VIII Congreso de la Asociación Española de Historia Económica
Santiago de Compostela, 13-16 de septiembre de 2005

"To capture or not to capture?" French Scholars, Scientists, and alleged Fish Depletions during the Eighteenth and Nineteenth Centuries

By Marc Pavé[•]

Abstract:
During the eighteenth and the first half of the nineteenth century, knowledge about fish and fishing was firstly produced by scholars of the Royal Garden – who became the French Natural History Museum - and of the French Academy of Sciences. They were only interested in maritime fauna, classifying and dissecting it. But they neglected the fishing. Secondly, some other scholars and some bureaucrats concerned by maritime activities described fishing and fisheries techniques. Sometimes, they promoted fishing effort limitations for the sector regulation. Around 1850, the industrialisation of fishing began. The first railway network was built and the new regimes (Second Republic and Second Empire) were opened to state interventions helping the industries. So, some scientists specialised in natural sciences and in the recent embryology proposed to repopulate French coasts and rivers with fishes, such as sturgeons, salmons and trouts because of their (presumed) depletion. During the second half of the nineteenth century, a research laboratory in Concarneau (Brittany) searched new techniques for fish farming and fertilisation. In the end, this new engineering did not have any real consequences for marine fishing but however it contributed to ichthyologic research. It did not help the increase in the fishing effort, since scientists were proposing to limit the captures. It seems that, in France, improvements in the fishing, fisheries and navigations techniques were independent from scientific research.

The relations between science and French marine fisheries in the eighteenth and nineteenth centuries concerned above all coastal fishing. The French Northern Atlantic deep-sea fishing attracted attention upon their commercial and strategic aspects[1]. The public administration dealing with the maritime fisheries – the Naval Service – was in charge of almost only the coastal fishing. To assess the relationship between this activity and science, it is necessary to know the producers and the users of the knowledge about coastal fishing and about natural conditions, that influenced it. On the one hand,

• Partner researcher and assistant teacher in the University of the Littoral- Côte d'Opale (Boulogne-sur-Mer).
[1] Laurier Turgeon. 'Le temps des pêches lointaines.' In: Michel Mollat (ed.). *Histoire des pêches maritimes en France* (Toulouse, 1987), 133-181.

this knowledge concerned the maritime environment. It was rather produced by scholars. Among them, an applied science born around 1850 the ideal of which was to repopulate sea, estuaries and riverbeds – considered depopulated – thanks to fish farming and artificial fertilisation. On the other hand, the knowledge aimed at the fishing and those who are doing it. It was produced by enlightened amateurs and by administrators. The latter ones were important because they were taking decisions.

So the chronological limits concurrently depended on public authorities, on knowledge and on fishing. Prior to that, the administration got really involved after 1715. It is thus our starting year. From around 1850, fishing took off and the vocation of science was partially modified. There was thus two distinct periods before and after 1850. At last, we shall stop by 1890, before the international conferences leading in 1902 to the foundation of the International Council for the Exploration of the Sea. First, we shall study the ichthyology up to 1850. We shall base ourselves on the *Encyclopédie méthodique*[2] with specialised books from Abbot Bonnaterre[3] and Daubenton[4], ichthyologic treatises, the five great dictionaries on natural history, accounts from the French Academy of Sciences sessions[5] and files from some of its members[6]. Next, we shall assess the Navy staff and other fishing watchers knowledge and their consequences. They are known thanks to the Naval district officers annual reports from 1815 to 1836[7] and known books of the time such as the Pluche's scholarly compilation[8], the *Encyclopédie*[9], the essay from Tiphaigne de la Roche, doctor of medicine and member of the Academy of Rouen (Normandy), called *Essai sur l'histoire oeconomique des mers occidentales de France*[10] and the absolute must the Duhamel du Monceau's *Traité général des pêches*[11]. Then, we will assess the reasons and effects from scientific changes from 1850. They are known from the minutes of the French Academy of Sciences sessions and from Victor Coste's writings, herald of the new applied science. Finally, we shall assess the importance of the links between science and coastal fishing, especially the influences of knowledge on the activity.

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[2] 'Methodical Encyclopaedia.'

[3] Abbé Bonnaterre, *Tableau encyclopédique et méthodique des trois règnes de la nature. Ichthyologie* (Paris, 1788).

[4] Louis-Jean-Marie Daubenton, *Encyclopédie méthodique ou par ordres de matières; par une société de gens de lettres, de savants et d'artistes. Histoire naturelle des animaux* (Paris and Liège, 1782-1787), volumes I and III.

[5] M.P. Demours and M. Cotte, *Table générale des matières contenues dans l'histoire et les mémoires de l'Académie des Sciences* (Paris, 1778-1809); Académie des sciences, *Procès-verbaux de l'Académie des Sciences (1795-1835), Tables générales alphabétiques* (Paris, 1979). Académie des sciences, *Procès-verbaux de l'Académie des Sciences, 1795-1835* (Paris, 1910-1922); Académie des sciences, *Comptes-rendus des séances de l'Académie des Sciences* (Paris), after 1835; Institut de France, *Mémoires présentés à l'Institut des Sciences, Lettres et Arts par divers savans et lus dans ses assemblées. Sciences mathématiques et physiques*. (Paris, 1806-1816).

[6] Archives of the French Academy of Science, 'Personal Archives of the Scientists.'

[7] French National Archives, Funds 'Navy and Colonies,' CC^5 131 to 151bis, the French maritime districts annual reports (1814-1834).

[8] Noël-Antoine Pluche, *Le Spectacle de la nature, ou Entretiens sur les particularités de l'histoire naturelle* (Paris, 1764).

[9] Denis Diderot and Jean D'Alembert, *Encyclopédie, ou Dictionnaire raisonné des sciences, des arts et des metiers* (Paris, 1751-1777), volume XII.

[10] "Essay on the France Western Seas Economic History". (Paris, 1760).

[11] "Fishing general treatise". Henri-Louis Duhamel du Monceau. *Traité général des pêches* (Connaissance et Mémoires européennes, 1998).

I. The limited contribution of an ichthyology unconcerned about the fishing (to about 1850)

Maritime environmental scholars studied only ichthyology. Physical oceanography produced very few results about the maritime environmental effects on fishes. Around 1800, few theories were elaborated on the herring trips. Noël de la Morinière "fisheries officer"[12] from 1789 to 1822 maintained in 1798 that the herrings did not migrate[13] in opposition to precedent ideas. The Deterville and Cuvier dictionaries also recalled yearly pendular migrations between the deep-sea and the coast, between the presumed food and laying spots[14]. But anterior theories remained, speculating about very long trips. Herrings, mackerels, sardines and tunas could swim in line under the seas. The Valmont-Bomarre[15] dictionary showed the herrings leaving from the Frozen North. They could split into three columns toward Iceland, Newfoundland and Norway. The latter one could split in two, the one column toward the Baltic Sea, the other one toward the North Sea and toward Scotland then the Channel, before setting off again toward the North Pole. The only valid argument was the interval between the fishing seasons. Moreover, theories on fishing ethology disappeared almost totally during the eighteenth and nineteenth centuries. Some theories about the tuna already existed in Aristotle[16] and Pliny's works[17]. They were also repeated in European ichthyologic books of the 16th century. It was known during that period that species came from the sea to the rivers in order to spawn or migrated to brackish or fresh water in search of prey, and hardly more. The lack of knowledge about fishes behaviour was reported in the Deterville dictionary: "who could enumerate the wars and express the perpetual ravages that fishes exert between themselves?"[18]. In fact, biological oceanography really begun with the British boat *Challenger* sea campaign (1872-1876). In France, less important campaigns were leaded by the *Travailleur* and by the *Talisman* in the Bay of Biscay (1881-1883) then by the *Caudan* (1894). That's why "France, after a promising beginning, did not participate in the development of the marine sciences"[19].

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[12] … *agent des pêches*.

[13] French National Archives, Funds 'modern,' F[12] 2624, 14 prairial an VI, 'Mémoire en forme d'examen des faits qui ont accrédité l'opinion des voyages du hareng; réfutation du système migratorial, nécessité de faire concorder les lois de pêche, avec les apparitions périodiques du poisson, par S. B. J. Noël, membre des sociétés des sciences de Rouen et de Bordeaux.'

[14] Deterville (ed.), *Nouveau Dictionnaire d'histoire naturelle* (Paris, 1816), volume XXVII, "hareng" (herring) definition; Georges Cuvier, *Dictionnaire des sciences naturelles* (Strasbourg and Paris, 1816), volume XX, "hareng" definition.

[15] Jacques Valmont-Bomarre, *Dictionnaire raisonné universel d'histoire naturelle* (Lyon, An VIII-1800), volume VI, "hareng" definition.

[16] *Œuvres d'Aristote. Histoire des animaux* (Paris, 1883), book VI, chapters XII and XVI (translation by Barthélémy Saint-Hilaire).

[17] Pline l'Ancien, *Histoire naturelle. Livre IX*. (Paris, 1955), 51-55 (translation by E. de Saint-Denis).

[18] …*qui pourroit dénombrer les guerres et exprimer les ravages perpétuels qu'exercent entre eux les poissons ?*. Deterville (ed.), *Nouveau Dictionnaire d'histoire naturelle*, volume XXVII, "poisson" (fish) definition.

[19] Margaret Deacon, *Scientists and the Sea, 1650-1900: a study of marine science* (Brookfield, 1971), 391.

Ichthyology had other preoccupations, i.e. to classify the fishes and to study their anatomy. Who are the ichthyologists? The natural history networks in the eighteenth and the nineteenth centuries kept two worlds in connection. On the one hand, one found during the *Ancien Régime* provincial academies[20] then museums and local learned societies, and also isolated scholars and collectors[21]. All these people passed on the knowledge and informed about sporadic discoveries. For example, when Cuvier and Valenciennes wrote their ichthyologic treatise, they received species specimens and descriptions sent by some "naturalists-travellers" and collectors[22]. On the other hand, two famous institutions produced and ratified the knowledge. The most specialised is the King's Garden founded in 1635, momentarily abolished during the Revolution and reinstated under the name of "National Museum of Natural History"[23] in 1793. From the end of the *Ancien Régime*, it opened to zoology[24]. Lacépède and Lamarck were members of it. They contributed to ichthyology in the beginning of the nineteenth century. They also belonged to the other important institution: the Academy of Sciences, abolished in 1790, reinstated in 1795 and 1816. Other academicians also did ichthyologic works: Georges Cuvier up to 1839, then, from the July Monarchy to the beginning of the Third Republic Achille Valenciennes, Victor Audouin, Henri Milne-Edwards, Armand de Quatrefages and Victor Coste. In this institution, as we will see that, appeared around 1850 a new preoccupation about the fishing.

The work assessing the European ichthyology up to the beginning of the eighteenth century is the Artedi's *Bibliotheca ichthyologica*[25]. The book to which several authors contributed lead by Sonnini[26] evaluated the eighteenth century in France. Then, from 1807 to 1832, Cuvier wrote annual reports to the Academy of Science, which made an inventory of the French natural history publications and were published as appendix of the Buffon's works[27]. The complementary information was supplied by the five great natural history dictionaries: the Valmont-Bomare, edited in 1764, reedited in 1768, 1775 and 1800, the Deterville, the Cuvier, the Bory de Saint-Vincent[28] and the Orbigny

[20] Daniel Roche, 'L'*Encyclopédie* et les pratiques du savoir au XVIII[e] siècle,' in Roland Schaer (ed.), *Tous les savoirs du monde. Encyclopédies et bibliothèques de Sumer au XXI[e] siècle*. (Paris, 1996), 383-410.
[21] Yves Laissus, 'Les cabinets d'histoire naturelle,' in René Taton (ed). *Enseignement et diffusion des sciences en France au XVIII[e] siècle* (Paris, 1964), 659-712.
[22] Marie-Louise Bauchot, Jacques Daget and Roland Bauchot. 'L'ichtyologie en France au début du XIX[e] siècle. L'Histoire naturelle des poissons de Cuvier et Valenciennes,' *Bulletin du Muséum national d'histoire naturelle, Paris*, 4, 12, 1990, section A, N° 1, supplement, 3-142.
[23] … *Muséum national d'histoire naturelle.*
[24] Yves Laissus, 'Le Jardin du Roi,' in René Taton (ed.), *Enseignement et diffusion des sciences en France*, 286-341 and Yves Laissus, *Le Muséum d'histoire naturelle* (Paris, 1995).
[25] Petri Artedi, *Ichthyologia sive opera omnia de piscibus scilicet* (Leiden, 1738).
[26] C.S. Sonnini, 'Notice des principaux auteurs qui ont écrit sur l'histoire naturelle des poissons,' in C.S. Sonnini (ed.), *Histoire naturelle, générale et particulière des poisons* (Paris, An XI-1802), 233-283.
[27] Georges Buffon and Georges Cuvier, *Oeuvres complètes de Buffon avec les supplémens, augmentées de la classification de G. Cuvier, et accompagnées de 700 vignettes gravées sur acier, représentant au moins 900 animaux* (Paris, 1835-1836), volume XI.
[28] Bory de Saint-Vincent (ed.), *Dictionnaire classique d'histoire naturelle* (Paris, 1822-1830).

dictionary[29]. At last, some famous naturalists published ichthyologic treatises and wrote its history: Lacépède[30], Cuvier[31], Cuvier et Valenciennes[32].

The word "ichthyology"[33] dated in France from 1649[34], but we can not find any significant contribution before the *Encyclopédie*. Those from the 16th and 17th centuries did not have any coherent criteria about the names and classifications of the species. The adjective "ichthyologic"[35] appeared in 1770[36]. The first task for ichthyology was systematics. The latter named the species and elaborated "methods" to classify them. At least, it was known how to define a fish. Bonnaterre used simple internal anatomical criteria: heart with ventricle and auricle, red blood and breathing with gills[37]. Nevertheless, a nomenclature had to respect a "classification"[38] which ordered the species in larger categories. But the task was difficult. Scholars were able to name the species thanks to the Linnaean conventions[39], but to order them between each other, almost each author had his own classification method. Sonnini listed eleven European classifications in the eighteenth century including four French ones[40]. In 1788, Bonnaterre deplored that there were as many "methods" as "ichthyologists" [41]. The nineteenth century classifications by Sonnini, Lamarck, Lacépède and Cuvier were simpler, but none outweighed the other ones. The improvements were slow, seeing that the known species number grew rapidly (See table 1). Twenty times more fishes were known in 1849 than in 1738.

The systematics having the vocation to describe, fishing did not have any place in the works. It was not even concerned with the second task of ichthyology: finding the functions of the organs. It was the subject of compared anatomy created by Daubenton, a Buffon's colleague, but above all later mastered by Cuvier[42]. It compared animals organs and skeletons to know their attributes and their functions. In spite of Lamarck and Geoffroy Saint-Hilaire, the reasoning was rebelious to the theory. According to Cuvier, "pure mind conceptions, theoretical dissertations, hypothesis (…) soon sank into

[29] Charles d'Orbigny (ed.), *Dictionnaire universel d'Histoire naturelle* (Paris, 1841-1849).
[30] Bernard de Lacépède, *Vue générale des progrès de plusieurs branches des sciences naturelles depuis la mort de Buffon, pour faire suite aux oeuvres complètes de ce grand naturaliste* (Paris, 1818).
[31] *Histoire des progrès des sciences naturelles, depuis 1789 jusqu'à ce jour* (Paris, 1834-1836).
[32] 'Tableau historique des progrès de l'ichtyologie depuis son origine jusqu'à nos jours,' in Georges Cuvier and Achille Valenciennes, *Histoire naturelle des poissons* (Paris, 1828-1849), volume I, book I.
[33] … *Ichtyologie.*
[34] Alain Rey (ed.), *Dictionnaire historique de la langue française* (Paris, 1992).
[35] … *ichthyologique* or … *ichtyologique*.
[36] Alain Rey (ed.), *Dictionnaire historique de la langue française.*
[37] Fishes formed a "genus" (*genre*) according with the French authors at this time. Nowadays they are considered as a "class" (*classe*).
[38] … *classification* (Lamarck's word).
[39] The teenth edition of the Linnaeus' *Systema Naturae* which was *Caroli Linnaei Systema naturae, regnum animale, editio decima, 1758, cura Societatis zoologicae germanicae iterum edita* (Leipzig, 1894) is authoritative because it is the conventional starting point of the living species classification.
[40] C.S. Sonnini, 'Notice des principaux auteurs qui ont écrit sur l'histoire naturelle des poissons,' 233-283.
[41] Abbé Bonnaterre, *Tableau encyclopédique et méthodique*, introduction, p. xij.
[42] René Taton (ed.), *La Science contemporaine. Le XIX^e siècle* (Paris : PUF, 1995), 485-489.

the same oblivion where sunk hypothesis or theories that preceded them" [43]. Cuvier imposed a point of view to the French scientific community, which lasted long after his death, at least up to 1880. It occulted the debate on species transformations[44]. So, the temporary victory of Cuvier's fixism played a very much more important part than fishing in ichthyology. There was no mutual influence.

So fishing preoccupied very little naturalistic scholars who had other fish to fry. The 1850 reorientation may now surprise: why most of the ichthyologists rallied the prevailing preoccupations about the fishing? However, the ichthyologists indifference did not prevent that their knowledge could have been of use by other people to know fishing better. What is the knowledge of the enlightened amateurs and of the Navy staff? We will see this now.

II. The knowledge of the activity watchers (till about 1850)

The enlightened amateurs constituted an intermediary group between the ichthyologists and the public authorities. As academies and learned societies members, they belonged to this French "literary republic" which composed public opinion. We can distinguish two kinds of authors. Sometimes they only described fishing and fishes, sometimes they added regulations propositions to that. Pluche and Diderot belonged to the first category. The former tackled the Ocean in the first volume of his *Spectacle de la Nature*[45]. He was inspired by ichthyologic treatises and by Academy of Science and *Royal Society* papers and reports. Pluche noticed that "in an element which does not produce anything, the fertility and the multitude of the inhabitants cannot be increased" [46] but also the "sea prodigality" [47]. Thanks to fishing, "the sea showers us with goods" [48]. The main fishing and fish species were described and peppered with emphatic appreciations about the world created by God. The *Encyclopédie* had the same lack of interest for the fishing future. Diderot – author of "fishing" and "sea fish" definitions – described some fishing and fish preserving techniques. He was inspired by the reports written by the fishing inspector Le Masson du Parc from 1723 to 1732 during his inquiries on the West coasts[49].

Tiphaigne de la Roche wrote the only book on maritime fishing, which was successful before the Duhamel du Monceau's *Traité*[50]. These were the two renown works at this time advocating measures for fishing. Tiphaigne's book was theoretical, written in a context where the Liberals and the

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[43] *… les pures conceptions de l'esprit, les dissertations théoriques, les hypothèses (…) tombent bientôt dans le même oubli où sont tombées les hypothèses ou les théories qui les avaient precedes*, in *Nouvelles annales du Muséum*, volume I, 1832, p. II-III.

[44] Cédric Grimoult, *Évolutionnisme et fixisme en France* (Paris, 1998); Franck Bourdier. *La lutte de Geoffroy Saint-Hilaire contre Cuvier en faveur de l'évolution paléontologique (1825-1838)*, 1967, Archives of the French Academy of Sciences, 'Personal archives of scientists,' Cuvier dossier.

[45] "Sight of the Nature".

[46] *…dans un élément qui ne produit rien, la fécondité et la multitude des habitans ne peut pas être grandi*, in Noël-Antoine Pluche, *Le Spectacle de la nature*, volume I, 377.

[47] *… prodigalité de la mer.*

[48] Noël-Antoine Pluche, *Le Spectacle de la nature*, volume I, 377.

[49] French National Archives, Funds 'Navy and Colonies,' C^5 18 to 26.

[50] Henri-Louis Duhamel du Monceau, *Traité général des pêches*, volume I, 'Avis des libraires sur un traité général des pesches,' 1.

Physiocrates were discussing about the value in economy: "our view are purely economical" [51]. Most of the ideas were original such as fixing quotas upon fishes captures (they had to wait till the 20th century). The author was also interested by the prices fluctuations, showing their pronounced elasticity in relation to the demand. In case of scarcity, fresh fish sales collapsed more quickly than the prices increased, provoking an income fall[52]. Tiphaigne is considered by Jean-Pierre Réveret as a precursor of fishing economy in the second half of the 20th century[53]. Nevertheless, he also used statements spread around in the eighteenth century Naval Service. French fishing would decline "since the 15th century"[54]. The author deplored the failures of the attempts to "restore" [55] the fishing during the next centuries. He suggested to regulate once again and "to renew, about this, public attention" [56]. He criticised the naturalists. He suggested that they "do not stop to marvel at the various colours of the shellfish husk, or count the fins osselets of our fishes. Seas outline, seas bottom nature, marine productions organizations, fishes multiplication and customs, all this considered in regard to fishing; those were the objects on which they have to reserve their attention" [57]. So, Tiphaigne wished that people studied the natural determinants of the fishing and that people promulgated prohibitive measures against some nets[58]. The latter idea was very classical, everywhere in the Duhamel's *Traité* and in the Navy staff reports.

The *Traité général des pêches* was serious and detailed: four volumes with 1 500 pages and 300 plates. It was published from 1769 to 1782. It was a description of fishing but also an ichthyology[59]. The author was a Naval inspector since 1759 and a member of the Academy of Sciences. He marked his time in agronomy, forestry, medicine and in shipbuilding. He was a bureaucrat with a very large knowledge. His contribution to the knowledge about fishing was the soundest of the period. His fished species ichthyology was much less sound. In 1828, Cuvier severely criticised his mix-up. His taxonomy criteria were very basic[60]. The three author's preoccupations corresponded to those of the public authorities, to whom he belonged: "It would be unnecessary to insist a lot about the utility of the work we are undertaking. Everybody knows that fishing occupies

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[51] … *Nos vues sont purement économiques*. (Tiphaigne de la Roche, *Essai sur l'histoire oeconomique*, 24).
[52] The detailed explications are in Paul Adam, 'Introduction, Histoire des pêches: point de vue d'un économiste,' in Michel Mollat (ed.). *Histoire des pêches maritimes en France* (Toulouse, 1987), 9-34.
[53] Jean-Pierre Réveret, 'Tiphaigne de la Roche (1760), un précurseur de l'analyse des pêches.' *Équinoxe*. 14 (1987), 39-42 and 15 (1987), 45-47.
[54] … *depuis le XV^e siècle*. In: Tiphaigne de la Roche, *Essai sur l'histoire oeconomique*, 'Préface' (introduction), iii.
[55] … *rétablir*. (Tiphaigne de la Roche, *Essai sur l'histoire oeconomique*, iv).
[56] … *renouveler, à cet égard, l'attention du public*. (Tiphaigne de la Roche, *Essai sur l'histoire oeconomique*, iv).
[57] … *ne s'arrêtent pas à admirer les couleurs variées de la robe d'un coquillage, ou à compter les osselets des nageoires de nos poissons. L'assiette des Mers, la nature des fonds, l'organisation des productions marines, la multiplication, les moeurs des poissons, tout cela considéré relativement aux pêches ; voilà les objets auxquels ils doivent leur attention* (Tiphaigne de la Roche, *Essai sur l'histoire oeconomique*, 138).
[58] Second part, chapter XII.
[59] Henri-Louis Duhamel du Monceau, *Traité général des pêches*, volume III.
[60] Georges Cuvier and Achille Valenciennes. *Histoire naturelle des poissons*, 117.

and keeps an important number of robust and useful men to the State. This job trains good seamen (…) Fishing, globally considered, presents another much appreciable utility, when we look at the side of the food it procures" [61]. At last, Duhamel was worried about the poor fishing effects on the resource[62], especially because of the trawling nets[63]. In his "recapitulation", he concluded in asserting: "all the reflections that we have just made are of the greatest importance in order to multiply fishes (…) It seems that the fishermen have taken the task to destroy the fishes race which brings nevertheless all their income. I would be happy if I could persuade the fishermen that it is of the highest importance to promote the multiplication of fishes, which are becoming day after day more and more scarce. They notice it, they complain about it and do not correct themselves" [64]. In his "Brief essay on what could cause fishing scarcity, mainly of the sea" [65], Duhamel intended to answer the following question: "I am often asked why fisheries are not so abundant as they used to be formerly (…) Could fishermen would have imagined fishing ways that could cause an enormous destruction of specie?" [66]. He answered affirmatively, tackling the presumed effects of fishing upon the "fish multiplication", the "disruption of sea bottoms" and the "spawning season". He minimised the natural fluctuations effects: "it is fortunately not due to causes which depends on the universe rhythm on which we must impute fish sterility on our coasts: I say fortunately because if the fish scarcity could depends on such a cause, one could not bring any remedy to it"[67]. And yet, the author showed also the frailty of the knowledge about fish, making sometimes contradictory remarks. On the one hand, he located spawns and fries in salted ponds and in calm shore parts of the coast[68]. On the other hand, fish weirs could have been responsible for fishing the spawns and the fry because they were located where the stream in the strongest[69]. So, Duhamel accomplished a rather remarkable work of fishing descriptions, with the consensual purpose to limit the catching.

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[61] *…Il seroit superflu de s'étendre beaucoup sur l'utilité du travail que nous entreprenons. Tout le monde sait que la pêche occupe et fait subsister un grand nombre d'hommes robustes et utiles à l'État. Ce métier forme les bons matelots (…) la pêche, considérée en général, présente encore une utilité bien sensible, quand on la regarde du côté des aliments qu'elle procure* (Henri-Louis Duhamel du Monceau, *Traité général des pêches*, volume I, 1 and 6).

[62] Henri-Louis Duhamel du Monceau, *Traité général des pêches*, volume I, sections 2 and 3.

[63] Henri-Louis Duhamel du Monceau, *Traité général des pêches*, volume I, section 2, 160-167.

[64] *…Toutes les réflexions que nous venons de faire sont de la plus grande importance pour favoriser la multiplication du poisson (…) Il sembleroit que les pêcheurs aient pris à tâche de détruire la race des poissons qui sont néanmoins tout leur revenu. Heureux si je pouvois persuader aux pêcheurs qu'il est de la plus grande importance de favoriser la multiplication du poisson qui devient tous les jours de plus en plus rare. Ils s'en aperçoivent, ils s'en plaignent et ne se corrigent point* (Henri-Louis Duhamel du Monceau, *Traité général des pêches*, volume I, section 2, 183).

[65] *…Dissertation sommaire sur ce qui peut occasionner la disette du poisson, principalement de mer* (Henri-Louis Duhamel du Monceau, *Traité général des pêches*, volume I, section 3, 100-104).

[66] *…On m'a souvent demandé pourquoi les pêches ne sont pas aussi abondantes qu'elles l'étoient anciennement (…) Seroit-ce que les pêcheurs auroient imaginé des façons de pêcher qui occasionneroient une énorme destruction de l'espèce ?* (Henri-Louis Duhamel du Monceau, *Traité général des pêches*, 100).

[67] *…Ce n'est heureusement pas à des causes qui tiennent au rythme de l'Univers qu'on doit attribuer la stérilité du poisson sur nos côtes : je dis heureusement parce que si la disette de poisson dépendoit de pareille cause, on ne pourroit y apporter aucun remède* (Henri-Louis Duhamel du Monceau, *Traité général des pêches*, 101).

[68] Henri-Louis Duhamel du Monceau, *Traité général des pêches*, 102.

[69] Henri-Louis Duhamel du Monceau, *Traité général des pêches*, 103.

The limits of the knowledge in natural history were also visible with the other bureaucrats, especially in the Naval districts annual reports for the years 1814 to 1834, the only homogeneous sources set in the period. The activity and resource fluctuations were almost always attributed to fishermen abuses[70]. In rare cases (25 reports out of about 500 consulted), the Naval districts officers added natural causes. Fish abundance was attributed to too cold water. The scarcity could have been caused by too hot water, dryness, bad weather, too hard or bad orientated winds, fished species predators, and indeed fishes moving "vagaries"[71]. In brief, every reasons seemed right[72]. In any case, these explanations did not weaken the whole early modern and modern conviction that fishermen were the real persons responsible for fish scarcity because of their bottom and resource devastating practices[73]. Only two reports wondered about the validity of these conventional explanations, putting not well-known natural fluctuations forward. The Naval District officer in Martigues (Provence) accused the fishermen for several years: abuses and disorders increase, dishonest, illiterate and undisciplined fishermen[74]. Then he declared that "the fish crowding and disappearance in deep-sea, effects which usually succeed one another, can not be imputed therefore to causes which depends on men" [75]. The Channel herring "disappeared" from the coasts in 1814. It came back around 1820 after five years of controversy about the techniques. So, it appeared that "the true cause for its four years desertion is not really known" [76]. In any case, not one bureaucrat considered neither that the marine resource could be unlimited, nor that people could fish as they wanted. But, as a result, natural fluctuations were ignored, at the same time not well known and neglected.

So, globally, the enlightened opinion was indifferent to fishing or said the same as bureaucrats. It sometimes gave away observations about fishing. But it knew little about natural environment and fish. Moreover, the Naval bureaucracy seemed to know little about science at this time. The Law-Decree of the 9th January 1852 then the four Decrees of the 4th July 1854 and that of the 19th November 1859 – one Decree for each of the five maritime counties – specifying how the law should be enforced, constituted the only global regulation since the Ordinance of 1681. Now, the 1852 and 1859 texts often resumed older acts, having as main vocation to limit fishing. Thus, scientific

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[70] Marc Pavé. *Réglementation et organisation de la pêche côtière en France (1715-1850)*, PhD thesis in history (University of Paris-Sorbonne, 2000), chapter 6.
[71] …*Caprices*.
[72] Marc Pavé. *Réglementation et organisation de la pêche côtière*, 227-230.
[73] Marc Pavé. 'L'épuisement présumé des ressources dans la politique de la pêche côtière en France (fin XVIe siècle – milieu XIXe siècle),' paper for the congress 'Pêche et aquaculture. Pour une exploitation durable des ressources vivantes de la mer et du littoral,' Nantes (France), 21st, 22nd and 23rd January 2004 (forthcoming).
[74] French National Archives, Funds 'Marine and Colonies,' CC5 148 (f° 121-122), 149 (f° 129-132), 150 (f° 168), 151 (f° 128), reports of the maritime district of Martigues for the years 1831 to 1834.
[75] …*L'affluence et la disparition du poisson en pleine mer, effets qui se succèdent habituellement, ne sauraient donc être attribués à des causes qui dépendent des hommes*, French National Archives, Funds 'Marine and Colonies,' CC5 151 bis, f° 140, report on the maritime district of Martigues for 1835.
[76] … *La véritable cause de sa désertion depuis quatre années n'est pas réellement connue*, French National Archives, Funds 'Marine and Colonies,' CC5 137, f°7, report on the first maritime county (…*arrondissement*) for 1820, which included all the maritime districts (…*quartiers*) of the French Northern Sea and Channel Coasts, excluding Brittany.

knowledge did not have any significant effects on fishing regulation. Nevertheless, around 1850, people witnessed a major reorientation. Some scientists pretended henceforth to produce a knowledge useful for fishing.

III. The beginnings of an applied science (second half of the nineteenth century).

Around 1850, fisheries started to be industrialised[77]. Steam-propulsion took the place of sail- and oar-propulsion. Boat sizes increased, and nets too. Hulls were more and more often made of iron. Some operations were mechanised: the steam winch to raise the nets replaced the handle capstan. The cotton nets took the place of those of hemp, being less expensive, lighter and less visible in the water. New tools were patented with their inventor names, persons or firms: "senne Belot", "filet Stuart", "filet Jouannin", "filet Broquand"[78]. Industrialisation also affected the canning industry, which henceforth put fish in iron tins of food. Captures increase was maintained with the growth of sea fish demand. With the installation of the first French railway network from 1842 to 1870, fresh fish went now through the entire country. All these transformations implied important investments. They entailed an increase in the preoccupations about the resource condition. However, all those new aspects were not sufficient to explain the new applied science, that was born at this time. Conversely, this science did not help industrialisation. Its emergence was primarily explained by changes in the scientific world and in the public authorities attitudes.

The Second Republic and especially the Second Empire public authorities were influenced by Saint-Simonism. In accordance with this trend of ideas, scientific knowledge had to be useful for society. It had to be encouraged as much by the State, as by the private sector. Now, the new applied science founders had a similar orientation: to directly help with their knowledge the fishing development and the elaboration of a proper regulation. We really notice a concomitance between the growth of sea biological researches, the creation of commissions of inquiries and laws about fishing. No doubt, this finding could have been valuable in the second half of the nineteenth century for other European maritime countries. The context was the same: industrialisation of the activity, improvement of the transportations network, public authorities receptivity. As it was the case for example with the United Kingdom[79], Denmark[80] and Portugal[81]. Moreover, the scientists corresponded with each other's

[77] Claude Vauclare, 'Naissance d'une industrie,' in Michel Mollat (ed.), *Histoire des pêches maritimes en France* (Toulouse, 1987), 243-250.
[78] Belot seine net, Stuart, Jouannin and Broquand nets.
[79] Royal Commissions (1863-1866, 1883), Sea Fisheries Acts (1868 and 1888), marine laboratory in Plymouth Hoe (1888). See: David Starkey, Chris Reid and Neil Ashcroft. *England's Sea Fisheries. The Commercial Sea Fisheries of England and Wales since 1300* (London, 2000), 174-182.
[80] Inquiry about the fishing and the fisheries of A.-J. Schmidt (1859-1863), Fisheries Act (1887), *Dansk Biologic Station* (1889). See: Jean-Pierre Corlay, *La pêche au Danemark. Essai de géographie halieutique*, PhD thesis in geography, Brest University, 1993, chapter 7.
[81] *Commissão Central de Pescarias* (1878), *Laboratório Marítimo* in Aveiro (projected in 1891), numerous laws from 1850 to 1913; See: Inês Amorim, 'A institutionalização da Oceanografia e a investigação pesqueira em Portugal, na segunda metade do século XIX, o laboratório marítimo de Aveiro,' in *Actas do Primeiro Congresso*

at a world level. It seemed however that the French initiatives had a slight – but a little lasting – lead. This was explained by the particularly strong and old State implication in fishing, but also by the early publicity about fish artificial fertilisation methods. The new applied science was born with these methods.

The Academy of Sciences was at the origin of the new science promotion. Before 1848, it had never been concerned either with fishing, or with fish farming, in spite of two papers, the first one written in 1742[82], the second in 1798[83]. This coincided with the already recorded ichthyologists' indifference. Now, between 1848 and 1853, seven papers dealt with marine species, of which five of them dealt with "aquiculture". This word referred to fish and shellfish farming. Among these papers, only one dealt with oyster farming[84]. The four others dealt with fish farming. It consisted on the one hand in creating water areas where the marine livestock could live. This rather concerned the continental waters species. These methods were known for a long time. Above all, on the other hand, it consisted in speeding up fish reproduction with artificial fertilisation. People kept then young fishes to make them grow or threw them back straight into the water. Sea "repopulation" was considered[85], and more often repopulation in fresh water was.

At the beginning, enlightened amateurs made (presumed) innovations known to the Academy of sciences. Doctor Haxo – the "Vosges Emulation Society"[86] perpetual secretary – sent a letter to the Academy, read during the 5th March session. On the 2nd May 1844, this learned society awarded two Vosges fishermen because they engaged themselves "greatly" into "the repopulation of our country and neighbouring countries" [87]. They had thrown into the rivers trouts fertilised with artificial techniques. During the years 1850-1855, Haxo received the support of numerous *départamental*[88] learned societies, that which really showed the public opinion interest[89]. The four other papers extended the projects to salmons and eels. They were written by two future academicians, Armand de

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Luso-Brasileiro de História da Ciência e da Técnica (Universidade de Évora e Universidade de Aveiro, 22 a 27 de Outoubro de 2000), Cidade, Editora, 2000.

[82] Sloane, 'Sur la manière de châtrer les poissons pour les engraisser,' in M.P. Demours and M. Cotte, *Table générale des matières contenues dans l'histoire et les mémoires de l'Académie des Sciences* (Paris, 1778-1809), year 1742.

[83] Noël de la Morinière, 'Mémoire sur les différents bateaux et barques employés à la pêche du hareng par les nations européennes, lu le 26 frimaire an VIII,' in Institut de France, *Mémoires présentés à l'Institut des Sciences, Lettres et Arts*, 229-250.

[84] 'Note sur la propagation des huîtres par les fécondations artificielles,' in Académie des Sciences, *Comptes-rendus des séances de l'Académie des Sciences* (Paris, 1853), volume XXVIII, 291-293.

[85] Armand de Quatrefages, 'Des fécondations artificielles appliquées à l'élève des poissons,' session of the 23 octobre 1848. in Académie des Sciences, *Comptes-rendus des séances*, volume XXVII, 413-416.

[86] … *Société d'émulation des Vosges.*

[87] … *En grand au repeuplement de notre pays et des pays voisins* (Letter of Doctor Haxo to the Academy of Sciences, red during the session of the 5th March 1849, in: Académie des Sciences, *Comptes-rendus des séances*, volume XXVIII, 351-352.

[88] The *département* is the district larger than the city and smaller than the region.

[89] Max Thibault, 'La Redécouverte de la fécondation artificielle de la truite en France au milieu du XIXe siècle; les raisons de l'engouement et ses conséquences,' in *Colloque Homme, Animal et Société, 13-16 mai 1987. Tome III, Histoire et animal, des sociétés et des animaux* (Toulouse, 1989), 206-207.

Quatrefages[90] and Victor Coste[91]. Since the end of 1849, the Minister of the Agriculture Dumas put Henri-Milne Edward – who had already worked on fishes[92] – in charge to visit the Vosges fish farming institution. This latter handed a moderate report at the beginning of 1850. However, Dumas founded with the ministerial decree of the 28th September 1850 a commission in charge of thinking about the mean of multiplying fishes in the French fresh waters. This commission was composed of nine members among whom the Academicians Henri Milne-Edwards and Achille Valenciennes, and Victor Coste admitted in the Academy of Sciences on the following year. From 1850 to 1852, they carried out assignments in France and abroad. Civil engineering department employees[93] implemented techniques to artificially fertilise hundred of thousand spawns. But these techniques were already known in France in the previous century. Duhamel published in his *Traité* the translation of a memoir sent in 1758 to Fourcroy by the Earl of Goldstein[94]. He reported salmon artificial fertilisation experiments performed around 1730. Jacobi, a Lippe-Detmold Earldom militia lieutenant[95], made them. They appeared later in other famous papers. Lacépède devoted them an article in the Sonnini's book in 1820[96]. Max Thibault listed five other books during the first half of the nineteenth century among which the Cuvier and Valenciennes' treatise and the Orbigny dictionary[97]. Thus the knowledge has never been forgotten. The reasons of the upheaval were due to the context explained above and to one person: Victor Coste.

In his "Report on the means to repopulate France's waters" [98], Coste drew up an alarming inventory of the halieutic resource in fresh (sturgeon, salmon and trout) and marine waters. About the sea, he incriminated the "disastrous practices"[99] accused of devastating the bottoms. The solution was to repopulate waters thanks to artificial fertilisation. Thus, the State could favour fish farming and regulate fishing. Victor Coste was the most famous naturalist about fish farming from the Second Republic. In those days, a caricature represented him rearing a herring as far as teaching it the piano[100].

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[90] Armand de Quatrefages, 'Des fécondations artificielles appliquées à l'élève des poissons.'
[91] 'Recherches sur la domestication des poissons et sur l'organisation des piscines,' in Académie des Sciences, *Comptes-rendus des séances*, volume XXIX, 797-801 (session of the 22nd April 1850); 'Transport et éclosion des œufs de saumons,' in Académie des Sciences, *Comptes-rendus des séances*, volume XXXIV, 124-126 (session of the 26th January 1852); 'Mémoire sur les moyens de repeupler les eaux de la France,' in Académie des Sciences, *Comptes-rendus des séances.*, volume XXXVI, 237-245 (session of the 7th February 1853).
[92] Jean-Victor Audouin and Henry Milne-Edwards, *Recherche pour servir à l'histoire naturelle du littoral de la France, ou recueil de mémoires sur l'anatomie, la physiologie, la classification et les moeurs des animaux de nos côtes... par MM. Audouin et Milne Edwards. Voyage à Granville, aux îles Chausey et à Saint-Malo* (Paris, 1832).
[93] *Ingénieurs des Ponts et Chaussées.*
[94] Henri-Louis Duhamel du Monceau. *Traité général des pêches*, volume I, section 2, 209-214.
[95] Emmanuel Fauré-Frémiet. *Notice sur la vie et les travaux de Victor Coste* (Paris, 1960), 21; Max Thibault, 'La Redécouverte de la fécondation artificielle de la truite en France,' 214.
[96] C. S. Sonnini 'Des effets de l'art de l'homme sur la nature des poissons,' 5-85.
[97] Charles d'Orbigny (ed.), *Dictionnaire universel d'Histoire naturelle*, p. 214.
[98] …*Mémoire sur les moyens de repeupler les eaux de la France*.
[99] …*Pratiques désastreuses.*
[100] Archives of the French Academy of Sciences, 'Personal archives of scientists,' Coste dossier.

Three reasons explained Victor Coste's success. Firstly, he was an embryologist. This discipline was very young. Its German founders (Von Baer and Rathke) published during the period 1820-1840[101]. Since 1831, after his medicine studies, Coste made himself known at the Academy of Sciences thanks to a paper on the chicken embryonic development[102]. He was twenty-four at that time. In 1832, he joined the Museum of Natural History. En 1836, he attained the comparative anatomy chair. In 1844, he occupied in the College of France the "comparative embryogeny"[103] chair, which was created for him. So he asserted a new scientific field before finding a field of practice for it: fish. But this did not explain his success in the eye of the public authorities opinion. Secondly, Victor Coste became a leading citizen. From 1850 to 1855, he was the doctor of Eugénie de Montijo, Napoleon III's wife. He was a member of the 1850 inquiry commission. In 1852, the Minister of the Agriculture gave him the task to visit the Huningue fish faming institution. The following year, the ministry released funds for its extensions. Then Coste published his "Practical instruction on fish faming, followed by papers and reports on the same topic"[104]. From 1853 to 1862, he carried out missions for the Minister of Trade and for the Emperor[105]. He became a river and maritime fishing inspector by Imperial Decrees of the 26th April and 24th May 1862. So, the applied science specialist was bound to inform and advise the public authorities. According to Coste, "fishing legislation is, above all, a natural history issue (…) Better informed by science, (regulation) would reconcile reproduction interests with those of free practice, industry requirements with repopulation needs" [106]. The craze persisted. Victor Coste was the principal propagandist of it during the Second Empire[107]. In 1853, he founded the Huningue fish farming institution in the Vosges[108] and in 1859 the Concarneau laboratory in Brittany[109]. Fish farming was mentioned in the preface of Henri de la Blanchère's book published around 1870 and devoted to fishing[110]. Thirdly, the success was explained by the break between applied science and the rest of the other sciences. So, presupposed ideas were never argued. Victor Coste missed the three great biology turning points of the second half of the nineteenth century. He did not provide any individual advice in the debates between Félix Pouchet and Louis Pasteur on

[101] René Taton (ed.), *La Science contemporaine. Le XIX^e siècle*, 497-498, 528-531.
[102] Emmanuel Fauré-Fremier. *Notice sur la vie et les travaux de Victor Coste*, 4.
[103] …*Embryogénie comparée.* The College of France (*Collège de France*) is a prestigious state-run institution of higher education founded at the beginning of the 16th century. It does not grant diplomas.
[104] *Instructions pratiques sur la pisciculture suivies de mémoires et de rapports sur le même sujet* (Paris, 1853).
[105] Ten reports were gathered in the second edition of the *Voyage d'exploration sur le littoral de la France* (Paris, 1861).
[106] … *La législation des pêches est, avant tout, une question d'histoire naturelle (…) Mieux informée par la science, (la réglementation) conciliera les intérêts de la reproduction avec ceux de la libre pratique, les exigences de l'industrie avec les besoins du repeuplement.* in: 'De la liberté de la mer au point de vue de l'industrie des pêches,' in: Académie des sciences. *Comptes-rendus des séances*, volume LIV, 805 (session of the 21st April 1862).
[107] Max Thibault, 'La Redécouverte de la fécondation artificielle de la truite en France,' 208.
[108] Paul Vivier, 'Un important centenaire: Rémy, Géhin, Haxo, Coste et l'établissement domanial de pisciculture d'Huningue (1843-1853-1953),' *Bulletin français de pisciculture*, 181 (1956), 1-5.
[109] François Tosello-Bancal, *Historique des recherches sur la sardine et sa pêche sur la façade atlantique de la France*, Master's thesis (University of Paris-Sorbonne, 1988).
[110] Henri de la Blanchère. *Nouveau dictionnaire général des pêches* (Paris, 2001), XII (preface by Duméril).

spontaneous generation from 1859 to 1864. Yet he was sought out for his knowledge in embryology[111]. Furthermore, he contested evolutionist theories. Lastly, he considered useless Claude Bernard's experimental method in biology and medicine, questioning the distinction between empirical observation and experimentation[112]. The latter answered him during an Academy of Science session in 1863.

The Concarneau "laboratory-fish-tank"[113] expanded up to 1859, six years after Victor Coste's death. Later, it was called "maritime laboratory"[114]. It was managed by Charles Robin until 1885 then by Georges Pouchet – comparative anatomy professor at the Natural History Museum – until 1894. The latter participated in 1885, 1887 and 1888 to scientific cruises on board of the Prince Albert I of Monaco's schooner *Hirondelle*[115]. Laboratory experiments concerned on the one hand oyster and shellfish farming and on the other hand the ichthyology of useful species, especially of sardine. During these years, the laboratory was known by the literary world. Michelet praised the Coste's and Pouchet's fish farming as cure for fish shortage in *La Mer* published in 1860[116]. Flaubert – adulator of Michelet's book[117] – went to Concarneau in Pouchet's home – Pouchet "who works on Coste's fish farming" [118] – from September to November 1875 in order to recover from a temporary financial ruin[119]. Over there, "from time to time, my companion, Georges Pouchet, dissects in front of me a fish or a mollusc"[120]. Flaubert wrote in 1875 and 1877 the third chapter of *Bouvard et Pécuchet* dedicated to science[121]. The work was published in 1881, one year after the author's death. It showed a willpower common to numerous nineteenth century writers: to invalidate the break between literature and sciences – yet irreversible – by endowing oneself with a sound scientific culture and by associating with the scholars. All this contributed to the fame of fish farming.

So the applied science had to improve fish farming and to advise public authorities. The administration presuppositions were used without discussion. This rallying was explained by the

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[111] John Farley and Gerald L. Geison, 'Le débat entre Pasteur et Pouchet: science, politique et génération spontanée au XIX^{e} siècle en France,' in Michel Callon and Bruno Latour (ed.), *La Science telle qu'elle se fait. Anthologie de la sociologie des sciences de langue anglaise* (Paris, 1991), 118-119.
[112] Mirko Grmek. *Claude Bernard et la méthode expérimentale* (Paris, 1991), 63-64.
[113] … *Vivier-laboratoire*.
[114] … *Laboratoire maritime*.
[115] Jacqueline Carpine-Lancre and Luiz Vieira Caldas Saldanha. *Dom Carlos I^{er} roi de Portugal, Albert I^{er} prince de Monaco, souverains océnographes* (Lisbon, 1992).
[116] "The See" (Paris, 1983), 268.
[117] Letter of Gustave Flaubert to Jules Michelet, 26 January 1872, in Gustave Flaubert, *Correspondance* (Paris, 1998), 398-401.
[118] … *Qui travaille à la pisciculture de Coste.* Letter of Gustave Flaubert to George Sand, 18 August 1875, in: Gustave Flaubert, *Correspondance*, 657.
[119] Letter of Gustave Flaubert to Edmond de Goncourt, 2 August 1875, in Gustave Flaubert, *Correspondance*, 655-656.
[120] … *De temps à autres, mon compagnon, Georges Pouchet, dissèque devant moi un poisson ou un mollusque*. Letter of Gustave Flaubert to Edma Roger des Genettes, 3 October 1875, In: Gustave Flaubert, *Correspondance*, 661. Almost the same sentence is written in a letter to George Sand of the same day (Gustave Flaubert, *Correspondance*, 663).
[121] Chronology and presentation of *Bouvard et Pécuchet* by Stéphanie Dord-Crouslé, in Gustave Flaubert, *Bouvard et Pécuchet* (Paris, 1999), 10-11, 23-24.

public authorities receptiveness, the embryology affirmation and Victor Coste's individual action. The halieutic or the fisheries science, that is to say the disciplinary topic dealing with "all which concerned fishing"[122] started. Numerous marine stations were built with the Concarneau pattern: Roscoff (1871) and Banyuls (1881) by Henri Lacaze-Duthiers, Vimereux (1874) by Alfred Giard, Marseilles and Saint-Vaast-La Hougue (1881) by Edmond Perrier, Arcachon (1883). Other creations took place after 1890[123]. The three founders had a similar profile. They worked at the Museum of Natural History. They were specialised in fauna inventories and in the embryology of the less well known species (small sized or marine). These foundations led more to the continuation of earlier researches than to fish farming improvement. In practical terms, during the second half of the nineteenth century, fish farming little expanded. It gathered less than 1 percent of the fish France's production in 1945[124]. In any case, "henceforth, improvements were insignificant" in regard to the processes[125]. Moreover, fish releases effects were difficult to evaluate. It did not lead to theoretical disruptions either knowing that Lacaze-Duthiers was against Claude Bernard[126] and that Giard and Perrier defended until the beginning of the 20th century the neo-Lamarckism against the Darwinism, from now on known in France[127]. So science did not have a decisive influence on coastal fishing, not even in advising public authorities, since those ones kept their old convictions, from there on shared by the scientists.

Thus, is there any connection between science and fishing in France in the eighteenth and nineteenth centuries? Before 1850, on the one hand, famous institutions naturalists neglected fishing when they did their ichthyologic work, as much as local scholars with whom they were in contact. They remained focused on taxonomy and comparative anatomy. On the other hand, some enlightened amateurs were interested in fishing. They were thinking alike Naval Service bureaucrats that activity problems were explained by fishermen abuses and that it was necessary to regulate. The work, which would synthesise all the ichthyologic and human knowledge would be the Duhamel du Monceau's *Traité général des pêches*. Nevertheless, the book had administrative and political objectives. They prevented from thinking fishing regulation differently than with techniques control. This break between science and fishing seemed to diminish since 1850. This was the beginning of a "new deal" for the activity. It got industrialised and it took advantage of the demand increase thanks to the railways. In this context, fish farming and artificial fertilisation entailed a craze favoured by a good public authorities reception. This craze was also explained by scientific evolutions, with the emergence of embryology and the trend in the researchers professionalisation. Victor Coste played a

[122] … *Tout ce qui concerne la pêche*. Hélène Rey, Joseph Catanzano, Benoît Mesnil and Gérard Biais. *Système halieutique. Un regard différent sur les pêches* (Paris, 1997), 63.
[123] René Taton (ed.), *La Science contemporaine. Le XIX^e siècle*, 421.
[124] Jean Chaussade and Jean-Pierre Corlay, *Atlas des pêches et des cultures marines: France, Europe, Monde* (Rennes, 1990).
[125] Guy Chauvey, *Les pionniers de la pisciculture salmoniculture* (Etouvans, 1997), 18.
[126] Mirko Grmek, *Claude Bernard et la méthode expérimentale*, 63-64
[127] René Taton (ed.), *La Science contemporaine. Le XIX^e siècle*, 544.

decisive part in the Museum of Natural History and in the Academy of Sciences. Then, other Museum researchers created maritime laboratories. However, researcher aimed more towards ichthyology than towards the new applied science, supposed to remedy the bottoms exhaustion. Victor Coste advised public authorities toward a limitation of fishing effort. This only confirmed an already-old legislation. An interesting paradox is at work: to guaranty a fishing increase, people had to limit it and replace it with fish farming. It is not sure than this paradox has nowadays disappeared.

Table 1 – The increase of the known species number

Years	1738	1758	1788	1803	1849
Species numbers	240	414	827	About 1 500	About 4 000

Sources :
- 1738: Petri Artedi, *Ichthyologia sive opera omnia de piscibus scilicet* (Leiden, 1738).
- 1758: Carl Von Linnaeus, *Caroli Linnaei Systema naturae, regnum animale, editio decima, 1758, cura Societatis zoologicae germanicae iterum edita* (Leipzig, 1894).
- 1788: Abbé Bonnaterre, *Tableau encyclopédique et méthodique des trois règnes de la nature. Ichthyologie.* (Paris, 1788).
- 1803: Bernard de Lacépède, *Vue générale des progrès de plusieurs branches des sciences naturelles depuis la mort de Buffon, pour faire suite aux oeuvres complètes de ce grand naturaliste* (Paris, 1818).
- 1849: Georges Cuvier and Achille Valenciennes, *Histoire naturelle des poissons*. (Paris, 1828-1849).