

## Economic aspects of fishing of dolphinfish in Sicily\*

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**SUMMARY:** Dolphinfish fishing with Fish Aggregating Devices (FADs) and purseseine nets is normally practised everywhere in Sicily and the Pelagic Archipelago. The fishing season starts in July when the FADs are placed and finishes in December. In the 1996 fishing season, in 5 sample ports, catches and fishing effort were taken through interviews during landing, fishing running costs were taken by interviewing fishermen and prices per kilos paid to fishermen were taken through direct observation. Catches, costs and profits per sample port, per week and for the entire fishing season were then calculated or estimated. Though it is freshly marketed only in Sicily, the resource would appear to provide a lucrative activity.

*Key works:* seasonal fishery, economic analysis.

### INTRODUCTION

Dolphinfish fishing with kannizzi and purse-seine nets is a traditional activity performed by some Sicilian fisheries. The fishing season starts in July with the placing of Fish Aggregating Devices (FADs) typical of the Mediterranean area called kannizzi, and finishes in December (Galea, 1961). The fleet dedicated to this type of fishing is generally made up of about 230 small to medium boats that in the remaining time of the year practise different types of fishing, such as swordfish and albacore fishing with long-line and/or gill-nets and trammel-nets (Morales-Nin et al., 1996). In the last few decades, the appeal of high earnings has led an increasing number of fishermen to turn to this resource (Bono *et al.*, 1997). Earnings are constantly high, even if the abundance of dolphinfish, as for all pelagic species, is subject to considerable

annual fluctuations because less abundant years cause prices to rise.

### MATERIALS AND METHODS

In the 1996 dolphinfish fishing season with FADs and purse seine all the boats dedicated to this activity in Sicily and in the Pelagic Archipelago were counted in a census. In 5 sample ports (Lampedusa, Linosa, Trapani, Sant'Agata di Militello and Siracusa) catches and the fishing effort were taken through interviews during landing, based on samples in time and space or based on a census. In addition, average prices per week paid to fishermen were taken through direct observation, and boat running costs were determined by interviewing shipowners. In 4 of the 5 sample ports (Linosa, Lampedusa, Siracusa and Sant'Agata di Militello) the surveys were carried out through a census in space and time; in practice, this involved interviewing all the fishermen every fishing day. However, in Trapani the sur-

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veys were carried out through sampling in space and time, that is, most of the fishermen were interviewed 3 times a week (Mondays, Wednesdays and Fridays).

Costs were divided into four categories:

1. *Running costs*: fuel, oil, ice, spare parts and repairs;
2. *Cost of fishing gear* concerning the whole cost of the FADs;
3. *Cost of Capital* including depreciation and opportunity cost;
4. *Labour cost* estimated according to the opportunity cost principle.

Repairs included both ordinary and special maintenance. The term capital means the value of the boat, inclusive of gear and facilities. The opportunity cost of capital was calculated by assuming that the capital stock value of the fleet would be invested in treasury bonds only during the months dedicated to the dolphinfish fishing (1 September 1996 - 31 December 1996).

This principle was also used to estimate the labour cost. The Italian system adopted by the fisheries to pay crew members is said to be on a lay. With this system the net revenue (gross revenue less some running expenses) represents the whole revenue which is divided fifty-fifty between the shipowner and crew members. It is clear that this system makes it difficult to check salaries. So we assumed that fishermen could be alternatively employed in the agriculture sector and we estimated the daily salary for a fishermen by the daily salary of

a farm-hand. On the basis of that principle we believe that an average monthly salary is underestimated in comparison with to the one actually received through the system of being on a lay.

The revenues were estimated by multiplying weekly catches and prices. The profit was estimated by the difference between revenues and costs. Prices, costs, revenues and profits were estimated in ECUs (1 ECU  $\approx$  1.1 \$).

## RESULTS AND DISCUSSION

Table 1 illustrates weekly catches and total in the sample ports during the 1996 fishing season. Except for Siracusa, the fishing season starts in the first week of September. In Trapani and Lampedusa the fishing season finished in the second and the third week of November respectively, whereas in the other ports the season finished in the last but one week of December. The Trapani and Lampedusa fishing seasons are shorter than those of the other areas. This is because that around the fishing area of Trapani dolphinfish arrive, in a sufficient quantity to justify the fishing activity, later than elsewhere and by the middle of November they have already left the area (Cannizzaro *et al.*, 1997). In Lampedusa, and initially in Linosa too, even though the resource is always very abundant, the fishermen usually wait for the dolphinfish to reach a more marketable size. The most abundant catches per weight were reported in October; around this period, as a matter of fact,

TABLE 1. – Catches in kg per week in the sample ports during the 1996 fishing season.

Period	Lampedusa	Linosa	Trapani	S.E. TP	Sant'Agata	Siracusa
11 - 18 August	-	-	-	-	-	4204
19 - 25 August	-	-	-	-	-	6081
26 Aug. - 01 Sep.	-	-	-	-	32	8327
02 - 08 September	78	339	719	25.5	0	13457
09 - 15 September	214	4196	1540	145.5	803	4762
16 - 22 September	234	2113	280	39.6	1241	6085
23 - 29 September	392	1085	1781	123.0	4611	11084
30 Sep. - 06 Oct.	1535	678	1003	119.4	1797	3252
07 - 13 October	735	3230	8603	1257.8	1621	4460
14 - 20 October	234	852	0	-	8314	3172
21 - 27 October	736	7312	7076	512.2	27461	6841
28 Oct. - 03 Nov.	70	1848	6300	431.5	5402	2320
04 - 10 November	359	3829	1372	165.6	3925	5399
11 - 17 November	140	5429	-	-	1135	4875
18 - 24 November	-	0	-	-	664	525
25 Nov. - 01 Dec.	-	0	-	-	405	0
02 - 08 December	-	1875	-	-	6520	0
09 - 15 December	-	2118	-	-	2502	5621
16 - 22 December	-	396	-	-	488	1819
TOTAL	4727	35300	28674	1452.9	66921	92284

TABLE 2. – Number of boats, fishing week and average catch per boat and per week in the sample ports during the 1996 fishing season.

Sample Ports	Boat Number	Weeks of fishing	Average catch per boat and per week in kg	Standard Deviation in kg
Lampedusa	2	11	215	216
Linosa	6	16	368	350
Trapani	14	10	205	227
Sant'Agata	17	17	232	385
Siracusa	27	19	180	129

the ratio between the number of specimens caught and somatic weight was the best.

Table 2 illustrates the number of boats, fishing weeks, average catches per week and per boat, and the relative standard deviation in the 1996 fishing season. The most abundant catch per week and per boat was registered in Linosa, but taking into consideration the high variability it seems that in all the sample ports the catch was more or less of the same amount.

In the Pelagic Islands of Linosa and Lampedusa, the prices of dolphinfish (see Table 3) are generally lower than in the most important ports of Sicily, for two reasons: lack of an internal market and transport costs. They are fixed through negotiations between fishermen and wholesalers. Linosa and Lampedusa fishermen sell the majority of the catch to a local warehouse with which they have a privileged relation, which in turn transport the fish by ferry to Sicily, where it is distributed by Porto

Empedocle, Catania and Palermo wholesalers. A small quantity of catch is usually sold locally. In 1996 in Lampedusa, wholesale prices were steady during the fishing season, because fishermen fixed them at the beginning of the season in agreement with the wholesalers. In Linosa, the wholesale price was 2.1 ECUs until 10 September and 1.5 ECUs for the remaining part of the season. By the middle of November, it is no longer convenient for dealers to pay dolphinfish at 2.1 ECUs per kg, as at the beginning of the season. Therefore, the fishermen from Lampedusa were forced to stop fishing. In 1996, the average wholesale price for dolphinfish varied in the most important ports of Sicily from a minimum of 3.0 ECUs to a maximum of 6.2 ECUs in Siracusa. In Siracusa and in Sant'Agata the wholesale prices are higher than in the other analyzed ports, because in eastern Sicily the dolphinfish demand is much higher. In Siracusa, the average wholesale price was about 5.2 ECUs, with a maximum of 6.25 ECUs and a minimum of 4.15 ECUs. In Sant'Agata and Trapani the average wholesale prices were respectively about 4.18 ECUs and 3.55 ECUs.

The highest prices were at the beginning of the fishing season because of a strong demand, and fell subsequently. Generally the interaction between demand and offer supply rise to small price fluctuations.

From the analysis of the total costs (see Table 4) met by the fleets dedicated to dolphinfish fishing it is deduced that labour costs have a greater impact than

TABLE 3. – Average prices per week paid to fishermen in sample ports in the 1996 fishing season.

Period	Lampedusa	Linosa	Trapani	Sant'Agata	Siracusa
11 - 18 August	-	-	-	-	6.22
19 - 25 August	-	-	-	-	6.22
26 Aug. - 01 Sep.	-	-	-	5.18	6.22
02 - 08 September	2.07	2.07	4.30	5.18	6.22
09 - 15 September	2.07	2.07	4.30	5.18	5.96
16 - 22 September	2.07	1.55	3.47	3.63	5.96
23 - 29 September	2.07	1.55	3.47	3.63	5.18
30 Sep. - 06 Oct.	2.07	1.55	3.47	3.37	3.63
07 - 13 October	2.07	1.55	3.00	3.37	4.40
14 - 20 October	2.07	1.55	-	3.37	4.14
21 - 27 October	2.07	1.55	3.47	3.37	4.14
28 Oct. - 03 Nov.	2.07	1.55	3.00	4.40	6.22
04 - 10 November	2.07	1.55	3.47	4.40	5.44
11 - 17 November	2.07	1.55	-	4.40	5.44
18 - 24 November	-	1.55	-	4.40	5.70
25 Nov. - 01 Dec.	-	-	-	4.40	5.70
02 - 08 December	-	-	-	4.92	6.22
09 - 15 December	-	1.55	-	4.92	6.22
16 - 22 December	-	1.55	-	4.92	6.22
Average price and relative standard deviation in the 1996 fishing season	2.07 S.D. 0	1.68 S.D. 0.23	3.69 S.D. 0.52	4.39 S.D. 0.72	5.61 S.D. 0.83

TABLE 4. – Total costs.

	Lampedusa	Linosa	Trapani	Sant'Agata	Siracusa
Running costs	27%	14%	27%	20%	31%
Cost of fishing gear	18%	29%	23%	31%	18%
Labour costs	32%	34%	30%	34%	34%
Capital cost	23%	23%	20%	15%	17%
Total costs	100%	100%	100%	100%	100%

TABLE 5. – Running costs.

	Lampedusa	Linosa	Trapani	Sant'Agata	Siracusa
Fuel costs	69%	60%	75%	75%	81%
Oil costs	4%	4%	5%	5%	5%
Repairs	27%	36%	20%	20%	14%
Running costs	100%	100%	100%	100%	100%

TABLE 6. – Profit.

	Lampedusa	Linosa	Trapani	Sant'Agata	Siracusa
Running costs	25%	7%	17%	12%	22%
Cost of fishing gear	16%	15%	14%	18%	13%
Labour costs	28%	18%	18%	19%	23%
Capital cost	21%	13%	12%	8%	12%
<b>Total costs</b>	<b>90%</b>	<b>54%</b>	<b>61%</b>	<b>57%</b>	<b>70%</b>
<b>Economic Rent</b>	<b>10%</b>	<b>46%</b>	<b>39%</b>	<b>43%</b>	<b>30%</b>
<b>Gross Revenue</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

any other costs do. On average they make up 33%. The smallest impact is recorded in Trapani, whose fleet is made up of small boats that require 2 or 3 hands at most. The greatest impact (34%) is recorded in Linosa, Sant'Agata and Siracusa, although in Linosa the large impact of labour cost is not connected to the structure of the fleet, which is also characterised by small size boats, but rather to the small impact of other costs. Running costs (Siracusa, Lampedusa, and Trapani) or the cost of the fishing gear (Sant'Agata, Linosa), have less impact than labour costs.

As far as running costs (see Table 5) are concerned, fuel consumption is the common feature for all the fleets under consideration, being the highest share. It makes up 72% of running costs on average, varying from a minimum of 60% in Linosa to a maximum of 81% in Siracusa, depending on the number of hours spent at sea and the structural features of the fleet.

In Linosa and Lampedusa, running costs were lower than in the other ports because of the small size of the boats, the closeness of fishing areas and the higher repair costs.

Maintenance charges have little impact on running costs. They vary between a minimum of 14% in Siracusa and a maximum of 36% in Linosa.

The cost of kannizzi make up an average of 23% of the total cost. It is not a fixed cost because it is a disposable tool, which means that it is completely exploited for only one fishing season. The total cost depends on the number of boats and on the number of kannizzi at sea for the entire fleet dedicated to dolphin fishing. In 1996, each boat lowered on average 48 kannizzi with an average cost of 36.3 ECUs per kannizzi. It was the Sant'Agata fleet that lowered the greatest number of FADs, about 65 per boat on average.

The capital cost (see Table 6), which made up an average of 20% of the total costs, was subdivided into depreciation and opportunity costs. Since all the boats employed in dolphin fishing are older than 10 years, they are completely depreciated and so the depreciation is referred to gear purchased during previous years. The average net rate of the Treasury Bonds in the period 1 September 1996 - 31 December 1996 was 5.86% and the opportunity cost of the capital was calculated by assuming that the capital stock value of the fleet would be invested in State Bonds (Treasury Bonds) in the aforesaid period and rate. The opportunity cost varies from a minimum of 1,214 ECUs in Lampedusa (where only 2 boats prac-

tice dolphinfish fishing) to a maximum of 15,668 ECUs in Siracusa. If we compare the value of the opportunity cost with the value of the yield, it is clear that investing in fishing dolphinfish is more profitable than investing in State Bonds. For example, in Sant'Agata the yield is equal to 94,973 ECUs, whereas the opportunity cost is equal to 11,224 ECUs.

In 1996, on the islands of Linosa and Lampedusa, the good results obtained in the previous season convinced the owners of the boats practising dolphinfish fishing to purchase new gear and to lower a greater number of kannizzi. Two new boats were induced to practice this kind of fishing, attracted by the prospect of gaining high incomes. However, the gross incomes gained in that season were not as high as expected. As a matter of fact, in Lampedusa the total income was 9,797 ECUs, whereas the highest income was reported in Linosa with 56,458 ECUs.

In both islands, since the price was more or less constant (only in Linosa was there a fluctuation from 2.07 ECUs to 1.55 ECUs from the first to the second half of October) the state of the incomes depended on the catches.

In Linosa, the highest incomes were gained in the second half of November and were equal to 12,227 ECUs, whereas in Lampedusa they were 3,237 ECUs equal to 26%.

In Trapani, Sant'Agata and Siracusa the total incomes were higher: 69,970, 222,382 and 463,196 ECUs respectively. In these ports the price was not constant, although the interacting of supply and demand caused some small price fluctuations, so the incomes were mostly influenced by the trend of the catches. From the analysis of the incomes in time it appears that in three ports (Linosa, Sant'Agata and Trapani) the highest income was gained in October, as a result of the greater quantity of fish caught than in other months.

The yield is equal to the difference between the total income and the total costs. Among the 5 ports under consideration it turns out that the yield, as a percentage of the total income, varies from a minimum of 10% in Lampedusa to a maximum of 46% in Linosa. In 1996, in Lampedusa the fishing of dolphinfish was not very profitable as a result of the fall in catches in comparison with the previous season. In the other ports this activity shows a good yield, although it is to be considered inclusive of tax. The good results obtained in Linosa are due to both the high catches (33% more than those obtained by an equal number of boats in Trapani) and the impact of

the total costs on total incomes, which show the lowest value (54%) of all the ports. Whereas in Linosa and in Lampedusa the fishing of dolphinfish is a relatively new business, it is an ancient tradition in the other ports under consideration. In particular, in Sant'Agata and Siracusa, this activity has a significant economic importance. As a matter of fact, prices are usually higher there and the boats employed in the fishing of the dolphinfish are more numerous and bigger. Only in those two ports the total catches are about 70%. However, in Siracusa, even though catches were abundant, the high impact of the total costs on the total income (70%) due to the fleet structure eroded the yield, which was equal to 30%. In Sant'Agata and Trapani, the yield was 43 and 39%, respectively.

To conclude, except in Lampedusa where the fishing season has not given interesting results, in Sicily dolphinfish can be considered as a species that gives good profits, ensuring one of the highest profit rates (from 30 to 46%) in the fishery market from September to December. In de EC, dolphinfish is only marketed freshly, in Sicily and in the Balearic Islands (Morales-Nin *et al.*, 1996). A price rise caused by an increase in demand, which might happen if the market for fresh and preserved dolphinfish in expands in the other European countries, could persuade other fishermen to catch dolphinfish instead of other overexploited species, such as swordfish between August and December (Cannizzaro *et al.*, 1996; 1997).

## REFERENCES

- Bono, G., L. Cannizzaro, S. Gancitano and P. Rizzo. – 1997. La pesca sui kannizzati aspetti quali-quantitativi. *Biologia Marina Mediterranea* (1998), 5 (1): 661-664;
- Cannizzaro, L., F. D'Andrea and P. Pizzicori. – 1996. La pesca e la commercializzazione della lampuga (*Coryphaena hippurus*, Linnaeus, 1758) a Linosa nella stagione 1995. *Note Tecniche e Reprints dell'Istituto di Tecnologia della Pesca e del Pescato* n° 51, pp.13. 1996.
- Cannizzaro, L., F. D'Andrea, P. Pizzicori and G. Norrito. – 1997. Aspetti economici della pesca della lampuga (*Coryphaena hippurus* Linnaeus, 1758) alle Pelagie. *Biologia Marina Mediterranea* (1998), 5 (1): 768-771;
- Cannizzaro, L., A. Potoschi, M. Scalisi, F. D'Andrea and T. Romeo. – 1997. Bio-economic Aspects of Swordfish and Dolphinfish Fisheries in Sicily. Proceedings of the Third International Conference on the Mediterranean Coastal Environment, MED-COAST 97, November 11-14, 1997; Qawra, Malta, E. Ozhan (Editor).
- Cunningham S., M. R. Dunn and D. Whitmarsh. – 1985. *Fisheries Economics an introduction*. Mansell Publishing Limited, London.
- Galea, J.A. – 1961. The "Kannizzati" fishery. *Proc. Gen. Fish. Coun. Medit.*, 6: 85-91.
- Hannesson, R. – 1988. Optimum fishing effort and economic rent: a case study of Cyprus - FAO Fish. Tech. Pap. (299): 1-57.

- Medina Pizzali, A.F. – 1988. Small-scale fish landing and marketing facilities. *FAO Fish. Tech. Pap.* 291: 1-68.
- Morales-Nin, B., P. Oliver, J.J. Castro, L. Cannizzaro, A. Potoschi and C. Pla. – 1996. Biology and fishery of Dolphinfish in the Western Mediterranean and Canary Island area. Commission of the European Communities Directorate General for Fisheries. Contract n° 94/031. Final Report.
- Panayotou, T. – 1982. Management concepts for small-scale fisheries: economic and social aspects. *FAO Fish. Tech. Pap.*, 228: 1-53.