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BLUEFIN TUNA TRAP FISHING IN THE MEDITERRANEAN

by

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1. In a volume by Parona, "Bluefin and Bluefin Fishing," edited in 1919, there is a map of the traps in the Mediterranean. The article cites the names of hundreds of installations, both active and inactive. Considering that the article was from the end of the nineteenth century, the number and concentration of these gears in places where today no bluefin are fished, the information is quite surprising. Of all the traps -- both large and small -- shown in Figures 1 and 2, only ten are left and of these, some are only set during intermittent periods.

2. The trap is a gear known since ancient times. It seems that the Phoenicians, who invented the first trap system, fished in the deep waters of the gulfs and caught the tuna, which arrived every year in the spring, by means of palm tree branches planted in the sandy bottom. The tuna, which gathered in this way in such limited space were beaten to death by clubs or spears. This system was used some 4,000 years ago, judging from the graffiti found in a grotto on the islet of Levanzo (Egade), just a few kilometers from Trapani and Favignana.

Aristotles and Pliny spoke of the traps, but the description which is closest to reality is that made by Oppiano (2 a.d.). We can reaffirm beyond a doubt that his description is "real" since, besides the emphasis in it, his description is actual. In effect, he says that the trap is formed by a "system of nets whose set-up resembles that of a city; there are entrances, gateways and access roads. The tunas arrive in line, pressed like the masses of an emmigrating town. There are young, adult, and old tunas. An indefinite number of tunas penetrate the interior of the nets. This movement of tuna does not stop until the fishermen so wish or when there is no space left for any more fish to enter."

Figure 3 shows a trap of the eighteenth century. Comparing it with the present-day traps, it is easy to see that, certainly, useful accessories have been added, the materials have been improved and the fishing operation has been perfected and accelerated, as can be seen from the following description. However, the installation, in concept, has stayed the same as in the past with all its limitations and its passive nature.

On the other hand, it is interesting to point out that from the indications of the Arab Edrisi (12th century), as well as those of more recent authors, the names and the places the trap installation have remained the same. If in addition to the cultural pleasure, we give the Levanzo graffiti a useful importance and, consequently, interest with respect to the knowledge which they provide -- from constant presence and from observations with a view to evident applications -- we cannot ignore taking into account the fact that, since several millenniums ago, the problem of the life and biology of tuna which periodically near the coasts, has been discussed, as well as the hydrology of the area -- in terms of constant

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observation of the currents -- since the trap is always set in the same place and with the same angle, that is, 05°N (or 185°S if it is a reverse installation) in order to take advantage of the general local currents and counter-currents.

3. By trap we mean an installation of nets in the sea, forming a barrier in a given aquatic space, and which forms an "island" comprised of "chambers" and a wing or pedal capable of channeling the tunas which come in contact with the nets while swimming about freely in the waters of the gulf. These tuna are then oriented towards the "island" where they are caught as if in a trap. This terminology, referring to the traps, has been utilized by von Brandt (1959) in his classification of the fishing gears.

In effect, we are dealing with a large trap, since the tuna arrive at the entrance after having passed along the wing and are trapped or they themselves penetrate the chambers formed by the nets, which have a moveable wall or "door" like a huge rake. This rake does not fall from above, but is lifted from the bottom by men who are on guard, where it normally rests when there are no tuna.

The trap forms a parallelepiped of nets which go from the sea surface, on which they are held by means of floats, to the bottom where they are held by weights. This parallelepiped has movable intermediate nets which make up the doors and delimit the chambers, and there is no exit other than through a directly communicated passageway, almost at a right angle with the wing, whose function is to direct the tunas towards this series of nets.

For its formation, the trap takes advantage of some basic observations which span various centuries:

a) The typical gregarious behavior of the tunas in the spawning or reproducing stage;

b) The tranquil behavior of the tunas, their scarce movement during the period in question, and the instinct which leads them towards the warm, salty clear waters of the gulfs, where generally they reproduce, and which calms or almost phases out the majority of their other innate tendencies, especially the nutrition or feeding instinct;

c) The constant proven movement of the gulf currents, where under the influence of the currents which enter regularly, form local currents or counter-currents, into which the tunas move. Because of the currents, the tuna move in the direction of the traps, essentially, in virtue of their (d) positive "reotropism" characteristic (i.e. movement in the direction of the current) which during the spawning period is much more accentuated. In effect, during the spawning stage, the tunas move generally in the layer of the water in which they are acclimated (Sara, 1961 and 1964), i.e. in the direction of the current, maintaining what we could call an "economic route" so as not to use up the accumulated reserves which are especially necessary for the production of sexual products. During the spawning period, at least in a captured situation within the trap, the tunas do not eat. This has been observed from examining several thousand stomachs of tunas which have been caught; the stomachs have been found empty in 95% of the fish examined (Genovese and Alonzo, 1961; Sara, op. cit.; Scaccini, 1965; Sara and Arena, 1966). As a result, the animal's reserves which are consumed little by little, are not replaced. This positive reotropistic behavior is taken advantage of -- based on the temporal observations which have been alluded to -- by the fishermen, who install a door in the trap, called a "clear door" (clear: very large mesh, with a 42-45 cm side and therefore a complete mesh measures some 90 cms) and which, in principle, is lifted from the bottom and theoretically closed. But since the currents normally circulate against the trap (from east to west) especially in fishing periods, at the end of the gulfs, the large mesh net of this door always remains open (like an enormous mouth in the form of a funnel). As a result the tuna enter the deepest chamber, from which they cannot get out,

since from the interior of the chamber the net of this door is against the bias in front of the fish and these meshes do not permit the tuna to escape to the open part of the trap;

e) The thermal conditions and the saline characteristics which, as a function of the local hydrology, are established in certain gulfs during some months of the year, especially during all of May to July (i.e. during the tuna spawning period).

From everything said before, it is understood that in the nineteenth century -- and from a theoretical point of view, it would also be done today - so many traps were installed, big and small (different only in their dimensions and not in the basic principles put into practice) that since, even without relying on the occurrence of the tunas, all or practically all of the points of the coast could be good and useful for fishing.

3.1 The installations for bluefin tuna fishing can be subdivided into two categories: the entry (spawning) traps and the exit (post-spawning) traps. We will clarify these expressions in order to facilitate the comprehension of the terminology we will be using. The first case refers to the installation which catches tuna in the spawning period or pre-spawning period; the second category refers to those traps which catch tunas at the end of the spawning period, or in the post-spawning period.

However, the terminology is vague and not very precise; it is based on the millennium configuration acquired after a general circular movement, in virtue of which, at the end of April or the beginning of May of each year, the tuna come close to the coasts to spawn and after satisfying their physiological needs, towards the middle of July or the end of August, they start returning to their places of origin, from which they came in the spring.

Thus, limited zones of concentration for spawning can be distinguished, where the entry traps could be installed, as well as dispersion zones where the exit traps can be situated. But, evidently, if on the one hand, the definitions that we have just given are valid, they continue being static, reducing the problems of the biology and migration of bluefin tuna to a "come and go" situation, existing only as a function of the sexual stimulus and taking into account a unique stock which moves with a determined route (the "emigrating town" of the Roman Oppien).

It is true that since remote times, these movements have led to very picturesque interpretations: From Aristotle (4th century B.C.) who affirmed that in the spring, the tuna penetrate the Black Sea, only to leave again in the autumn accompanied by their young, and submerge to the submarine depths to escape the adverse winter weather conditions; to Pliny (1st century A.D.) who pointed out the general belief that bluefin could only see with their right eye and therefore followed a route whereby they would always be in view of the coast; to Oppien (2nd century A.D.) mentioned previously; Elian (3rd century A.D.), Aldovrandi (16th century). All of these explained the movements of the tuna in a similar way.

We have not limited ourselves to mentioning only the most representative authors while omitting the mention of all others (and there were many, to the point that Belloc in 1961 said that "if the Mediterranean is considered the birthplace of civilization, it is also the birthplace of bluefin tuna fishing") who in one text or another showed an interest in tunas and their migrations, and presented ideas and hypotheses that often were merely of a humorous nature.

Cetti (1777) is a case apart. He was the first one that, completely without instruments for research, presented sound truths on a scientific basis, which were not verified until various centuries later.

More than his observations concerning the fact that tunas in the spawning stage reached the Mediterranean from the Atlantic, in a west-east direction, what called more attention to him was his intuition regarding the movements of the tunas whereby they entered the Mediterranean and then separated "into divisions, subdivisions and numerous squadrons," evidently as a function of the ramifications of the Atlantic currents, whose existence was not yet established at that time, but which he imagined and understood their function. He described the routes followed by the principal groups, and if we observe their movements. we cannot fail to recognize that they almost correspond to the circuits of the currents which enter the western Mediterranean basin whose existence have now been proven.

Another of his assertations, whereby during the winter months, after the spawning period, the tuna remain in the gulfs (from this we get the name of "golfitani" which always refers to the young individuals which stay in the Mediterranean) since "upon cooling of the upper layer of the water the tuna seek the warmth of the depths and they remain there until the temperature of the upper layer becomes warm again" evidently reminds us of the idea of the constant temperature at the deep layers of the water, unquestionably confirmed and which permits us to assume the "thermocline."

In the course of the same century and during those which followed, many other authors wanted to describe the navegations of the tunas, sometimes giving feeding stimuli as a cause and other times genetic stimuli and still other times the cause is attributed to attacks by sharks and swordfish. In any case, these authors all admitted to a "coming and going" movement, more or less in a wide circular pattern, and whose final point was almost always the Black Sea or the Azov Sea.

More recently, the same general ideas have been sustained, with only one difference which refers to the nuptial trip: some people have supported the hypothesis of a return beyond the Hercules Columns. Others support the hypothesis that the tuna resort to the deep waters of the Mediterranean. The former theory was considered as the most plausible from the end of the nineteenth century until approximately 1930. At any rate, because of the natural difficulties which were faced in researching this matter and due to the lack of adequate scientific and technical instruments, these ideas and explanations did not take into account the principal elements, which as a result, are emphasized in the modern theories. This involves the situation of the same traps within a general well-defined framework,where the geographical location of each one of them has a meaning in function with the surrounding currents (if they are of local origin as well as if they have greater scale) as the currents from the Atlantic or the Mediterranean returning currents and equally from the close relation which has been established between these currents and the influences experienced because of the barometric and meteorological conditions in the overall area of the Mediterranean basin. In order to prove this theory, besides presenting Figure 4, which reproduces the general circulation scheme of the surface waters of the Mediterranean basin and the distribution of the tunas as a function of their size (Sara, 1964), we are presenting herewith some examples which refer to the influence of the winds on the catches of a trap: If winds from a determined quadrant (quadrant IV) are very effective for the entry-type trap fishing but extremely harmful for the return-type trap fishing, in an antithetical or opposite way, the return type trap fishing benefits from the winds of the other quadrants (Quadrant II) (Sara, op. cit.). Therefore, the winds from one or another influence the predominant currents (to which the tuna are acclimated) pushing them further offshore where the traps are set, or by distancing the currents even beyond the traps thereby moving the tunas along with the currents (Sar and Arena, 1966).

The return-type traps -- set beforehand during mid-June -- can catch tunas in full spawning period, which proves on the one hand the extent of their concentration and on the other hand, the simultaneous presence of various stocks (which are distinguishable by their degree of sexual maturity) in the same basin, as a function of the ramifications of the large Mediterranean currents and not according to the "coming and going" definitions interpreted in the strict sense in which they were presented throughout the centuries. That is, tuna caught returning were those which had escaped from the entry-type traps.

Both of these types of traps can be subdivided into two classes: those of the gulf and those of the point. The definition depends on the installation of the trap itself, whether it is located in the interior of a gulf (since a contingent of tunas enters precisely in the gulfs where there are optimum conditions for spawning) or whether the trap is located at the extreme end of a headland (promontory) in order to catch the tuna which pass by on their way to new spawning areas. A gulf trap is more protected than a "point" trap. However, the former type trap suffers the negative consequences of the disadvantages and disturbances which are more and more frequently provoked, for example, by illegal or savage fishing, by pollution caused by urban or industrial residuals, which are normally found in greater quantity in the gulfs than in the promontory extremes (Figs. 5 and 6).

Fodera, Sara and Cambiano (1960) describe, in the attached text, the two most important vessel types used for trap fishing: the "vascello" and the "muciara." Both types use medium-sized boats, whose only function is to transport the nets and the rocks used as weights and to "fortify," i.e. maintain on board the high part of the lateral of the death chamber at the time of the catch; these boats are called "sciabica."

4. In the past many trap installations were pointed out along the Mediterranean coasts, but in reality the number of large traps was very small (more or less the same number as there are today). We could mention the traps of Favignana, Bonagia, Scopello, Capo Passero, Carloforte, Sidi-Daoud, Misurata, Marsa Zuara, Tarifa and after the Gibraltar trap, those of Sancti Petri and Barbate.

The majority of the trap installations indicated on the old maps were "tonnarelle," i.e., small traps which were shifted along the coast, depending on the weather conditions. They also served to protect the large traps and which, in this case, were set from time to time in order to conserve the rights to the inherited concession of maritime sites.

The real traps were only set for bluefin fishing, but evidently, they also caught other species which penetrated the nets (especially swordfish) only in cases in which the catch justified the expense of hauling up the death chamber which is considerably large, and for which a reinforcement team or land-based team was necessary.

The small traps, whose chamber was much lighter and could be hauled up several times a day, were generally located in more protected areas. Besides catching adult tunas which penetrated its enclosures, these small traps also caught juvenile tunas (called "golfitani") which weighed between 25 and 60-70 kgs. Other species caught by the small traps were albacore (Thunnus alalunga, Bonn.), Atlantic little tuna (Euthynnus alletteratus, Raf.), Atlantic bonito (Sarda sarda, Block), frigate tuna (Auxis thazard, Lac), picarel (Seriola dumerili, Risso) and naturally, swordfish (Xiphias gladius, L). They also caught small fish, such as, Scomber scombrus, L., Scomber colias, Gm., Sardina pilchardus, Walb., Engraulis encrosicholus, L., Trachurus trachurus, L., Sardinella aurita, Cthr., Belone belone, Brunn., and Scomberesox saurus, Walb.

Mugil cephalus, L., Tetrapturus belone, Raf., T. albidus, Poey and Orcynopsis unicolor, Geoffr., were sometimes caught, especially in the traps located more towards the west.

Often the traps were filled with Mola mola, L., and with Balistes capriscus, Gmel.

Many species of sharks were also caught in the trap, such as Odontaspis ferox, Risso; Isurus oxyrhinchus, Raf.; Lamna nasus, Bonn; Carcharodon carcharias, L.; Cetorihinus nasus, Gum.; and young individuals, mainly Alopias vulpinus, Bonn, Prionace glauca, L. and Sphyrna zygaena, L.

Caretta caretta, L. and Chelone mydas, L. were also caught.

5. Neither bait nor lights are used in trap fishing.

6. During the winter, four or five men, who work year round with traps, manually prepare the pieces of the net that are replaced little by little and are put together around the first of April, when the crew is organized.

It takes about 30 days to assemble the nets, to caulk the boats and to prepare the floats.

At the beginning of the month of May, the crew goes to sea to "cross" the trap, that is, to install the set of cables over which, immediately afterwards, are hung the nets into which are placed -- in the field -- large stones or blocks of cement.

At the end of four or five days, the trap is ready for fishing and the wait for the tuna, which at times is very short, begins. If a theoretical daily schedule of the arrivals could be established, it would be that during the first days of fishing, the trap catches the white sharks that are found in the area, then the "golfitani" tuna weighing 20-60 kgs and albacore (which shows that the water is still cold) are caught. Later the first large tunas in the spawning stage arrive, and are caught alone during the middle part of the season and until the end (towards the end of June), when the "golfitanis," the Atlantic little tunas, the billfishes and some hammerhead sharks reappear. From the beginning to the end of the fishing season, swordfish are caught alone or in pairs.

Around June 20 they begin to weigh anchor, the nets are withdrawn, and later the cables are lifted. At the same time, on land, part of the crew puts the nets out to dry, the anchors and iron floats are cleaned and painted again and all of the material is stored for the following year. All of this ends between July 25 and 30. For a middle-sized trap fishery, the crew is comprised of about 50 men.

6.1 Weather has a great influence on the fishing operations, since it detours, moves back or brings nearer the currents flowing towards the nets and the surface counter-currents.

The weather of the fourth quadrant* is considered beneficial to the "di corsa" traps, while the weather of the second quadrant* is adverse. The opposite occurs for the returning traps (Sara, 1964).

6.2 The crew is contracted at the beginning of April and returns to shore July 30. The men receive a daily salary--double on Sundays and holidays--and receive an extra share according to their classification: fisherman - one share; skipper - two shares; watchman three shares, and so on successively.

6.3 The tuna caught are sent immediately, fresh, to the markets. When there is a small quantity, they are sold to local merchants. For at least the last 40 years, the Italian trap exploiters that are still in existence have not prepared their products in oil, with the exception of some that, for reasons of prestige, want to keep their own label on the market, in spite of the small production.

7. The first information that history gives us concerning tuna products refer to Sicily. Traselli (1953) shows that from the time of the Italian maritime republics, very active commerce was established with the island, based on five principal products: wheat, salt, salted tuna, cheese and, since the 15th century, sugar cane.

* Possibly refers to the lunar month.

Between the inhabitants of Trapani and the Tuscan and Catalan cloth manufacturers, for whom the main product desired was the "tonina" or salted tuna, the exchanges were famous and profitable.

The salted tuna, under different names, was the basic product of the Sicilian commercial economy of the era. This is proved by the concessions and protection the Sicilian trap fisheries have received throughout the centuries and almost until the present time.

This fact is pointed out because it shows the existence of a very profitable fishery which was the object of concessions given only by the powerful to those who had given distinguished service.

The first concrete information dates from the year 1598, during which time 21,140 barrels of salted tuna were exported from Trapani (the only product of the traps of that port and equivalent to about 15,000 MT of the product). If we add about as many barrels of salted fish for local consumption, an overall figure of more than 40,000 barrels is reached. This represents - reference to the traps existing in Trapani in that year - a catch of at least 15,000 tunas, with an average weight of 150 kgs each. Also, the consumption of fresh fish should be added and the resulting figure from the share allotted to the crew and of the pay in kind, and on the other hand, the obligations and charges of the churches, monasteries and the clergy.

But the volume of exports through the years varied quite irregularly, which indicated a fluctuating index in the volume of the catches in that era. So, 200 years later, in the course of a very poor fishing season, no more than 3,000 tunas were caught (the calculation was made with the same parameters described earlier).

This was confirmed by the catches obyained more than a century later: from 1896 to 1914. This informationwas supplied to us by Parona, who gave details for the end of the 19th century and the beginning of the 20th century. In his study, he only took into account the traps that figured in the statistics with more than 100 MT per year.

It is quickly confirmed that, with the exception of the traps from Favignana, Formica, Porto Scuso, Porto Paglia and Isola Piana, the 19 trap fisheries studied do not always reach the catch figure mentioned earlier.

Without taking into account the fact that some traps appear very rarely in the list of the years studied, it is observed that in 1898 only six out of 54 traps set caught 100 MT; in 1901 7 out of 49; in 1906, 7 out of 43; in 1907, 5 out of 44; in 1909, 6 out of 45; in 1912, 2 out of 43; and in 1913, 4 out of 50. We point out these figures in order to demonstrate that, even in not too recent years but when the fishing of tuna could still be considered productive and profitable, the fluctuation of the catches was very important.

As already stated, the given data exclude the trap fisheries from Favignana and Formica (Egates) as well as from Isola Piana, Porto Scuso and Porto Paglia (Sardinia) in which, each year, 100 MT of tuna were fished regularly. It is done with the intention of emphasizing the variations by eliminating the constants.

In Table 1, the following is observed:

--Between the maximum and the minimum, there is a difference of almost 3,000 MT of tuna, which, in average unit value, gives more or less a different of 25,000 fish, a figure that is not reached today by all the Mediterranean traps, even during an excellent season;

--During the 20-year period studied, there were, as already mentioned, 19 trap fisheries that surpassed 100 MT per year, but their appearance in the annual trade balances was irregular; 13 of them appeared in one year only (1905), but the average is 7. In 1912, there was an alarming minimum of 2 out of the 42 traps set (always excluding the five aforementioned large trap fisheries) which exceeded 100 MT.

Examining the most recent catch data, it is confirmed that, in absolute values, they are quite different from the data of the past. However, identical irregularities are observed, with the same highs and lows in the fluctuation of the catches. There exists only one difference, in the past the tunas were caught more easily, because they entered more easily into the gulfs and remained there - in the quiet waters - so the installation was not very specialized. However, today, installations which are more and more perfected and therefore more expensive must be used to catch tunas and these installations must be capable of catching tunas even during unfavorable environmental conditions.

If, on the one hand, long ago, the calculation should have been made of a loss (in our opinion, a very uniform loss) of tunas that escaped because of the inefficiency of the installation, function of the floats and the fibers that were used in the preparation of the nets, then on the other hand, in the present, it should be considered that many of the tunas do not arrive at the installation which is much more resistant and efficient - because the tunas do not find in the coastal waters the tranquility that they seek for their physiology.

During the past years, the production of the group of trap fisheries that exist in Sicily has averaged 7,000 tunas (around 1,000 MT), while the yield of the bonito traps is close to 3,500 fish (around 250 MT). In 1978, Favignana and Formica traps combined together caught 2,100 tunas (500 t); those from S. Cusumano, 400 (around 100 t), and those from Scopello, 108 (30 t). In 1979, no traps were set in Formica; Favignana caught a thousand tunas (250 t); S. Cusumano 300 (90 t); the Scopello trap did not reach 200 tunas in some 50 t of catches.

7.1 In reference to the development of the catches, the only possible affirmation is to say that it leans towards a total abandonment of the traps, which is shown perfectly by the figures above.

8. As an example, let us say that in 1979, a fisherman of a middle-sized trap caught, in 45 days at sea, around 45 kg of tuna daily; while counting all the days of fishing (including Sundays and holidays: about 130 days), he caught around 14 kg of tuna per day. This means that, with the present prices and the cost of his daily contract (which costs a total of 20,000 lire per day and includes the base salary and the cost of insurance and Social Security), he has earned 42,000 lire. The remaining 22,000 lire go to cover the costs of equipment, taxes, division of shares, interest, dividends (evaluated at 150-180 million lire) and insurance.

9. Except for the beginning and the end of the fishing season, when the small local of "golfitani" tunas are present, the "di corsa" trap catches large tunas in the spawning stage which exceed 150 kg, being able to reach 600 kg. The most important part of the catch is comprised of fish of 10, 11 and 12 years of age, whose weight is from 150 to 200 kg. As already stated, the average weight of tunas caught in the traps constantly increases. From a general average of 170 kg in 1960, it has now reached - in respect to the tunas in the spawning stage that enter the trap - an average weight of 270 or even 350 kg. This signifies that the survivors of the oldest age classes are being caught, while the recruitment of the 10-11 age classes is decreasing.

All are found in the spawning stage: in the "di corsa" traps, at first, it is a matter of phase III (mature) and of phase IV (pre-spawning) and at the end, phase V (spawning) (cf. Rodríguez-Roda's table).

This means that the tuna ovaries are hard and of an orange tone that fades little by little, and at the same time they acquire more volume and weight and soften.

In the traps for returning fish, the first tunas are in phase V, then in phase VI (post-spawning), with straw-colored yellow ovaries with thick violet-colored veins, and whose volume progressively lessens.

The small-sized tunas are also found in the spawning stage: the smallest studied by R. Sara weighed 27 kg and the largest weighed 604 kg in 1977.

10. As already indicated, since the catches are becoming more and more rare, the tunas are almost always sold fresh (except for the trap catches conserved in oil, in small quantities, because of the great distances to the markets or in order to keep the tradition alive).

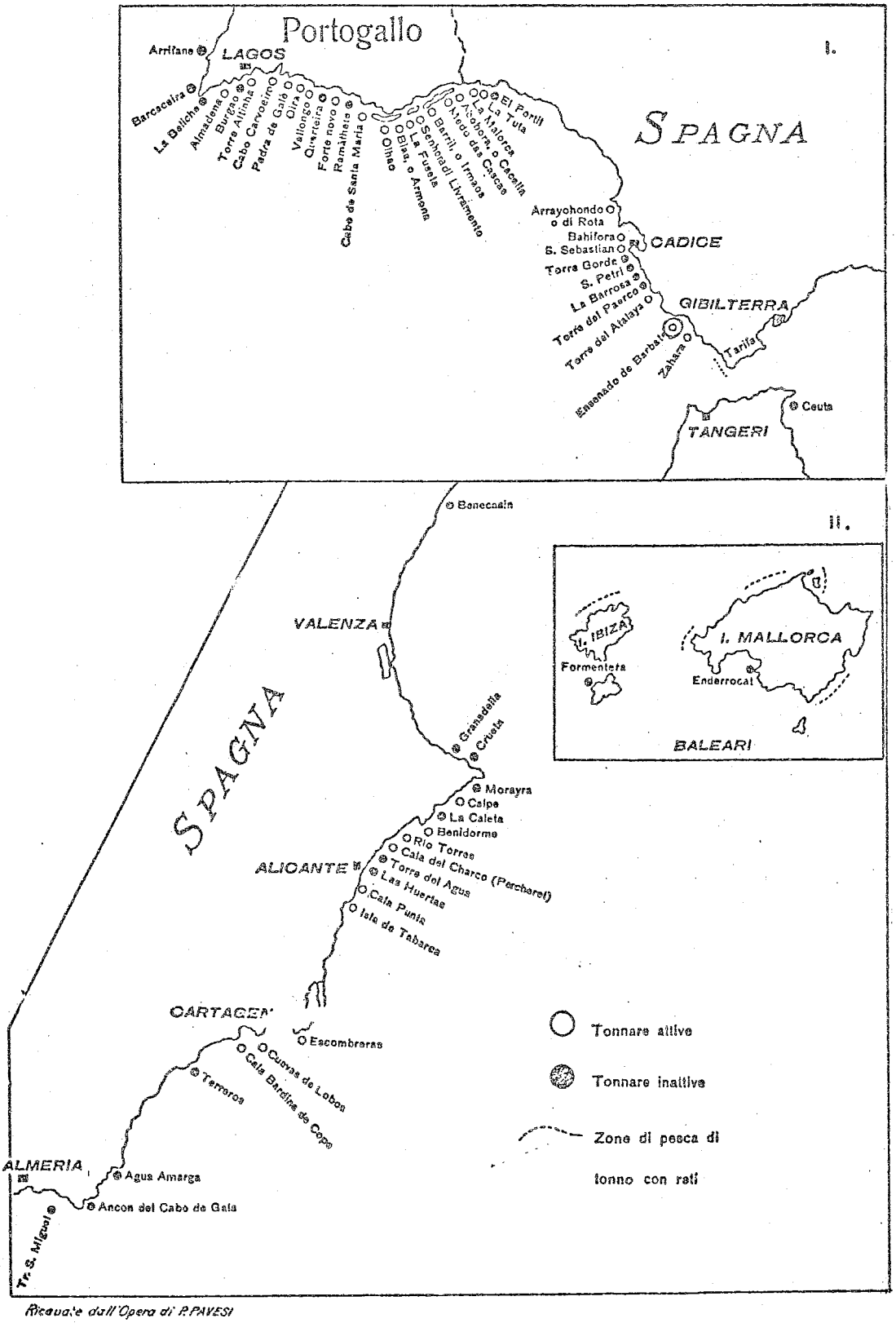
The average selling prices of the Sicilian trap production are from 2,800 to 3,000 lire per kilo of whole fish; at the beginning of the season prices may reach a maximum of 6,000 lire/kg and at the end of the season, drop to 1,200-1,500 lire/kg.

Table 1. Tuna catches in certain Italian traps, from 1896 to 1914*

Tonnare / Anni		1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914
+ S. Cusumano	q.li	2.600	—	—	—	—	—	—	1.678	2.690	2.490	3.000	1.122	1.674	2.130	1.250	1.040	—	—	—
Oliveri (**)	»	2.000	2.000	2.525	1.400	3.500	1.750	2.627	3.166	1.458	2.200	—	—	1.004	—	1.513	1.600	—	—	2.900
Saline (**)	»	1.505	1.131	—	—	3.109	2.252	3.378	1.920	—	2.459	2.743	—	3.882	—	4.210	2.551	—	1.335	—
Tono (***)	»	1.500	4.000	3.040	6.000	3.800	2.530	1.842	6.815	4.055	—	1.060	2.773	1.290	1.931	2.664	1.200	—	—	—
Magazzinazzi (***)	»	1.214	1.500	—	1.000	1.002	—	—	2.470	1.748	1.950	2.007	—	—	—	—	—	—	—	—
Solanto (****)	»	1.200	2.700	1.001	3.000	3.500	1.557	5.700	2.195	2.280	2.700	—	—	1.566	—	1.605	—	—	1.066	—
+ Bonagia	»	1.200	—	—	1.200	—	1.000	—	1.791	3.427	6.124	2.576	3.485	1.774	1.724	2.000	—	—	1.490	—
Scopello	»	1.170	1.490	1.059	1.800	1.710	—	1.561	2.480	1.361	1.043	—	—	—	—	—	—	—	—	—
S. Nicola (****)	»	—	2.900	—	4.000	1.175	—	1.400	2.132	—	2.445	—	—	—	1.133	—	—	—	—	—
S. Giorgio (***)	»	—	—	3.300	—	2.700	—	1.300	—	—	—	—	—	—	—	—	—	—	—	—
Castellammare (**)	»	—	—	—	—	1.110	—	—	1.835	—	1.650	—	—	—	—	3.095	—	—	—	—
Trabia	»	—	—	—	—	—	—	2.000	—	—	1.375	—	—	—	—	—	—	—	—	—
Cefalù (****)	»	—	—	—	—	—	—	—	—	—	2.600	—	—	—	—	—	—	—	—	—
Vergine Maria (****)	»	—	—	—	—	—	—	—	—	1.385	—	—	—	—	—	—	—	—	—	—
++ Torre dell'Orsa	»	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2.690	—	—	—	—
Marzameni (**)	»	2.296	1.500	1.036	—	—	—	2.655	1.180	4.372	1.877	2.735	1.090	1.378	1.614	—	3.233	1.255	—	1.370
Capo Passero (**)	»	1.400	1.200	—	1.400	—	—	2.784	2.145	1.981	2.536	3.420	1.100	1.805	4.500	—	3.624	2.550	1.137	3.491
Pachino (****)	»	—	—	—	2.000	1.000	2.200	—	—	—	—	—	—	—	—	—	—	—	—	—
Avola (***)	»	—	—	—	—	—	1.296	1.242	—	—	—	—	—	—	—	—	2.195	—	—	1.144
Totale	q.li	16.085	18.442	11.961	21.600	22.606	12.585	26.499	29.807	24.757	31.449	17.541	9.570	14.373	13.032	18.927	15.443	3.805	5.028	8.905

*Only those installations are mentioned which caught more than 100 MT per year, i.e. the traps of Favignana, Formica, Isola Piana, Porto Scuso, Porto Paglia, in which usually more than 100 MT are taken per year.

+Combined since 1967.
++Replaced in 1960 by the Punta Raisi trap.
**Set intermittently.
***Considered abandoned.
****Definitely abandoned.



Ricavate dall'Opera di P.PAVESI

Fig. 1-A.

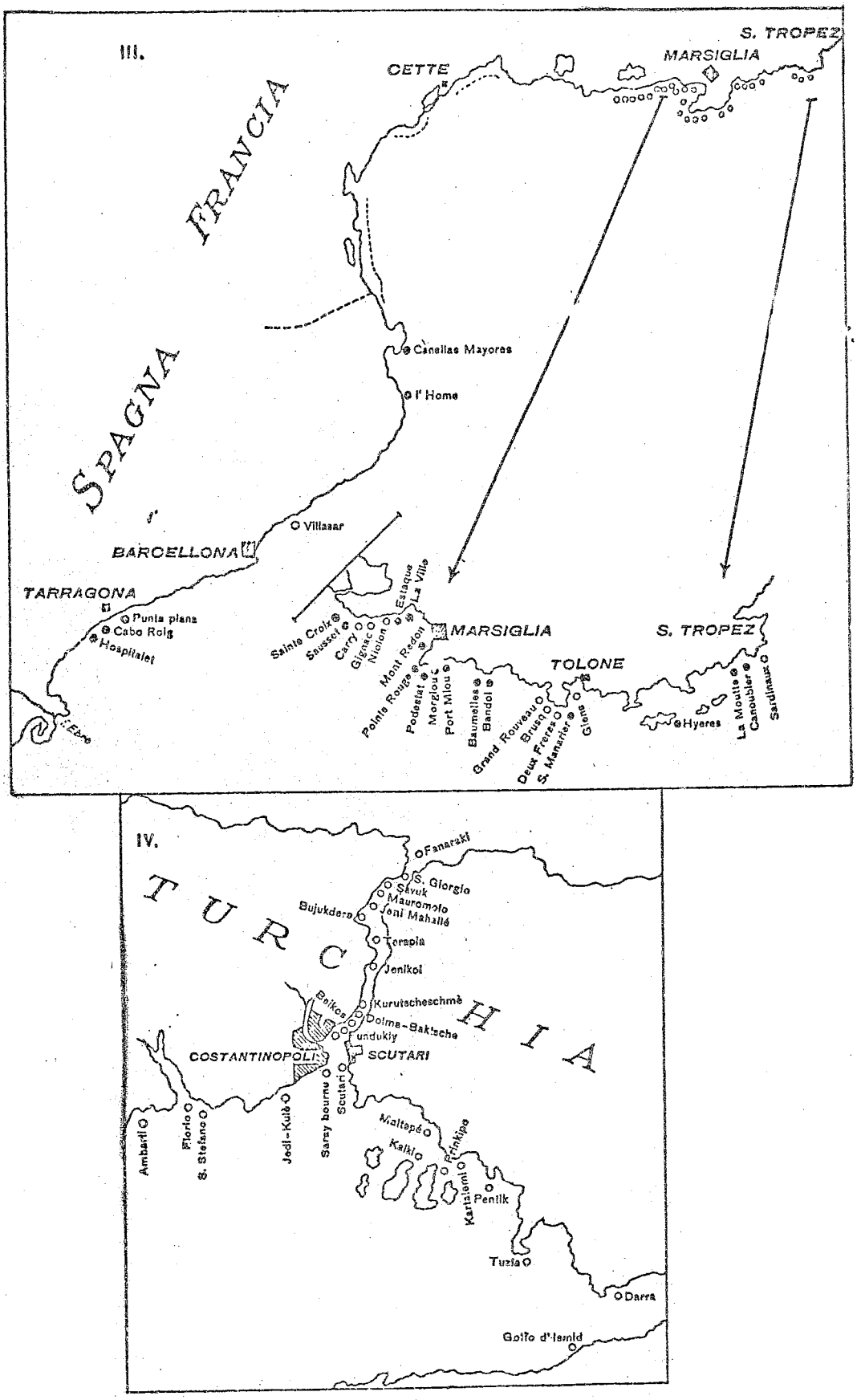

III.
SPAGNA
FRANCIA
CETTE
MARSIGLIA
S. TROPEZ
Canellas Mayores
l' Home
Villasar
BARCELLONA
TARRAGONA
Punta plana
Cabo Roig
Hospitalet
Ebro
Sainte Croix
Sausset
Carry
Gignac
Nioion
Estaque
La Ville
Mont Redon
Pointe Rouge
Podestat
Morgiou
Port Miou
Baumelles
Bandol
Grand Rouveau
Brusc
Deux Freres
S. Manarier
Giens
TOLONE
Hyeres
La Moutte
Canoubier
Sardinaux
IV.
TURCHIA
Fanaraki
S. Giorgio
Skyuk
Mauromolo
Sujukdere
Jeni Mahallé
Terapia
Jenikoi
Kurutscheschmè
Balkos
Dolma-Baktsche
Tundukly
COSTANTINOPOLI
SCUTARI
Scutari
Sarayhourne
Jedi-Kulè
Ambarli
Florio
S. Stefano
Maltepé
Kalkio
Prinkipo
Kartaimi
Penilk
Tuzla
Darra
Golfo d'Ismid

Fig. 1-B.

Italian traps

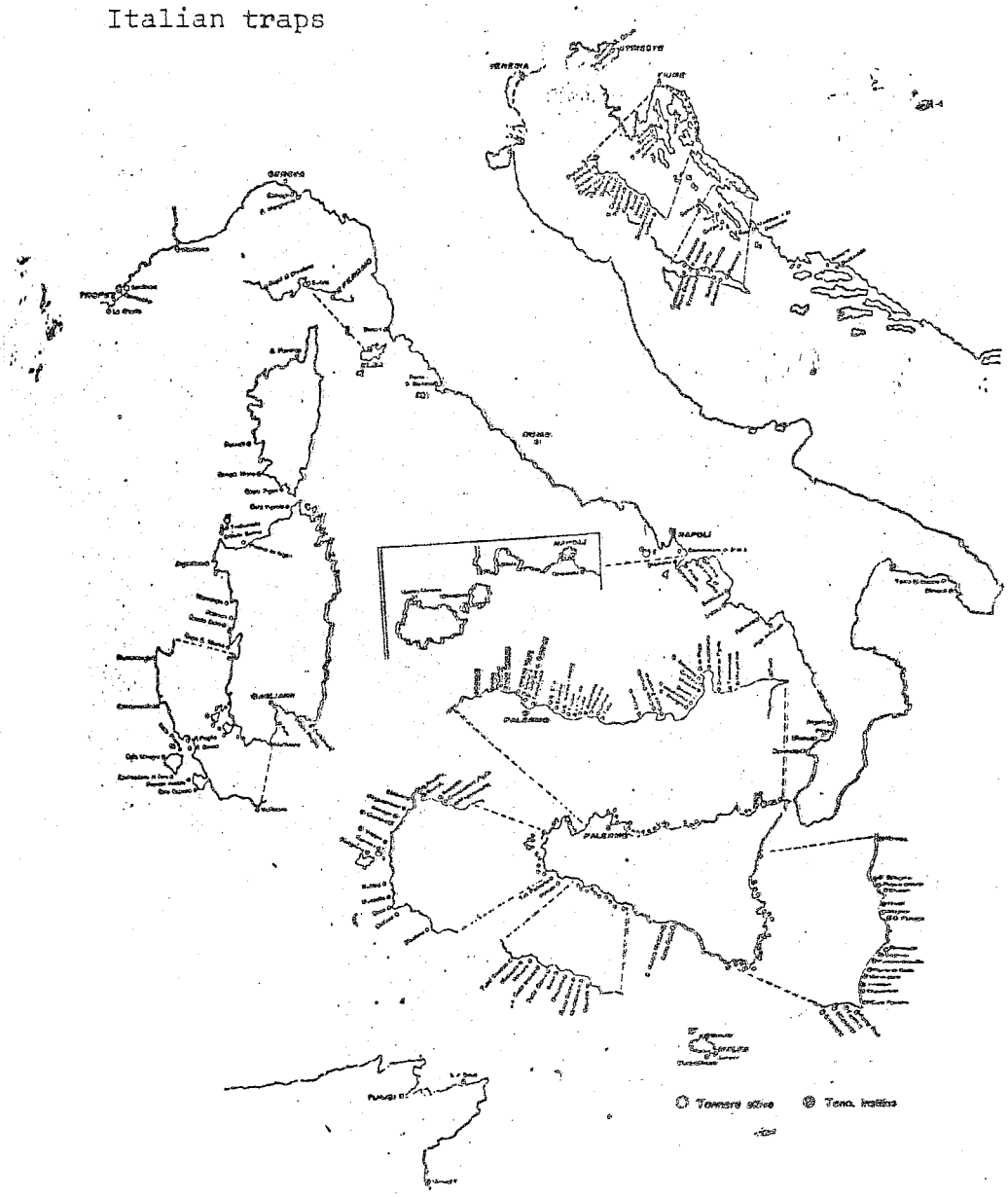


Fig. 2. The traps in Italy in 1900 (Parona, 1919).

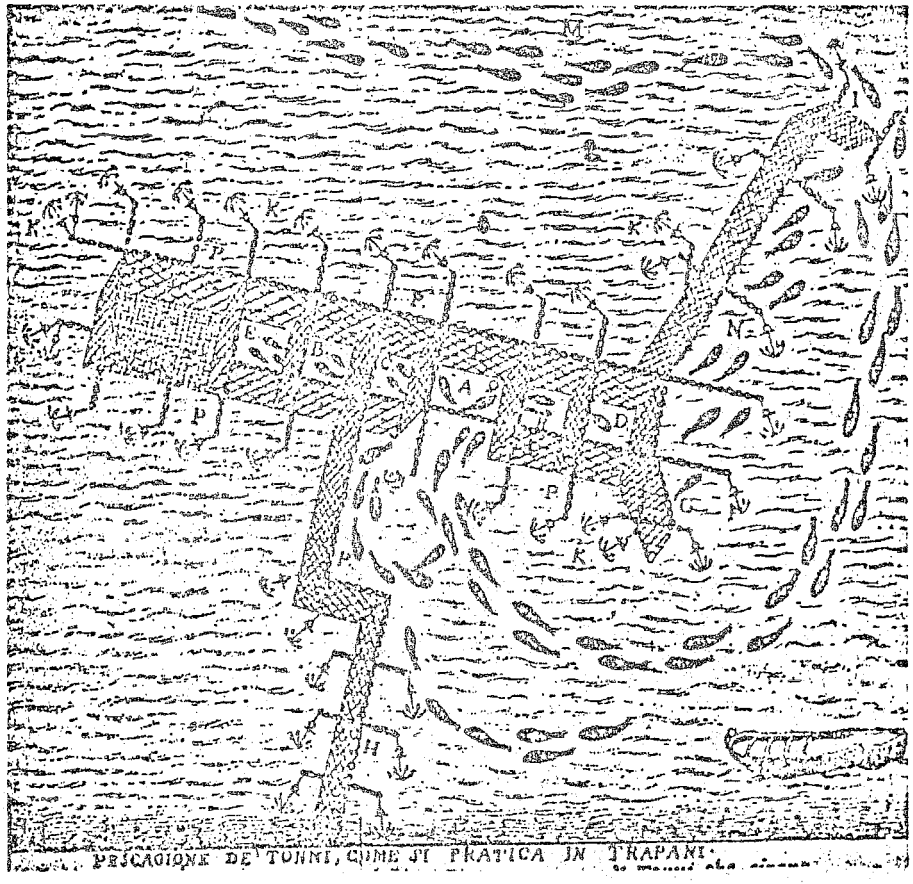


Fig. 3. A Sicilian trap as it appeared in a drawing of the XVII century. The concept of the installation has not changed throughout the centuries.

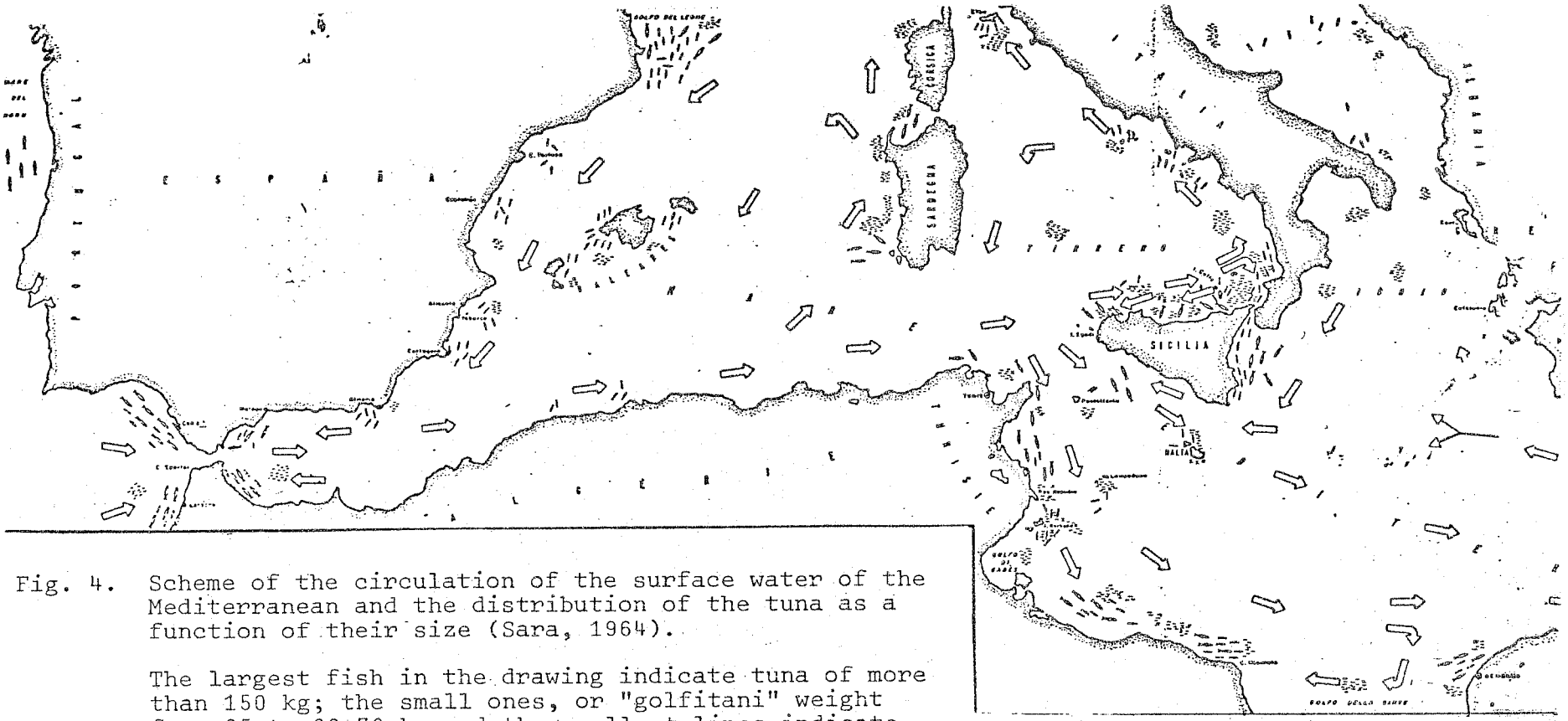


Fig. 4. Scheme of the circulation of the surface water of the Mediterranean and the distribution of the tuna as a function of their size (Sara, 1964).

The largest fish in the drawing indicate tuna of more than 150 kg; the small ones, or "golfitani" weight from 25 to 60-70 kg and the smallest lines indicate tuna weighing less than 20 kg.

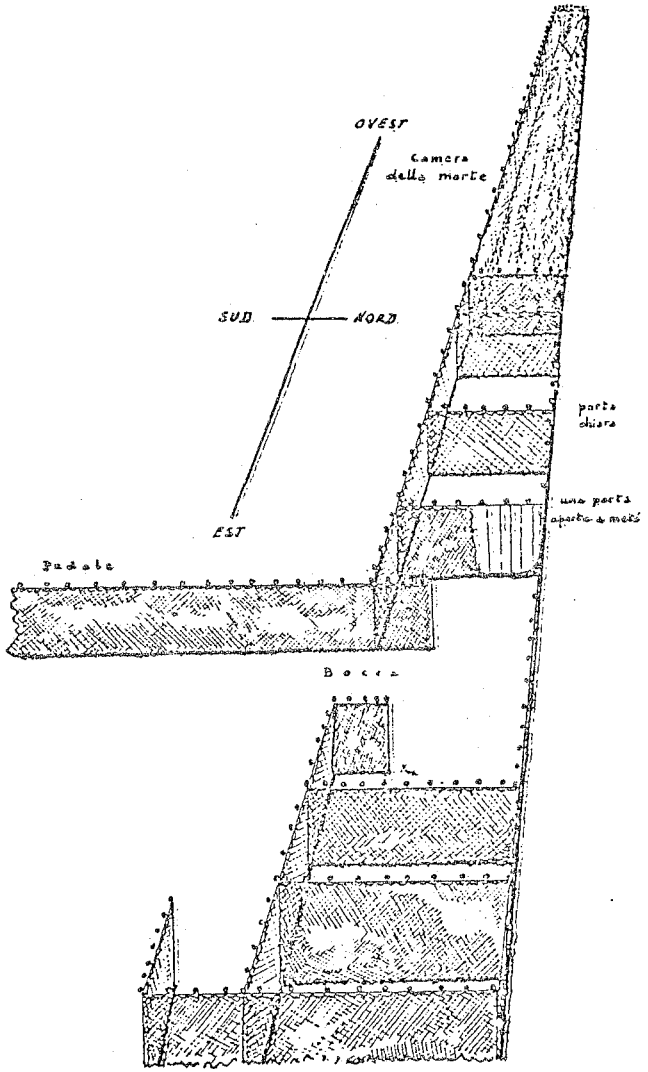


Fig. 5. Drawing of traditional trap of the Sicilian gulf.

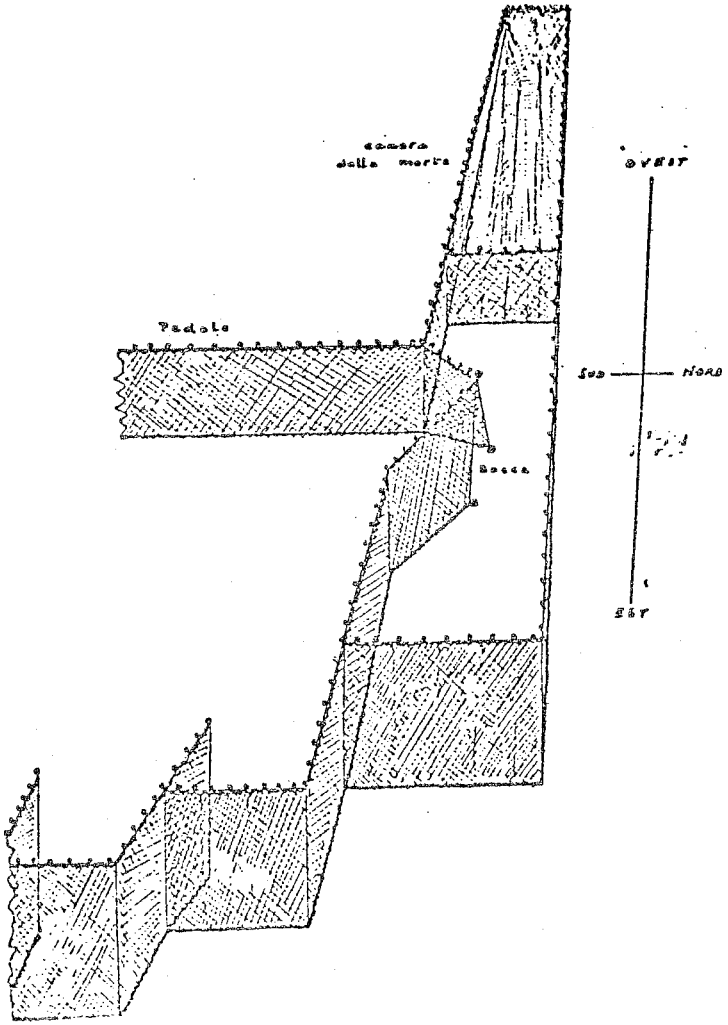


Fig. 6. Drawing of a Spanish type trap also used in Sicily, especially close to the capes.