tuna heads. The machine should recover the meat so it could be incorporated into current products of the tuna industry without loss in quality or sold as speciality product. It should also be compatible with current automated tuna processing lines in terms of capacity and flexibility regarding fish size.

The project focused on three main work packages: 1. Determination of the parts (and quantity) of tuna head and collar meat that can be incorporated into canned goods. 2. Development of a prototype machine to remove the meat. 3. Testing of the machine under laboratory and industrial conditions. In the project a multidisciplinary approach was used to ensure that the intended process technology development could be efficiently integrated into current working practices and that product quality was not affected by the incorporation of the recovered meat. The project involved transfer of expertise from one fishing sector to another or from the North to the South of Europe.

The project was to start at the end of 1998 but was delayed for about 6 months because of participant changes. The prime SME in the project is an Icelandic machine manufacturer, specialising in the construction of equipment for meat recovery from different marine species. Another Icelandic SME participated in the project, an engineer consultant. Two Spanish SMEs (machine engineering companies) also participated in the project. The RTD participants have been three, two Spanish (tuna manufacturer and a University) and one Icelandic (fish research institute) that also acted as the co-ordinator.

The novelty of the technology of mechanically recovering meat from tuna heads will be patented. Initially the novel machine will be utilised in Spain and when proven successful sold and/or licensed to other countries. The prime proposer and the other SME's intend to use the new technology to obtain new markets or services.

II. Description of work

Five plenary meetings were held during the project in Spain and Iceland. The research and development work has been placed in the following Tasks; *Manual head splitting* (Task 1), *Testing of recovered meat* (Task 2), *Development of a prototype machine* (Task 3), *Testing of the prototype machine* (Task 4), *Setting of quality and hygienic standards* (Task 5), *Ergonomic and engineering study* (Task 6), *Industrial Trials* (Task 7), *Economic impact assessment* (Task 8), *Market survey* (Task 9), *Dissemination and preparation of final report* (Task 10) and *Co-ordination* (Task 11).

III. State of progress and achievements

All tasks have been successfully finished.

Manual head splitting (Task 1) indicated that the meat is principally located at the back, on the top of the head (upper neck muscles or forehead meat) and at the lower part of the head (collar meat). The meat recovered from the lower part of the head is very dark due to the fact that the fish is not bled during killing. The meat from the top of the head is removed as two separate long muscle pieces; this meat is in effect from long muscles that extend from the forehead of the tuna backwards following the spine. The yield for the top head meat was found to be about 4% of the head weight. The collar meat was found to be about 1% of the head weight.

Testing of recovered meat (Task 2). Extensive analysis were carried out where manually recovered meat from tuna head (both from forehead and cheeks) was compared with loin meat (reference). Raw, cooked and canned samples were evaluated. The forehead meat is darker in colour than normal meat and that may give difficulties when it is mixed into normal products at very high levels. The odour and flavour of the recovered forehead meat was however similar to that of loin meat. The forehead meat has one advantage over loin meat as it is more tender and juicier and could therefore be canned as a special, high quality product. On the other hand, meat recovered from tuna cheeks did not comply with the quality criteria of canned tuna due to dark colour and low scores for flavour and texture.

Development of a prototype machine (Task 3). The machine recovers the two top head muscles by imitating manual removal.

Testing of the prototype machine (Task 4) under laboratory conditions was made in Iceland. Heads were transported from Spain to Iceland for this purpose. The yield, capacity, ease of use, properties and technology of the prototype machine were evaluated. The testing under laboratory conditions (limited amount of tuna heads) revealed values for these parameters were found to be within the criteria set forward at the start of the project. The machine was thereafter sent to Spain where industrial trials (Task 7) are being performed

Setting of quality and hygienic standards (Task 5) was performed resulting in Code for Good Manufacturing Practices (GMP) and Hazard analysis and control of Critical Points (HACCP) schemes for processing of recovered tuna head meat. The schemes will ensure that the recovered tuna head meat will comply with quality standards set by the factory and with the safety regulations of the EU.

Ergonomic and engineering study (Task 6) was performed to ensure successful incorporation of the prototype machine into the current processing lines. The work revealed that several changes are necessary in the classical operation procedures at tuna factories for incorporation of the machine. The main changes are at the cutting area of the tuna and in setting up of tubs for thawing heads but the tuna heads need to be unfrozen before mechanical recovery of tuna head meat. The thawing of heads requires 16 to 24 hours preferably in running water. This continuous running of water and body fluids from the fish led to modification in the drain system in the floor of the thawing area to ensure hygienic conditions. Furthermore, changes were made at the waste disposal system as cutting of the head in two pieces when leaving the machine leads to increased volume of waste.

The *Industrial Trials* (Task 7) revealed that the principle of the automatic head meat recovery works as planned. The yield of automatically recovered meat was found to be comparable to that of manually recovered meat. The trials furthermore revealed that the capacity of the machine was lower than planned and modifications of the machinery are necessary to reach the initial objective. The testing showed a number of

problems most of which are minor. However, these changes are outside the scope of this research project.

Economic impact assessment (Task 8). According to the industrial trials the operation capacity of the prototype lower than expected and the machine therefore not economically feasible. It is foreseen that the optimisation of the prototype machine according to results from the Industrial trials (Task 7) will improve the capacity, lower the labour cost of recovery and make the production economically feasible. The participants are also considering designing an automated head feeding system to improve the process speed even further.

A *Market survey* (Task 9) revealed that the world catches of tuna have increased considerably and also the production of canned tuna. At the same time the number of tuna production companies has been decreasing but the companies have become bigger. This fact is very promising for marketing of the machine as the it is mainly aimed at the tuna canning industry and the companies need to be big for the machine to be economical.

Dissemination of results (Task 10). Promotion material has been made and will be sent to the producers on the provided list in the marketing report when the prototype has been optimised.

IV. Future actions

The proposed SME will carry on work regarding patent application of the results. Marketing will be carried out built on results from the project through promotion material and on sales mass. A promotional material for the technology is being prepared and will be sent to potential users of the machinery. The participants estimate that 0.5-1 year period will be required after the completion of this project before the final machine will be marketed.