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Some Elements of a Sociology of Translation

Domestication of the Scallops and the
Fishermen of St. Brieuc Bay*

Scallops and fishermen

Highly appreciated by French consumers, scallops have only been systematically exploited for the last twenty years. In a short period they have become a highly sought-after gourmandise to the extent that during the Christmas season, although prices are spectacularly high, sales increase considerably. They are fished in France at three locations: along the coast of Normandy, in the roadstead of Brest, and in St. Brieuc Bay. There are several different species of scallops. Certain ones, as in Brest, are coralled all year round. However, at St. Brieuc the scallops lose their coral during spring and summer. These characteristics are commercially important because, according to the convictions of the fishermen, the consumers prefer coralled scallops to those which are not.

Throughout the 1970s, the stock at Brest progressively dwindled due to the combined effects of marine predators (starfish), a series of hard winters which lowered the general temperature of the water, and the fishermen who, wanting to satisfy the insatiable consumers, dredged the ocean floor for scallops all year round without allowing time to reproduce. The production of St. Brieuc had also been falling off

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steadily during the same period, but fortunately the Bay was able to avoid the disaster. There were fewer predators and the consumer's preference for coralled scallops obliged the fishermen to stay on land for half the year. As a result of these factors, the reproduction of the stock decreased less in St. Brieuc Bay than at Brest.¹

The object of this study is to examine the progressive development of new social relationships through constitution of a "scientific knowledge" that occurred during the 1970s.² The story starts at a conference held at Brest in 1972. Scientists and the representatives of the fishing community assembled to examine the possibility of increasing the production of scallops by controlling their cultivation. The discussions were grouped around the following three elements.

1. Three researchers who are members of the Centre National d'Exploitation des Océans (CNEOX)³ have discovered during a voyage to Japan that scallops are being intensively cultivated there. The technique is the following: the larvae are anchored to collectors immersed in the sea where they are sheltered from predators as they grow. When the shellfish attain a large enough size, they are "sown" along the ocean bed where they can safely develop for two or three years before being harvested. According to the researcher's accounts of their trip this technique made it possible to increase the level of existing stocks. All the different contributions of the conference were focused around this report.
2. There is a total lack of information concerning the mechanisms behind the development of scallops. The scientific community has never been very interested in this subject. In addition, because the intensive exploitation of scallops had begun only recently, the fishermen knew nothing about the earlier stages of scallop development. The fishermen had only seen adult scallops in their dredges. At the beginning of the 1970s no direct relationship existed between larvae and fishermen. As we will see, the link was progressively established through the action of the researchers.
3. Fishing had been carried out at such intensive levels that the consequences of this exploitation were beginning to be visible in St. Brieuc Bay. Brest had practically been crossed off the map. The production at St. Brieuc had been steadily decreasing. The scallop industry of St. Brieuc had been particularly lucrative and the fishermen's representatives were beginning to worry about the dwindling stock. The decline of the scallop population seemed inevitable and many feared that the catastrophe at Brest would also occur at St. Brieuc.

This was the chosen starting point for this paper. Ten years later, a "scientific" knowledge was produced and certified; a social group was formed (the fishermen of St. Brieuc Bay) through the privileges that this group was able to institute and preserve; and a community of specialists was organized in order to study the scallops and

promote their cultivation. Basing my analysis on what I propose to call a *sociology of translation*, I will now retrace some part of this evolution and see the simultaneous production of knowledge and construction of a network of relationships in which social and natural entities mutually control who they are and what they want.

The four moments of translation

To examine this development, we have chosen to follow an actor through his construction-deconstruction of nature and society. Our starting point here consists of the three researchers who returned from their voyage to the Far East. Where they came from and why they act is of little importance at this point of the investigation. They are the *primum movens* of the story analyzed here. We will accompany them during their first attempt at domestication. This endeavour consists of four moments which can in reality overlap. These moments constitute the different phases of a general process called translation, during which the identity of actors, the possibility of interaction, and the margins of manoeuvre are negotiated and delimited.

The problematization, or how to become indispensable

Once they returned home, the researchers wrote a series of reports and articles in which they disclosed the impressions of their trip and the future projects they wished to launch. With their own eyes they had seen the larvae anchor themselves to collectors and grow undisturbed while sheltered from predators. Their question was simple: Is this experience transposable to France and, more particularly, to the Bay of St. Brieuc? No clear answer can be given because the researchers know that the *briochine* (*Pecten maximus*) is different from the species raised in Japanese waters (*Pecten patinopecten yessoensis*). Since no one contradicts the researchers' affirmations, we consider their statements are held to be uncontested. Thus the aquaculture of scallops at St. Brieuc raises a problem. No answer can be given to the following crucial question: Does *Pecten maximus* anchor itself during the first moments of its existence? Other questions which are just as important accompany the first. When does the metamorphosis of the larvae occur? At what rate do the young grow? Can enough larvae be anchored to the collectors in order to justify the project of restocking the bay?

But in their different written documents the three researchers did not limit themselves to the simple formulation of the above questions. They determined a set of actors⁴ and defined their identities in such a way as to establish themselves an obligatory passage point in the network of relationships they were building.

This double movement, which renders them indispensable in the network, is what I call *problematization*.

The interdefinition of the actors. The questions formed by the three researchers and the commentaries that they provided bring three other actors directly into the story: the scallops (*Pecten maximus*); the fishermen of St. Brieuc Bay; and the scientific colleagues. The definitions of these actors, as they are presented in the scientists' report, are quite rough. However it is sufficiently precise to explain how these actors are necessarily concerned by the different questions which are formulated. These definitions as given by the three researchers themselves can be synthesized in the following manner.

1. *The fishermen of St. Brieuc:* they fish scallops to the last shellfish without worrying about the stock; they make large profits; if they do not slow down their zealous efforts, they will ruin themselves. However, these fishermen are considered to be aware of their long-term economic interests and, consequently, seem to be interested in the project of restocking the bay and approve of the studies which have been launched to achieve this plan. No other hypothesis is made about their identity. The three researchers make no comment about a united social group. They define an average fisherman as a base unit of a community which consists of interchangeable elements.
2. *Scientific colleagues:* participating in conferences or cited in different publications, they know nothing about scallops in general nor about those of St. Brieuc in particular. In addition, they are unable to answer the question about the way in which these shellfish anchor themselves. They are considered to be interested in advancing the knowledge which has been proposed. This strategy consists of studying the scallops in situ rather than in experimental tanks.
3. *The scallops of St. Brieuc:* a particular species (*Pecten maximus*) which everyone agrees is coralled only six months of the year. They have only been seen as adults, at the moment they are dredged from the sea. The question which is asked by the three researchers supposes that they can anchor themselves and will "accept" a shelter that will enable them to proliferate and survive.⁵

Of course, and without this the problematization would lack any support, the three researchers also reveal what they themselves are and what they want. They present themselves as "basic" researchers who, impressed by the foreign achievement, seek to advance the available knowledge concerning a species which had not been thoroughly studied before. By undertaking this investigation, these researchers hope to render the fishermen's life easier and increase the stock of scallops of St. Brieuc Bay.

This example shows that the problematization, rather than being a reduction of the investigation to a simple formulation, touches on elements, at least partially

and locally, which are parts of both the social and the natural worlds. A single question – Does *Pecten maximus* anchor? – is enough to involve a whole series of actors by establishing their identities and the links between them.⁶

The Definition of Obligatory Passage Points (OPP). The three researchers do not limit themselves simply to identifying a few actors. They also show that the interest of these actors lie in admitting the proposed research program. The argument which they develop in their paper is constantly repeated: if the scallops want to survive (no matter what mechanisms explain this impulse), if their scientific colleagues hope to advance knowledge on this subject (whatever their motivations may be), if the fishermen hope to preserve their long-term economic interests (whatever their reasons), then they must (1) know the answer to the question, How do scallops anchor?, and (2) recognize that their alliance around this question can benefit each of them.

Figure 5-1 shows that the problematization possesses certain dynamic properties: it indicates the movements and detours that must be accepted as well as the alliances that must be forged. The scallops, the fishermen, and the scientific colleagues are fettered: they cannot attain what they want by themselves. Their road is blocked by a series of obstacles-problems. The future of *Pecten maximus* is threatened perpetually by all sorts of predators always ready to exterminate them; the fishermen, greedy for short-term profits, risk their long-term survival; scientific colleagues who want to develop knowledge are obliged to admit the lack of preliminary and indispensable observations of scallops in situ. As for the three researchers, their entire project turns around the question of the anchorage of *Pecten maximus*. For these actors the alternative is clear; either one changes direction or one recognizes the need to study and obtain results about the way in which larvae anchor themselves.⁷

As Figure 5-2 shows, the problematization describes a system of alliances, or associations, between entities, thereby defining the identity and what they “want”. In this case, a holy alliance must be formed in order to induce the scallops of St. Brieuc Bay to multiply.

The devices of intersement, or how the allies are locked into place. We have emphasized the hypothetical aspect of the problematization. On paper, or more exactly, in the reports and articles presented by the three researchers, the identified groups have real existence. But reality is a process. Like a chemical body, it passes through successive states. At this point in our story, the entities identified and the relationships envisaged have not yet

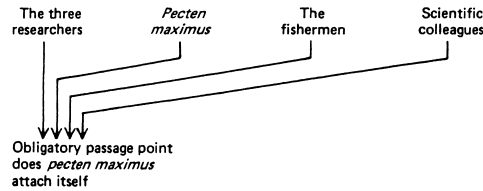


Figure 5-1

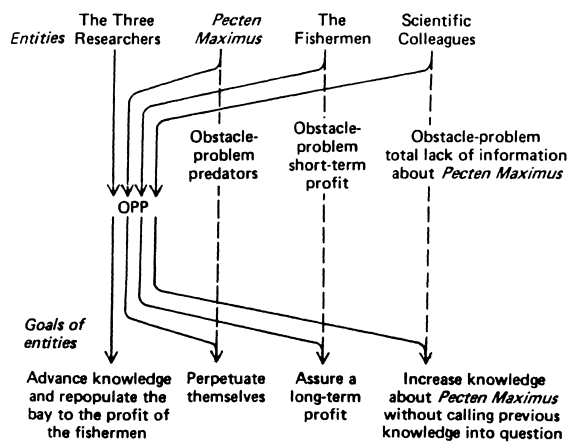


Figure 5-2

been tested. The scene is set for a series of trials of strength whose outcome will determine the solidity of our researchers' problematization.

The devices of interssement, or how the allies are locked into place. Each entity enlisted by the problematization can submit to being integrated into the initial plan, or inversely, refuse the transaction by defining its identity, its goals, projects, orientations, motivations, or interests in another manner. In fact the situation is never so clear cut. As the phrase of problematization has shown, it would be absurd for the observer to describe entities as formulating their identity and goals in a totally independent manner. They are formed and are adjusted only during action.

Interessement is the group of actions by which an entity (here the three researchers) attempts to impose and stabilize the other actors it defines through its problematization. Different devices are used to implement these actions. Why talk of *interessement*? The etymology of this word justifies its choice. To be interested is to be in between (*inter-esse*), to be interposed. But between what? Let us return to the three researchers. During their problematization they join forces with the scallops,

the fishermen, and their colleagues in order to attain a certain goal. In so doing they carefully define the identity, the goals or the inclinations of their allies. But these allies are tentatively implicated in the problematizations of the actors. Their identities are consequently defined in other competitive ways. It is in this sense that one should understand *interesement*. To interest other actors is to build devices which can be placed between them and all other entities who want to define their identities otherwise. A interests B by cutting or weakening all the links between B and the invisible (or at times quite visible) group of other entities C, D, E, and so on, who may want to link themselves to B (see Figure 5-3).

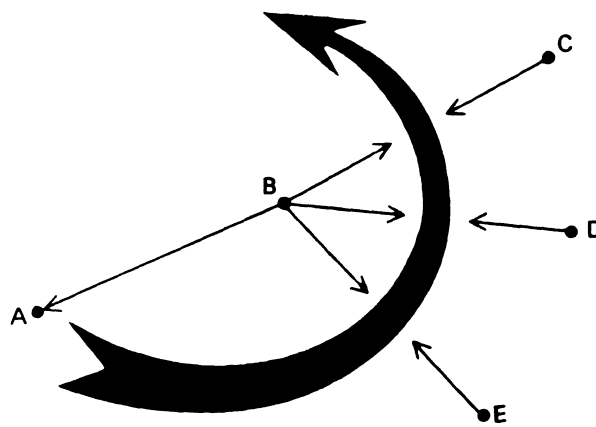


Figure 5-3

The properties and identity of B (whether it is a matter of scallops, scientific colleagues, or fishermen) are consolidated and/or redefined during the process of *interesement*. B is a “result” of the association which links it to A. This link disassociates B from all the C, D, and E’s (if they exist) that attempt to give it another definition. We call this elementary relationship, which begins to shape and consolidate the social link, the triangle of *interesement*.

The range of possible strategies and mechanisms that are adopted to bring about these interruptions is unlimited: anything goes. It may be pure and simple force if the links between B, C, and D are firmly established. It may be seduction or a simple solicitation if B is already close to the problematization of A. Except in extremely rare cases when the shaping of B coincides perfectly with the proposed problematization, the identity and “geometry” of the interested entities are modified all along the process of *interesement*. We can illustrate these points by the story of the domestication of scallops.

The domestication of scallops strikingly illustrates the general *interessement* mechanisms. The three researchers are inspired by a technique that had been invented by the Japanese. Towlines made up of collectors are immersed in the sea. Each collector carries a fine-netted bag containing a support for the anchorage of the larvae. These bags make it possible to assure the free flow of water and larvae while preventing the young scallops from escaping. The device also prevents predators from attacking the larvae. In this way the larvae are protected during the period when they have no defence: that is, when they have no shell.⁸ The collectors are mounted in a series on the line. The ends of the two lines are attached to floats that are kept in place by an anchorage system.

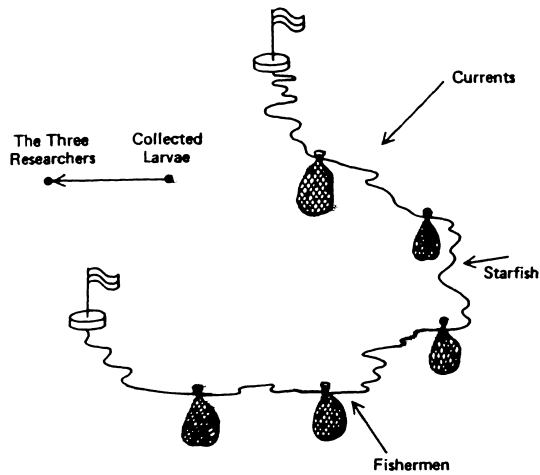


Figure 5-4

The towline and its collectors constitute an archetype of the *interessement* device. The larvae are “extracted” from their context. They are protected from predators (starfish) which want to attack and exterminate them, from currents that carry them away where they perish, and from the fisherman’s dredge which damages them. They are (physically) disassociated from all the actors who threaten them (see Figure 5-4).

In addition, these *interessement* devices extend and materialize the hypothesis made by the researchers concerning the scallops and the larvae: (1) the defenseless larvae are constantly threatened by predators; (2) the larvae can anchor; (3) the Japanese experience can be transposed to France because St. Brieuc’s scallops are not fundamentally different from their Japanese cousins. The collectors would lose all effectiveness if the larvae “refused” to anchor, to grow, to metamorphose, and to proliferate in (relative) captivity. The *interessement*, if successful, confirms (more or

less completely) the validity of the problematization and the alliance it implies. In this particular case study, the problematization is eventually refuted.

Although the collectors are necessary for the *interessement* of the scallops and their larvae, this type of “machination” proves to be superfluous for the *interessement* of the fishermen and the scientific colleagues. In addition, the three researchers do not intend to convince the first group as a whole. It is rather the representatives of professional organizations who are the targets of the researchers’ solicitation. The three researchers multiply their meetings and debates in order to explain to the fishermen the reasons behind the extinction of the scallops. The researchers draw up and comment upon curves which “indisputably” show the incredible decline of the stock of scallops in St. Brieuc Bay. They also emphatically present the “spectacular” results of the Japanese. The scientific colleagues are solicited during conferences and through publications. The argumentation is always the same: an exhaustive review of the literature shows that nothing is known about scallops. This lack of knowledge is regrettable because the survival of a species which has increasing economic importance is at stake (in France at least).⁹

For the case of the scallops (like the fishermen and the scientific colleagues) the *interessement* is founded on a certain interpretation of what the yet-to-be-enrolled actors are and want as well as with which entities these actors are associated. The devices of *interessement* create a favorable balance of power: for the first group, these devices are the towlines immersed in St. Brieuc Bay; for the second group, they are texts and conversations which lure the concerned actors to follow the three researchers’ project. For all groups involved, *the interessement* helps corner the entities to be enrolled. In addition, it attempts to interrupt all potential competing associations and to construct a system of alliances. Social structures comprising both social and natural entities are shaped and consolidated.

How to define and coordinate the roles: enrollment

No matter how constraining the trapping device, no matter how convincing the argument, success is never assured. In other words, the device of *interessement* does not necessarily lead to alliances, that is, to actual enrollment. The issue here is to transform a question into a series of statements which are more certain: *Pecten maximus* does anchor; the fishermen want to restock the bay.

Why speak of *enrollment*? In using this term, we are not resorting to a functionalist or culturalist sociology which defines society as an entity made up of roles and holders of roles. Enrollment does not imply, nor does it exclude, preestablished roles. It designates the device by which a set of interrelated roles is defined and attributed to actors who accept them. *Interessement* achieves enrollment if it

is successful. To describe enrollment is thus to describe the group of multilateral negotiations, trials of strength, and tricks that accompany the *interessement* and enable them to succeed.

If the scallops are to be enrolled, they must first be willing to anchor themselves to the collectors. But this anchorage is not easy to achieve. In fact the three researchers will have to lead their longest and most difficult negotiations with the scallops. Like in a fairy tale, there are many enemy forces which attempt to thwart the researchers' project and divert the larvae before they are captured. First the currents: of the six towlines, four functioned correctly before different variables intervened. It appears that the larvae anchor themselves better in the innermost parts of the bay where the tidal currents are the weakest.¹⁰

To negotiate with the scallops is to first negotiate with the currents because the turbulences caused by the tide are an obstacle to the anchorage. But the researchers must deal with other elements besides the currents. All sorts of parasites trouble the experiment and present obstacles to the capture of the larvae.

A large part of the variation is due to the way in which parasites are attracted. We have had many visitors who provoked accidents, displaced lines, entangled collectors. This immediately caused negative results. It seems that the scallops are extremely sensitive to all manipulations (displaced lines, collectors which rub against each other, etc.) and react by detaching themselves from their supports.¹¹

The list goes on. A veritable battle is being fought. Currents and visitors are only some of the forces which are opposed to the alliances which the researchers wish to forge with the scallops.¹² In the triangle A-B-C which we spoke of earlier, C, the party to be excluded (whether it is called currents or starfish) does not surrender easily. C (the starfish) has the possibility of interrupting the relationships between A (the researchers) and B (the larvae). C does this by also interesting B (the larvae) which are coveted by all.

The census done by the researcher also shows that the anchorages are more numerous between 5 meters above the sea floor and the sea floor itself. This is perhaps due to the depth as well as to the specific behaviour of the scallops when they anchor: the larvae lets itself sink and anchors itself to the first obstacle that stops its descent.¹³

The towline, an *interessement* device, reveals the levels of anchorage to the observer. The hypotheses and the interpretations of the researchers are nothing but a program of negotiations: Larvae, should we search for you at the bottom of the bay or should we wait for you on your way down in order to trap you as you sink?

This is not all. The researchers are ready to make any kind of concession in order to lure the larvae into their trap. What sort of substances do the larvae prefer to anchor themselves on? Another series of transactions is necessary to answer the question.

It was noted that the development of the scallops was slower with the collectors made of straw, broom, or vegetable horsehair. These types of supports are too compressed and prevent water from circulating correctly through the collector.¹⁴

Thus a *modus vivendi* is progressively arranged. If all these conditions are united then the larvae will anchor themselves in a significant manner. But what does the adjective “significant” signify? To answer this question, we must introduce, as in the tripartite Vietnam conferences held in Paris, the second actor with whom the three researchers must negotiate: scientific colleagues.

In the beginning a general consensus existed: the idea that scallops anchor was not discussed.¹⁵ However, the first results were not accepted without preliminary negotiations. The proposition: “*Pecten maximus* anchors itself in its larvae state” is an affirmation which the experiments performed at St. Brieuc eventually called into question. No anchorages were observed on certain collectors and the number of larvae which anchored on the collectors never attained the Japanese levels. At what number can it be confirmed and accepted that scallops, in general, do anchor themselves? The three researchers are prepared for this objection because in their first communication they confirm that the observed anchorages did not occur accidentally: it is here that we see the importance of the negotiations which were carried out with the scallops in order to increase the *interessement* and of the acts of enticement which were used to retain the larvae (horsehair rather than nylon, and so on). With scientific colleagues, the transactions were simple: the discussion of the results shows that they were prepared to believe in the principle of anchorage and that they judged the experiment to be convincing. The only condition that the colleagues posed is that the existence of previous work be recognized, work that had predicted, albeit imperfectly, the scallops’ capacity to anchor.¹⁶ It is at this price that the number of anchorages claimed by the researchers will be judged as sufficient. Our three researchers accept, after ironically noting that all bonafide discoveries miraculously unveil precursors, who had been previously ignored.¹⁷

Transactions with the fishermen, or rather, with their representatives, are non-existent. They watch like amused spectators and wait for the final verdict. They are prepared simply to accept the conclusions drawn by the specialists. Their consent is obtained (in advance) without any discussion.

Therefore for the most part, the negotiation is carried between three parties since the fourth partner was enrolled without any resistance. This example illustrates the different possible ways in which the actors are enrolled: physical violence (against the predators), seduction, transaction, and consent without discussion. This example mainly shows that the definition and distribution of roles (the scallops which anchor themselves, the fishermen who are persuaded that the collectors could help restock the bay, the colleagues who believe in the anchorage) are a result of multilateral negotiations during which the identity of the actors is determined and tested.

The mobilization of allies: are the spokesmen representative? Who speaks in the name of whom? Who represents whom? These crucial questions must be answered if the project led by the researchers is to succeed. This is because, as with the description of *interesement* and enrollment, only a few rare individuals are involved, whether these be scallops, fishermen or scientific colleagues.

Does *Pecten maximus* really anchor itself? Yes, according to the colleagues, the anchorages which were observed are not accidental. Yet, though everyone believes that they are not accidental, they acknowledge that they are limited in number. A few larvae are considered to be the official representatives of an anonymous mass of scallops which silently and elusively lurk on the ocean floor. The three researchers negotiate the *interesement* of the scallops through a handful of larvae which represent all the uncountable others that evade captivity.

The masses at no time contradict the scallops which anchor themselves. That which is true for a few is true for the whole of the population. When the CBI negotiates with union delegates they consider the latter to be representatives of all the workers. This small number of individuals speaks in the name of the others. In one case, the epistemologists speak of induction, in another, political scientists use the notion of spokesman. The question however is the same. Will the masses (employers, workers, scallops) follow their representatives?

Representation is also an issue in the researchers' transactions with the colleagues and fishermen. Properly speaking, it is not scientific community which is convinced but a few colleagues who read the publications and attend the conference. It is not the fishermen but their official representatives who give the green light to the experiments and support the project of restocking the bay. In both cases, a few individuals have been interested in the name of the masses they represent, or claim to represent.

The three researchers have formed a relationship with only a few representatives – whether they be larvae on a collector, professional delegates, or scientific colleagues participating at a colloquium. However it may seem that the situations are not comparable. The delegates and colleagues speak for themselves while the

larvae are silent. On the one hand, they are real spokesmen, but on the other, the anchored larvae are simply representatives. However this difference disappears on closer analysis.

Let us return to the scallops. The larvae which anchored themselves on the collector are “equal” to the scallops of St. Brieuc Bay. They themselves express nothing; however, they end up having, like the fishermen, an authentic spokesman. As we have seen, the negotiations between the scallops and the researchers revolve around one question: How many larvae can be trapped? The fact that this number should be retained as a principal subject of discussion is not a result of any absolute necessity. By counting the larvae, the three researchers wish to know what they can count on their negotiations with their colleagues and the fishermen. Their interlocutors pay particular attention to the number of anchorages: the first to be convinced of the generality of the observation; the latter to be convinced of the efficiency of the device. How many electors came forward to choose their representatives? How many larvae anchored themselves on the collectors? This is the only question of any importance in either case. The anchorage is equivalent to a vote and the counting of anchored larvae corresponds to the tallying of ballots.¹⁸ When spokesmen for the fishing community are elected the procedure is the same. From the fishing community which is just as silent as the scallops in the bay, a few individuals come forward to slip their votes into the ballot boxes. The votes are counted and then divided between different candidates: the analysis of these results leads to the designation of the official spokesman. Where are the differences in the case of the larvae? The larvae anchor themselves and are counted; the three researchers register these numbers on sheets of paper, convert these figures into curves and tables which are then used in an article or paper. These results are analyzed and discussed during a conference and, if they are judged to be significant, three researchers are authorized to speak legitimately for the scallops of St. Brieuc Bay: *Pecten maximus* does in fact go through an anchorage stage.

The symmetry is perfect. A series of intermediaries and equivalences are put into place which lead to the designation of the spokesman. In the case of the fishermen, the chain is a bit longer. This is because the professional delegates stand between the tallying of the vote and the three researchers. However, the result is the same: both the fishermen and the scallops end up being represented by the three researchers who speak and act in their name. Although no vote is taken, the agreement of the scientific community is also based on the same type of general mechanism: the same cascade of intermediaries who little by little reduce the number of representative interlocutors. The few colleagues who attend the different conferences or seminars speak in the name of all researchers involved.¹⁹ Once the

transaction is successfully accomplished, there are three individuals who, in the name of the specialists, speak in the name of the scallops and fishermen.

The schema below shows how entities as different as *Pecten maximus*, the fishermen of St. Brieuc Bay and the community of specialists are constructed by interposed spokesmen (see Figure 5-5).

Using the notion of spokesman for all the actors involved at different stages of the process of representation does not present any problem. To speak for others is to first silence those in whose name we speak. It is certainly very difficult to silence human beings in a definitive manner but it is more difficult to speak in the name of entities that do not possess an articulate language: this supposes the need for continuous adjustments and devices of *interessement* that are infinitely more sophisticated.²⁰

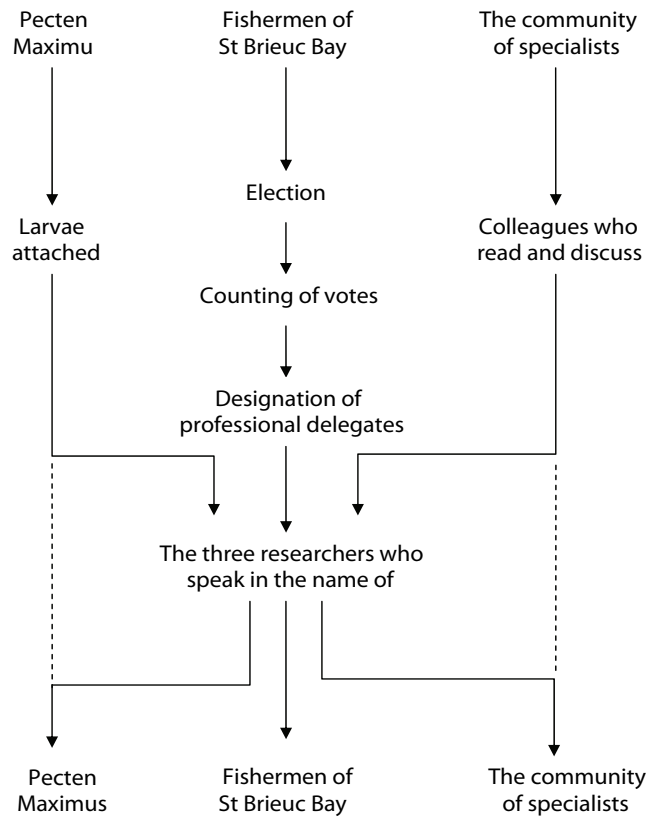


Figure 5-5

Three men have become influential and are listened to because they have become the “head” of several populations. They have mixed together learned experts,

unpolished fishermen, and savoury crustaceans. These chains of intermediaries which result in a sole and ultimate spokesman can be described as the progressive mobilization of actors who render the following propositions credible and indisputable by forming alliances and acting as a unit of force: "*Pecten maximus* anchors" and "the fishermen want to restock the bay". The notion of mobilization is perfectly adapted to the mechanisms that we have described. This is because this term emphasizes all the necessary displacements. To mobilize, as the word indicates, is to render entities mobile which were not so beforehand. At first, the scallops, fishermen, and specialists were actually all dispersed and not easily accessible. At the end, three researchers at Brest said what these entities are and want. Through the designation of the successive spokesmen and the settlement of a series of equivalencies, all these actors are first displaced and then reassembled at a certain place at a particular time. This mobilization or concentration has a definite physical reality which is materialized through a series of displacements.

The scallops are transformed into larvae, the larvae into numbers, the numbers into tables and curves which represent easily transportable, reproducible, and diffusible sheets of paper (Latour 1987). Instead of exhibiting the larvae and the towlines to their colleagues at Brest, the three researchers show graphic representations and present mathematical analysis. The scallops have been displaced. They are transported into the conference room through a series of transformations. The choice of each new intermediary, of each new representative must also meet a double requirement: it renders each new displacement easier and it establishes equivalences which result in the designation of the three researchers as spokesmen. It is the same for the fishermen transformed into voting ballots and then professional delegates whose previously recorded points of view are reported to Brest.

The obtained result is striking. A handful of researchers discuss a few diagrams and a few tables with numbers in a closed room. But these discussions commit uncountable populations of silent actors: scallops, fishermen, and specialists who are all represented at Brest by a few spokesmen. These diverse populations have been mobilized. That is, they have been displaced from their homes to a conference room. They participate, through interposed representatives, in the negotiations over the anchorage of *Pecten maximus* and over the interests of the fishermen. The enrollment is transformed into active support. The scallops and the fishermen are on the side of the three researchers in an amphitheatre at the Oceanographic Center of Brest one day in November 1974.

As this analysis shows, the groups or populations in whose name the spokesmen speak are elusive. The guarantor (or the referent) exists once the long chain of representatives has been put into place. It constitutes a result and not a starting point. Its consistency is strictly measured by the solidity of the equivalencies that have been

put into place and the fidelity of a few rare and dispersed intermediaries who negotiate their representativity and their identity. Of course, if the mobilization is successful, then: *Pecten maximus* exists as a species which anchors itself; the fishermen want the repopulation and are ready to support the experimental project; colleagues agree that the results obtained are valid. The social and natural “reality” is a result of the generalized negotiation about the representativity of the spokesmen. If consensus is achieved, the margins of maneuver of each entity will then be tightly delimited. The initial problematization defined a series of negotiable hypotheses on identity, relationships, and goals of the different actors. Now at the end of the four moments described, a constraining network of relationships or what I called elsewhere an actor-network (Callon 1986), has been built. But this consensus and the alliances which it implies can be contested at any moment. Translation becomes treason.

Dissidence

Betrayals and controversies

During recent years, sociologists have devoted numerous studies to controversies and have shown the important role they play in the dynamics of science and technology. Why and in what conditions do controversies occur? How are they ended? The proposed schema of analysis makes it possible to examine these two questions in the same way. At the same time, this schema maintains the symmetry between controversies which pertain to nature and those which pertain to society.

Is a spokesman or an intermediary representative? This is a practical and not a theoretical question. It is asked in the same manner for the scallops, the fishermen and the scientific colleagues. Controversy is all the manifestations by which the representativity of the spokesman is questioned, discussed, negotiated, rejected and so forth.

Let us start with the scallops. The first experiment or, if we use our vocabulary, act of *interessement* mobilizes them in the form of larvae anchored to collectors and in the form of diagrams discussed at Brest before a learned assembly. This group established a fact: *Pecten maximus* anchors itself when in the larval state. About a hundred larvae gathered in nets off the coast of St. Brieuc were enough to convince the scientists that they reflect the behavior of an uncountable number of their invisible and elusive brothers.

But is this movement likely to last? Will the scallops continue to anchor their larvae on the collectors generation after generation? This question is of crucial

importance to our three researchers. It concerns the future of the restocking of the bay, the future of the fishermen, and, in consequence, their own future. The years pass and things change. The repeated experiment results in a catastrophe. The researchers place their nets but the collectors remain hopelessly empty. In principle the larvae anchor, in practice they refuse to enter the collectors. The difficult negotiations which were successful the first time fail in the following years. Perhaps the anchorages were accidental! The multiplicity of hostile interventions (this at least is the interpretation of the researchers in their role of spokesman for the scallops), the temperature of the water layers, unexpected currents, all sorts of predators, epizooty, are used to explain why the *interessement* is being inefficient. The larvae detach themselves from the researchers' project and a crowd of other actors carry them away. The scallops become dissidents. The larvae which complied are betrayed by those they were thought to represent. The situation is identical to that of the rank and file which greets the results of union negotiations with silent indignation: representativity is brought into question.²¹

This controversy over the representativity of the larvae which anchor themselves during the first year's experiments is joined by another: this time it is the fishermen. Their elected representatives had been enrolled in a long-term program aimed at restocking St. Brieuc Bay without a shadow of reservation and without a peep of doubt. In the two years following the first (and only) anchorages, the scallops hatched from the larvae "interested" by the collectors, after being regrouped at the bottom of the bay in an area protected by a concrete belt, are shamelessly fished, one Christmas Eve, by a horde of fishermen who could no longer resist the temptation of a miraculous catch. Brutally, and without a word, they disavowed their spokesmen and their long-term plans.

Faced with these silent mutinies of scallops and fishermen, the strategy of the three researchers begins to wobble. Is anchorage an obligatory passage point? Even scientific colleagues grow skeptical. The three researchers have now to deal with growing doubt on the part of their laboratory director and the organization which had agreed to finance the experiment.

Not only does the state of beliefs fluctuate with a controversy but also the identity and characteristics of the implicated actors change as well. (What do the fishermen really want? How does *Pecten maximus* behave? ...). Nature and society are put into place and transformed in the same movement.

By not changing the grid of analysis, the mechanisms of the closure of a controversy are now more easily understood. Closure occurs when the spokesmen are deemed to be beyond question. This result is generally obtained only after a series of negotiations of all sorts which could take quite some time. The scallops do not follow the first anchored larvae and the fishermen do not respect the commitments

of their representatives; this leads the three researchers to transform the device of *interessement* used for the scallops and their larvae and to undertake a vast campaign to educate and inform (i.e., form) the fishermen to choose other intermediaries and other representatives. It is at this point of their story that we leave them in order to examine the lessons that can be drawn from the proposed analysis.

Concluding remarks

Throughout this study we have followed all the variations which affected the alliances forged by the three researchers without locking them into fixed roles. Not only was the identity of the scallops or the fishermen and the representatives of their intermediaries or spokesmen (anchored larvae, professional delegates, and so on) allowed to fluctuate but also the unpredictable relationships between these different entities were allowed to take their course. This was possible because no a priori category or relationship was used in the account. Who at the beginning of the story could have predicted that the anchorage of the scallops would have an influence on the fishermen? Who would have been able to guess the channels that this influence would pass through? These relationships become visible and plausible only after the event. The story described here, although centered around the three researchers, did not bring in any actor that they themselves did not explicitly invoke nor did it impose any fixed definition on the entities which intervened.

Despite what might be judged a high degree of permissiveness in the analysis, the results were not an indescribable chaos. Certainly the actors studied were confronted with different types of uncertainties. The situation proposed for them here is much less comfortable than that which is generally given by sociology. But their competencies prove to be worthy of the difficulties they encountered. They worked incessantly on society and nature, defining and associating entities, in order to forge alliances that were confirmed to be stable only for a certain location at a particular time. This methodological choice through which society is rendered as uncertain and disputable as nature, reveals an unusual reality which is accounted for quite faithfully by the vocabulary of translation.

First, the notion of translation emphasizes the continuity of the displacements and transformations which occur in this story: displacements of goals and interests and also displacements of devices, human beings, larvae, and inscriptions. Because of a series of unpredictable displacements, all the processes can be described as a translation which leads all the actors concerned to pass, through various metamorphoses and transformations, by the three researchers and their development project.

To translate is to displace: the three untiring researchers attempt to displace their allies to make them pass by Brest and their laboratories. But to translate is also to express in one's own language what others say and want, why they act in the way they do and how they associate with each other: it is to establish oneself as a spokesman. At the end of the process, if it is successful, only voices speaking in unison will be heard. The three researchers talk in the name of the scallops, the fishermen, and the scientific community. At the beginning these three universes were separate and had no means of communication with one another. At the end a discourse of certainty has unified them, or, rather, has brought them into a relationship with one another in an intelligible manner. But this would not have been possible without the different sorts of displacements and transformations presented above, the negotiations, and the adjustments that accompanied them. To designate these two inseparable mechanisms and their result, we use the word *translation*. The three researchers translated the fishermen, the scallops, and the scientific community.

Translation is a process before it is a result. That is why we have spoken of moments which in reality are never as distinct as they are in this paper. Each of them marks a progression in the negotiations which results in the designation of the legitimate spokesmen who, in this case study, say what the scallops want and need and are not disavowed: the problematization, which was only a simple conjecture, was transformed into mobilization. Dissidence plays a different role since it brings into question some of the gains of the previous stages. The displacements and the spokesmen are challenged or refused. The actors implicated do not acknowledge their roles in this story nor the slow drift in which they had participated, in their option, wholeheartedly. As the aphorism says, "traduttore-traditore" from translation to treason there is only a short step. It is this step that is taken in the last stage. New displacements take the place of the previous ones but these divert the actors from the obligatory passage points that had been imposed upon them. New spokesmen are heard that deny the representativity of the previous ones. Translation continues but the equilibrium has been modified.

Translation is the mechanism by which the social and natural worlds progressively take form. The result is a situation in which certain entities control others. Understanding what sociologists generally call power relationships means describing the way in which actors are defined, associated, and simultaneously obliged to remain faithful to their alliances. The repertoire of translation is not only designed to give a symmetrical and tolerant description of a complex process which constantly mixes together a variety of social and natural entities. It also permits an explanation of how a few obtain the right to express and to represent the many silent actors of the social and natural worlds they have mobilized.

Notes

- 1 The notion of "stock" is widely used in population demography. In the present case the stock designates the population of scallops living and reproducing in St. Brieuc Bay. A given stock is designated by a series of parameters that vary over time: overall number, cohorts, size, natural mortality rate, rate of reproduction, and so on. Knowledge of the stock thus requires systematic measures which make it possible to forecast changes. In population dynamics mathematical models define the influence of a range of variables (e.g., intensity of fishing and the division of catch between cohorts) upon the development of the stock. Population dynamics is thus one of the essential tools for what specialists in the study of maritime fishing call the rational management of stocks.
- 2 For this study we had available all the articles, reports and accounts of meetings that related to the experiments at St. Brieuc and the domestication of scallops. About twenty interviews with leading protagonists were also undertaken.
- 3 Centre National d'Exploitation des Océans (CNEXO) is a public body that was created in the early 1970s to undertake research designed to increase knowledge and means of exploiting marine resources.
- 4 The term *actor* is used in the way that semioticians use the notion of the *actant* (Greimas and Courtes 1979). For the implication of external actors in the construction of scientific knowledge or artifacts see the way in which Pinch and Bijker (1984) make use of the notion of a social group. The approach proposed here differs from this in various ways: first, as will be suggested below, the list of actors is not restricted to social entities; but second, and most important, because the definition of groups, their identities and their wishes are all constantly negotiated during the process of translation. Therefore, these are not pre-given data but take the form of an hypothesis (a problematization) that is introduced by certain actors and is subsequently weakened, confirmed, or transformed.
- 5 The reader should not impute anthropomorphism to these phrases! The reasons for the conduct of scallops – whether these lie in their genes, in divinely ordained schemes, or anything else – matter little! The only thing that counts is the definition of their conduct by the various actors identified. The scallops are deemed to attach themselves just as fishermen are deemed to follow their short-term economic interests. They therefore act.
- 6 On the negotiable character of interests and identities of the actors see Callon (1980).
- 7 As can be discerned from its etymology, the word *problem* designates obstacles that are thrown across the path of an actor and which hinder his movement. This term is thus used in a manner which differs entirely from that current in the philosophy of science and epistemology. Problems are not spontaneously generated by the state of knowledge or by the dynamics of progress in research. Rather they result from the definition and interrelation of actors that were not previously linked to one another. To problematize is simultaneously to define a series of actors and the obstacles which prevent them from attaining the goals or objectives that have been imputed to them. Problems, and the postulated equivalences between them, result from the interaction between a given actor and all the social and natural entities which it defines and for which it seems to become indispensable.
- 8 When the shell is formed it constitutes an effective shield against certain predators such as starfish.
- 9 Numerous analyses have made it clear that a scientific argument may be seen as a device for *interessement*. See, among others, Michel Callon, John Law, and Arie Rip (1986). Since

- the point is well established, details of the rhetorical mechanisms by which academics and fishermen were interested are not described in the present article.
- 10 D. Buestel, J-C. Dao, A. Muller-Fuega (1974). Resultats préliminaires de l'expérience de collecte de naissains de coquilles Saint-Jacques en rade de Brest et en baie de Sainte-Brieuc' in Colloque sur l'aquaculture, Brest, October 1973. *Actes de Colloque I*, CNEXO.
 - 11 Ibid.
 - 12 The description adopted here is not deliberately anthropomorphic in character. Just because currents intervene to thwart the experiments of researchers does not mean that we endow them with particular motives. Researchers sometimes use a vocabulary which suggests that starfish, climatic changes, and currents have motives and intentions of their own. But it is precisely here that one sees the distance that separates the observer from the actor and the neutrality of the former with respect to the point of view of the latter. The vocabulary adopted, that of *interessement* and enrollment, makes it possible to follow the researchers in their struggles with those forces that oppose them without taking any view about the nature of the latter.
 - 13 Buestel et al. Resultats préliminaires.
 - 14 Ibid.
 - 15 The discussions were recorded in reports which were made available.
 - 16 One participant in the discussion, commenting on the report of Buestel et. al., noted: "At a theoretical level we must not minimise what we know already about scallops ... It is important to remember that the biology of *Pecten* was somewhat better known than you suggested."
 - 17 Buestel et al. Resultats préliminaires.
 - 18 Furthermore, right at the beginning of the experiments, the three researchers gathered the St. Brieuc collectors together and transported them to their laboratory at Brest. Only after their arrival in Brest and in the presence of attentive colleagues were the larvae extracted from the collectors, arrayed on a pallet somewhere near the Spanish Bridge, and counted. There is no difference between this and what happens after the polling stations close and the ballot boxes are sealed. These are only reopened under the vigilant gaze of the scrutineers gathered round the tables upon which they are to be counted.
 - 19 In the course of discussion the researcher whose opinions were constantly sought by the participants made this judgment: "Let me underline the fact that this very remarkable communication marks an important date in our knowledge of the growth of *Pecten maximus*."
 - 20 This does not imply that all fishermen actively subscribe to the position adopted by their delegates. Rather it simply signifies that they do not interrupt the negotiations that those delegates undertake with the scientists and the larvae. As what subsequently happened reveals, interruption can occur without the fishermen explaining themselves publicly.
 - 21 It is no surprise that the controversy of dispute was not explicitly voiced. Even electors sometimes "vote with their feet."

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