

# Aquaculture research with funding from CONAHCYT in three public research centers in Mexico

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## ABSTRACT

**Objective:** Analyze the projects on aquatic species financed by CONAHCYT through the information provided by the Transparency Units (TU) of the public research centers (PRC) CIBNOR, CICESE and CIAD.

**Design/Methodology/Approach:** The information was requested from the TUs of the centers through the official email of the TUs. The TUs sent the information, and it was organized in spreadsheets for later analysis. For the analysis, only the projects financed by CONAHCYT were considered and the following were selected: the year the project began, the technical manager, the species or species that were the main object of the project, and the amount approved.

**Results:** The projects financed in the timeline established by each center are shown, as well as the amounts approved, the responsible researchers and the species addressed. Native species are the ones that have obtained the most financed projects, although part of the budget has been applied to invasive alien species. The social incidence is perceptible in some of the financed projects, although it has been a characteristic that has been fairly attended.

**Study limitations/Implications:** The research has been limited to the information provided by the TUs of PRCs. If more information exists, it is not available through this route.

**Findings/Conclusions:** The three PRCs propose projects that are mostly on native aquatic species. There has been a decrease in the number of projects funded. The social incidence is barely perceptible in the projects proposed and financed by CONAHCYT.

**Key words:** Projects, budget, Mexico, social incidence, aquaculture.

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## INTRODUCTION

The System of Public Research Centers (PRC) of the National Council of Humanities, Science and Technology (CONAHCYT for its acronym in Spanish) is a group of 26 Mexican public institutions dedicated to research and higher-level teaching in various



disciplines of knowledge. The fundamental axes of these centers are research, training of specialized human resources, promotion of scientific progress and generation of technical and scientific information (CONAHCYT, 2023). The centers integrated into this system carry out research of a diverse nature according to the objectives for which they were created, in this way, all of these allow practically all lines of knowledge to be addressed.

Within this system of centers there are three that stand out for attending to research related to aquatic, marine and freshwater organisms, with proven or potential use in cultures for food production: the Centro de Investigaciones Biológicas del Noroeste (CIBNOR), the Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE) and the Centro de Investigación en Alimentación y Desarrollo (CIAD).

Even though they are iconic centers in this scientific and technological area, little or nothing is known, in the public sphere, about how their research work has been developed, especially everything related to projects that have been financed by the federal government, through calls issued mainly by CONACYT (now CONAHCYT). The information, which is public, derived from these centers is not easily accessible, nor is it organized in such a way that it can be consulted. Due to the above, the present study, took out the tools that the Mexican State itself has contemplated for access to public information; the National Institute of Transparency, Access to Information and Protection of Personal Data (INAI). This institute has the obligation to provide the public information generated by the agencies and institutions of the federal government (INAI, 2023), which is the case of the CONAHCYT PRCs.

Therefore, the main objective of this study is to analyze certain aspects of the development of research, financed by the federal government, aimed at aquaculture species in PRCs, CIBNOR, CIAD and CICESE, based exclusively on the information provided by the Transparency Units of these centers, through the INAI.

## MATERIALS AND METHODS

The Transparency Units (TU) of CIBNOR, CIAD and CICESE, attached to INAI, were requested to obtain the information required to carry out this study, based on the following request sent by email to those responsible:

*With the intention of developing a postdoctoral study on the impact of public funding on the development of research and culture technology of native and exotic aquatic species, I request the information corresponding to the projects that have been submitted to CONACYT calls and have been approved. and funded by the agency. This information is required from the current date to three previous decades, with the amounts approved, the participating researchers and the products obtained. (Sic)*

The three centers sent information through the same means, email, in various formats, spreadsheet files (Excel<sup>®</sup>), pdf files and images. The information that was not found in spreadsheets was transferred to that format by direct capture. Once the databases were formed in spreadsheets, each center was analyzed.

For the analysis, only the projects financed by CONAHCYT through various calls were considered. From the wealth of information received in each project, the following were selected: the year the project began, the responsible researcher, the species or species that were the main object of the project, and the amount approved. No information was received on the products obtained by the project, so it could not be included as part of the study. With these data, new databases were created that were used for the final analysis.

## RESULTS AND DISCUSSION

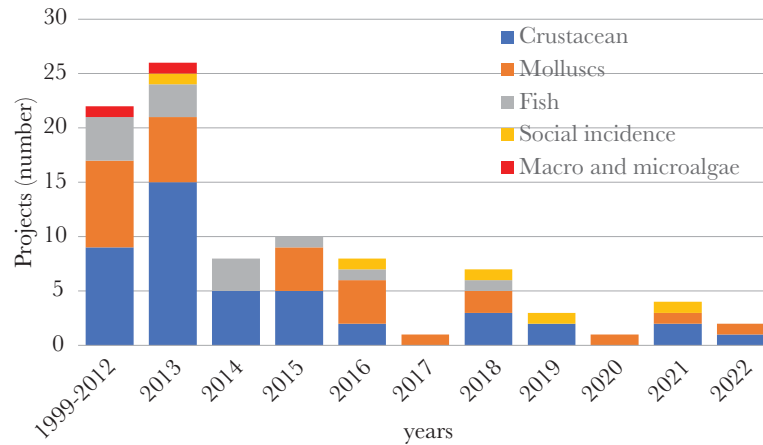
The information provided by the TUs of each PRC was dissimilar in quantity and quality. CIBNOR was the center that provided the most information on the projects financed by CONAHCYT (92 projects from 1999 to 2022), it also included those that were supported by private companies and other non-federal organizations, but these were not considered in this analysis. CICESE provided information on 27 projects supported between 1993 and 2021 and CIAD 23 between 2011 and 2019. CIBNOR was the public center that provided the most information, in a period of 23 years, while CICESE provided a period of 30 years, and that of CIAD only nine years.

These three centers are not newly created, CICESE and CIBNOR were founded as civil associations in the 1970s and CIAD in the 1980s, although the Mazatlán Unit, the main headquarters for research with aquatic species, was founded in 1993, so it can be considered the youngest of the three (information obtained from the official pages of the aforementioned centers). Subsequently, these centers became part of CONAHCYT's PRCs, however, since their creation they had both state and federal support. Also, almost since its creation, they promoted research related to aquaculture species of commercial interest. Therefore, it is paradoxical that, despite being centers that conduct research and technological development in this sense, they can barely share limited information on the projects financed by the federation through CONAHCYT. The foregoing demonstrates that, although the TUs complied with the obligation to provide the information required by law, these types of requests, even though they refer to their essential and substantive activities, are apparently *sui generis*.

The results by center, based on the analysis provided by their TUs, are presented below. If the information received is partial and does not fully reflect the full scenario (mainly due to the lack of inclusion of projects actually approved, in the periods established by the centers themselves) it is equally important, since it not only draws a panorama that despite being limited, it is real but, in addition, it highlights the capacity of the centers to provide public information. It is necessary to clarify that the projects that only referred to increasing the infrastructure, specific analytical techniques, and laboratory equipment, were not taken into account in all the analyzes since the greatest interest was given to those that were specifically directed to the study of organisms with aquaculture interest.

### CIBNOR

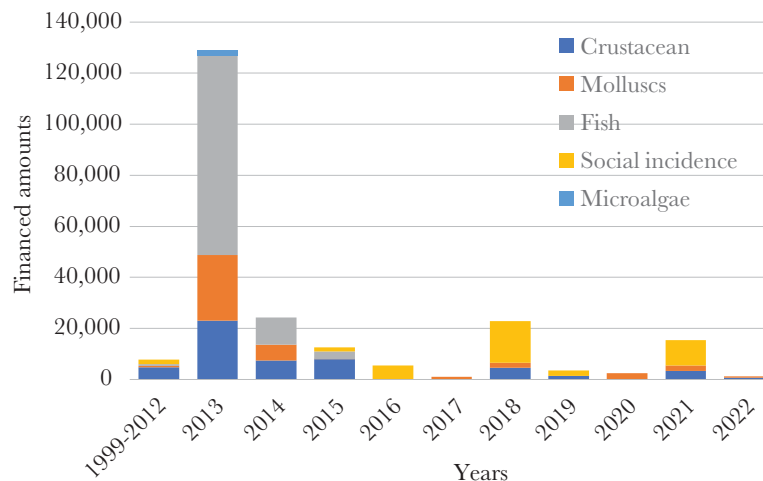
Figure 1 shows the number of projects financed by CONAHCYT during the period from 2013 to 2022. Species are included by group, crustaceans, mollusks, fish, microalgae, and those with a social incidence orientation.



**Figure 1.** Number of CIBNOR projects financed by CONAHCYT during reported period.

In this Figure it is possible to notice that crustaceans have been the group most widely supported with public financing (44 projects). This group includes species of marine shrimp (mainly *Penaeus vannamei*) and prawns of the genus *Macrobrachium*. The molluscs group is the second most financed with 28 projects. According to the data provided, *Crassostrea gigas* (an exotic species) has received most of the funding, although there are also studies with native species (see table 2). Fish research shows 13 funded projects. Studies financed with macro and microalgae only show one. The social incidence projects total five in that period, which shows that this center began to seek to contribute significantly to this area, even before CONAHCYT’s research policies, modified as of 2019, included this aspect in the calls to request funding.

Regarding the amounts approved for the projects, Figure 2 shows that the fish group, despite not being the one with the largest number of projects, is the one that benefited from the greatest financing (\$92’540 million in the period), much higher than that of the



**Figure 2.** Amounts of CIBNOR projects financed by CONAHCYT during reported period (in thousands of Mexican pesos).

projects financed for crustaceans (\$53'484 million) and molluscs (\$51'023 million). Of relevant importance, especially at present, is to verify that projects with a social incidence have begun to be reflected in the statistics of the centers. In the case of CIBNOR, these have added almost 37 million in financing, especially since 2018.

Table 1 shows the CIBNOR staff researchers who obtained projects financed by CONAHCYT. For this table, the projects that were directed to the improvement of the infrastructure or acquisition of equipment for laboratories were considered. The ability of some researchers on the CIBNOR staff to obtain federal resources for their studies or for growth in infrastructure and equipment in their specific areas is evident. Of the total number of researchers affiliated to that center, only 45 were supported with funding in the period analyzed.

Regarding the aquatic species studied, Table 2 shows that most of them are native. However, investment has been dedicated to exotic species such as Tilapia (10 projects financed) and the *Australian lobster*, *Cherax quadricarinatus* (9 projects), both freshwater species that have been considered invasive and currently occupy largely ecological niches of the country with undetermined consequences. In the same way, the Japanese oyster, *Crassostrea gigas*, has been identified as highly invasive, which has not limited the fact that 15 funded projects are dedicated to its study. Even so, the number of native species that have been subject to budget support is relevant.

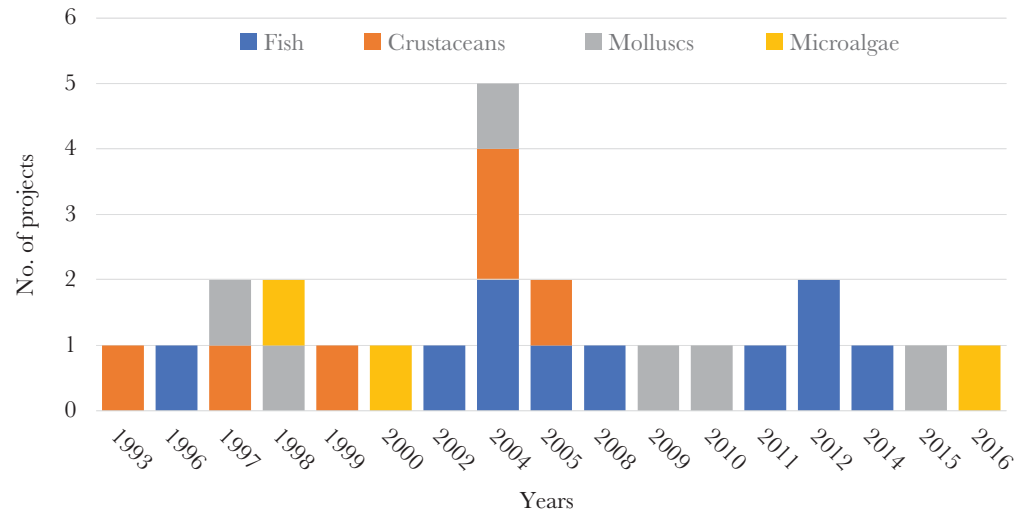
### CICESE

Despite the fact that the period reported by the CICESE TU covers from 1993 to 2021, the number of projects that received financing from CONAHCYT is much lower than those reported by CIBNOR (Figure 3). The group that showed the most funded projects was fish with 10, while crustaceans and molluscs reported six each; three projects involving microalgae and one addressing bioremediation (not included in the Figure). The projects that were supported for the validation of a product, creation of infrastructure or laboratory equipment, were not included in this Figure or in the one of the approved amounts (Figure 4), because they do not represent the study of a particular organism or organisms.

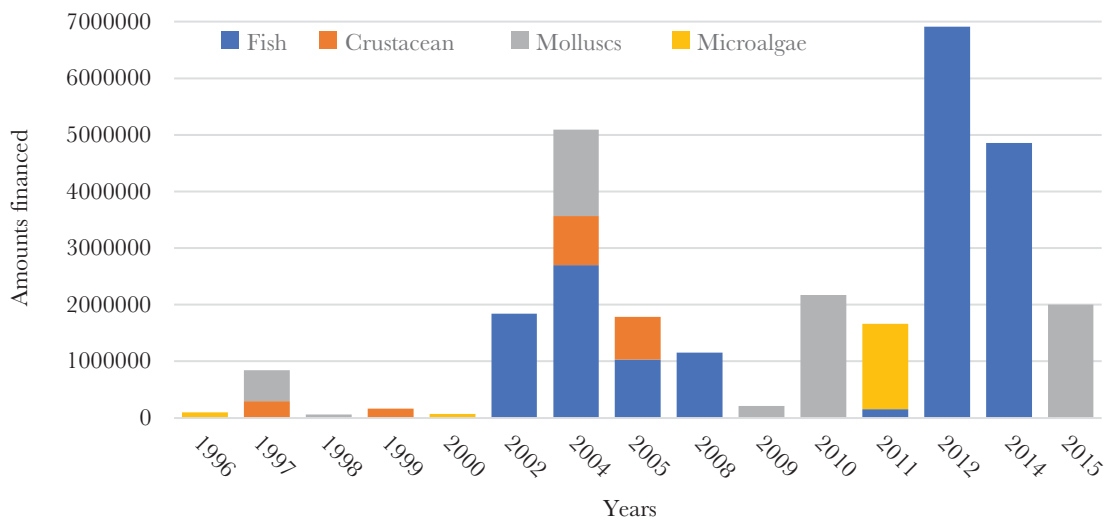
In relation to the amounts granted to projects, similar to what occurs at CIBNOR, the fish group obtained the most resources (\$18,661,000), followed by the molluscs group with a third of that amount (\$6' 517,918). The crustacean group only obtained one ninth of what was obtained by fish (\$2,090,033) and the microalgae projects were very close (\$1,671,900). This clearly reflects the research interests of the different public centers. In the case of CICESE, the projects with the most funding are those aimed at fish and shellfish, despite the fact that the latter only have six projects. Crustaceans are not as important a line of research as they are for CIBNOR. Obviously, the regional vocation of the centers is applied in the study of species with economic interest in their direct area of influence. Table 3 shows the CICESE staff researchers who obtained projects financed by CONAHCYT, in the period from 1993 to 2021. As was the case for CIBNOR, this table did include projects that were aimed at improving infrastructure or acquisition of equipment for laboratories. The difference between CICESE and CIBNOR in this regard is clear. In the case of CICESE, the highest amount obtained by a researcher (10 million) is less than

**Table 1.** CIBNOR researchers with projects financed by CONAHCYT from 1999 to 2022 (in Mexican pesos).

Researchers	Amounts	Projects
Maeda Martínez Alfonso Nivardo	120,078,000	6
Racotta Dimitrov Ilie Sava	80,208,433	10
Cruz Hernández Pedro	21,297,573	3
Villarreal Colmenares Humberto	20,044,704	5
Ascencio Valle Felipe De Jesús	18,875,402	5
Magallón Barajas Francisco Javier	10,253,001	5
Cortés Jacinto Edilmar	9,633,492	5
Ibarra Humphries Ana María	7,547,495	3
Nolasco Soria Héctor Gerardo	7,421,407	2
Magallón Servín Paola	7,189,041	2
Tovar Ramírez Daríel	6,832,136	4
Mejía Ruiz Claudio Humberto	6,697,106	4
Palacios Mechetnov Elena	6,195,077	6
Espinosa Chaurand Luis Daniel	5,991,000	1
Maldonado García Minerva Concepción	5,883,000	2
Escobedo Fregoso Cristina	4,788,803	2
Pérez Enríquez Ricardo	4,748,461	3
Rojo Arreola Liliana Carolina	3,300,000	1
Hernández Llamas Alfredo	3,236,430	1
Murillo Amador Bernardo	3,194,400	1
Civera Cerecedo Roberto	2,997,812	1
Campos Ramos Rafael	2,950,000	2
Vázquez Juárez Ricardo	2,912,865	3
Mazón Suastegui José Manuel	2,770,492	2
Estrada Muñoz Norma	2,649,800	3
Gómez Anduro Gracia Alicia	2,498,926	2
Peña Rodríguez Alberto	2,471,000	2
López Martínez Juana	1,969,550	2
Gopal Murugan	1,865,000	1
Gutiérrez Jaguey Joaquín	1,676,872	1
Guerrero Tortolero Danitzia Adriana	1,500,000	1
Reyes Alvarado Ana Gisela	1,414,388	1
Mercier Laurence Stephanie	1,396,000	1
Campa Córdova Ángel Isidro	1,391,000	1
Arcos Ortega Guadalupe Fabiola	1,385,706	2
Sánchez Paz José Arturo	1,139,434	1
García Carreño Fernando L.	1,095,436	2
Sicard González María Teresa	1,044,980	1
Valenzuela Quiñonez Fausto	999,321	1
García De Leon Francisco Javier	733,673	2
Martínez Rincón Raúl	609,295	1
Hernandez Lopez Jorge	238,111	1
Monteforte Sánchez Mario	106,000	1
Hernández Cortés Martha P.	100,000	1



**Figure 3.** Number of CICESE projects financed by CONAHCYT during reported period.



**Figure 4.** Amounts of CICESE projects financed by CONAHCYT during reported period (in millions of Mexican pesos).

a tenth of that obtained by the most benefited researcher at CIBNOR (120 million). Only 13 CICESE researchers are reported as technical responsables of financed projects, while at CIBNOR that number is 45. The difference in approval of federal amounts for research between CICESE and CIBNOR is dramatic, especially considering that CIBNOR reports a shorter period than that reported by CICESE. It is also clear that some researchers have the capacity to present financially approved projects, which surely results in benefits for the development of research in their area of expertise or to increase the installed capacity of the laboratories in which they carry out their activities.

The species that have received the most attention for the CICESE projects financed by CONAHCYT are shown in Table 4. Except for Japanese oysters, the Mediterranean

**Table 2.** Aquatic species subject to study in projects financed by CONAHCYT, at CIBNOR.

Species	Common name	Status
<i>Penaeus vannamei</i>	White shrimp	Native
<i>Crassostrea gigas</i>	Japanese oyster	Exotic
<i>Macrobrachium</i> sp.	Prawn	Native
<i>Oreochromis</i> sp.	Tilapia	Exotic
<i>Cherax quadricarinatus</i>	Australian lobster	Exotic
<i>Seriola rivoliana</i>	Longfin yellowtail	Native
<i>Nodipecten subnodosus</i>	Paw scallop	Native
<i>Mycteroperca rosacea</i>	Leopard grouper	Native
<i>Anadara tuberculosa</i>	Mangrove cockle	Native
<i>Panopea globosa</i>	Geoduck clam	Native
<i>Lutjanus peru</i>	Pacific red snapper	Native
<i>Paroctopus digueti</i>	Pacific pygmy octopus	Native
<i>Crassostrea corteziensis</i>	Cortez oyster	Native
<i>Argopecten ventricosus</i>	Catarina scallop	Native
<i>Megapitaria squalida</i>	Chocolate clam	Native
<i>Crassostrea virginica</i>	American oyster	Native
<i>Haliotis fulgens</i>	Green abalone	Native
<i>Chirostoma estor</i>	Silverside fish	Native

**Table 3.** CICESE researchers with projects financed by CONAHCYT from 1993 to 2021 (in Mexican pesos).

Researchers	Amounts	No. of projects
Lazo Corvera Juan Pablo	10,046,962	5
Hernández Rodríguez Mónica	6,530,426	4
Sánchez Saavedra M. del Pilar	5,708,454	3
Lafarga de la Cruz Fabiola	5,378,652	2
del Río Portilla Miguel Ángel	2,341,216	2
Barón Sevilla Benjamín	2,254,300	2
Segovia Quintero Manuel Alberto	1,499,960	1
Bückle Ramirez Luis Fernando	1,169,185	3
Cáceres Martínez Jorge A.	1,050,792	3
Paniagua Chávez Carmen G.	211,900	1
Paniagua Michel José de J.	101,900	1
Ponce Rivas Elizabeth	70,000	1

mussel and tilapia, all the rest are native species. The foregoing demonstrates the interest of this center in research and technological development of species native to the region rather than introduced ones. Financing for the three exotic species mentioned is minimal considering the amounts oriented towards native species. At CICESE, based on the



**Table 4.** Aquatic species subject to study in projects financed by CONAHCYT, at CICESE.

Species	Common name	Status
<i>Haliotis</i> spp.	Abalone	Native
<i>Oncorhynchus mykiss</i> .	Rainbow trout	Native
<i>Crassostrea gigas</i>	Japanese oyster	Exotic
<i>Mytilus galloprovincialis</i>	Mediterranean mussel	Exotic
<i>Panulirus interruptus</i>	California lobster	Native
<i>Paralichthys californicus</i>	California halibut	Native
<i>Oreochromis</i> sp.	Tilapia	Exotic
<i>Penaeus stylirostris</i>	Blue shrimp	Native
<i>Penaeus vannamei</i>	White shrimp	Native
<i>Poecilia sphenops</i>	Molly fish	Native
<i>Procambarus clarkii</i>	Crayfish	Native
<i>Seriola lalandi</i>	Yellowtail kingfish	Native

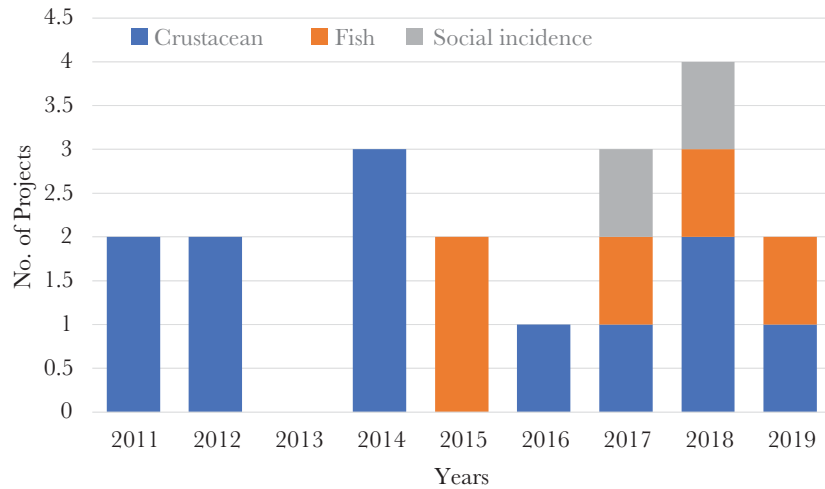
information provided by the TU, it was not possible to detect any financed project that could be considered as having a social incidence.

### CIAD

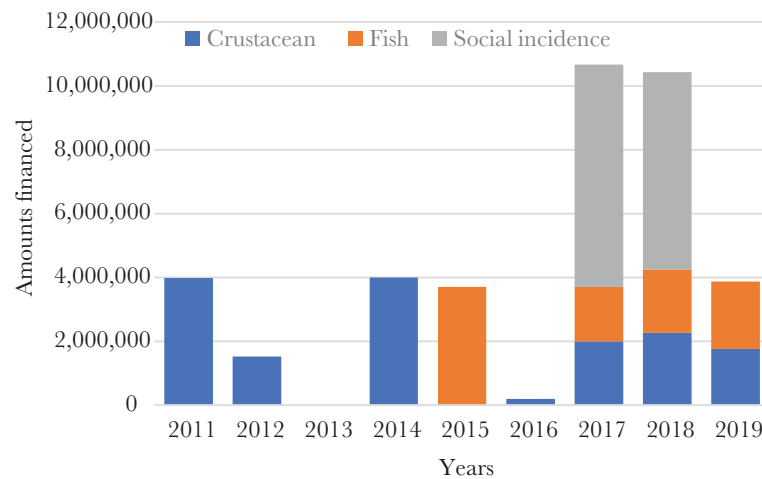
The period for which information was obtained by the CIAD TU covers the year 2011 to 2019 and is the smallest of the three centers in the present study. The financed projects addressed three main groups: crustaceans, fish, and social incidence. The number of projects for the crustacean group was 12, much higher than for fish with only five, and none for molluscs (Figure 5). It is evident that the line of crustaceans represents great interest for CIAD, which has eleven projects in the period for *Penaeus vannamei*. For fish, *Lutjanus guttatus* (Spotted rose snapper), is the only project financed for a native species of commercial interest, although the social incidence projects (two) have tilapia as a central interest.

Contrary to what is presented in CIBNOR and CICESE, for CIAD the largest amounts of financing are for projects aimed at marine shrimp research (\$15,705,328) and in close numbers, for projects with social incidence. (\$13,133,820). The third and last place in financing is occupied by the fish group with \$9,499,064 pesos. It is interesting to note that CIAD, despite having fewer projects financed (compared to CIBNOR and CICESE) has obtained significant financing for its social incidence projects (Figure 6).

Table 5 shows the CIAD researchers who obtained projects financed by CONAHCYT, in the period from 2011 to 2019. Similarly for the other two centers, this table does include projects aimed at improving infrastructure or acquisition of equipment for laboratories. A similar phenomenon occurs in the amounts financed for CIAD projects as the one mentioned for CICESE. There is a striking difference between CIAD and CIBNOR in the amounts obtained by the researchers. Only 14 CIAD researchers are reported as technical managers of financed projects, similar in this sense to CICESE, but well below



**Figure 5.** Number of CIAD projects financed by CONAHCYT during reported period.



**Figure 6.** Amounts of CIAD projects financed by CONAHCYT during reported period (in millions of Mexican pesos).

CIBNOR. The difference in the approval of federal amounts for research between CIAD and CIBNOR is dramatic, although the periods are considerably different.

The sum of the projects financed by CONAHCYT to CIAD is a little less than 55 million pesos, while for CIBNOR it is 323 million pesos. However, CICESE only managed to obtain financing for 36 million pesos, over a much longer period. Although only CIBNOR shared information on the projects not financed by CONAHCYT, that is, from external and self-generated resources, and which represent a part of its budget, the other two centers, CICESE and CIAD, must also obtain significant amounts through projects of private companies, specialized services, and consultancies.

In general, several common characteristics can be established among the three centers, regardless of the number of projects reported by the TUs. The most important, from our point of view, is that they spend most of their research on native aquatic species.

**Table 5.** CIAD researchers with projects financed by CONAHCYT from 2011 to 2019 (in Mexican pesos).

Researchers	Amount	Projects
Martínez Porchas Marcel	8,323,127	3
Javier Ávila Emma Josefina	6,965,820	1
Yépiz Plascencia Gloria	6,255,028	4
Hernández González Crisantema	6,168,000	1
Pacheco Aguilar Ramón	4,885,000	1
Sotelo Mundo Rogerio R.	4,813,500	4
Gasca Silva Silvia A.	3,791,828	1
Chávez Sánchez Ma. Cristina	2,705,000	1
Liera Herrera Raúl A. / Almazán Rueda Pablo	2,187,978	2
Morales Serna Francisco / Soriano Ávalos Anaguiven	2,098,460	1
Soto Rodríguez Sonia	1,767,000	1
Lozano Betancourt Miguel	1,700,000	1
Muhlia Almazán Adriana T.	1,498,000	1
Berlanga Robles César A.	1,476,400	1

The foregoing complies with the concern expressed by the FAO (2010, 2014, 2016, 2020, 2022) in relation to avoiding the introduction of exotic species with potential or known invasive capacity, and the need to research and develop technologies of regional species, native or endemic. Another common characteristic is that, in their staff, there are researchers with a high capacity to present projects that can be financed with federal resources and have been benefited with large amounts. In the reported periods, these researchers have exercised millionaire budgets. Of relevance are the amounts assigned to CIBNOR researchers, in the reported period, much higher than those exercised by the most benefited researchers from the other two centers. In relation to the number of projects financed in the periods reported by the TUs of the three centers, in the case of CIBNOR a dramatic decrease is evident. However, for CICESE and CIAD, this is not perceived. It is worth mentioning that the CIBNOR TU was the one that provided the most information and, consequently, the center where this phenomenon is most clearly perceived. Such a decrease is probably linked to the new regulations that CONAHCYT applies for research financing. La relevancia de las especies nativas es clara para los tres centros, para la mayoría de los grupos (crustáceos, moluscos y peces) en este estudio. El grupo de crustáceos es el que más ha sido abordado por estos centros a través del financiamiento otorgado por el CONAHCYT.

Marine shrimps, with *Penaeus vannamei*, as the most important species, are the ones that gather the largest number of financed projects. Other species that have received funding are shrimps of the genus *Macrobrachium* and *Procambarus*, which are also native freshwater species. The first of these is of great socioeconomic importance on both sides of the country as it represents an artisanal fishing resource for riverside communities. The only exotic and invasive species that has received funding is the Australian lobster, *Cherax quadricarinatus*,

and it is only present in CIBNOR reports. In the case of this crustacean, native to Australia and New Guinea, its high invasive capacity has been demonstrated in Mexico and other countries (Rodríguez-Cruz *et al.*, 2023); however, it received support from CONAHCYT for various studies, although it is not the only exotic species (classified as invasive) whose projects have been financed. In the case of molluscs, there is a great variety of native species that have been the subject of research and financial support at CIBNOR and CICESE. However, *Crassostrea gigas* is the one that accumulates the most projects, an exotic Asian species and considered invasive in other countries (King *et al.*, 2021). Finally, the group of fish is also addressed in the three centers, with all native species, except for the projects directed at tilapia. Fish of African origin and that has been introduced in a large part of the country as an alternative for fishing and aquaculture (although the ecosystem effects of this introduction have not been properly studied).

Similar to what has happened with terrestrial animal species subject to production, many aquatic species have been introduced into areas outside their natural range of distribution, due to their ease of handling, adequate growth, and survival. Its efficient cultivation allows the generation of food and jobs for the aquaculture sector. Despite the economic and social benefits that, in fact, they provide, their dispersal in native ecosystems has caused disturbances that are of global concern (FAO, 2022). Although most of the native species that have been introduced to Mexico are species whose production is considered, in most cases, of high added value, there are others that were introduced to alleviate the nutritional deficit of rural communities. The greatest exponent of this is the tilapia, *Oreochromis niloticus*, introduced into Mexico in 1964, from the United States and kept at the Temascal Fish Station, Oaxaca (INAPESCA, 2018). The development of the cultivation of this exotic freshwater species has been such that in 2017 almost 150 thousand tons are reported, however, the apparent consumption is almost 276 thousand, so it must be imported from the largest producer in the world, China (Télez-Castañeda, 2019). Based on the foregoing, we assume, although we cannot confirm it, that both CIBNOR and CIAD addressed the study and cultivation of tilapia and, even more, gave their projects a high impact or social incidence.

In relation to social incidence, the three PRCs declare, on their official web pages, variants of the same manifesto: “*sustainable well-being of Mexican society, especially in its least favored and most vulnerable sectors*” (CIBNOR), “*contributes to generating the knowledge that can contribute to the solution of problems that affect the social and economic environment of Mexico*” (CICESE), “*contribute to sustainable development and the well-being of society*” (CIAD). However, if the projects with a real impact on social welfare (understood as improving the lives of vulnerable sectors) are evaluated, we find that they are few compared to the rest of the majority.

The Special Program for Science, Technology, and Innovation (PECITI) 2021-2024 of CONAHCYT, establishes the strategic bases of a humanities, science, technology and innovation policy that contributes to social well-being, environmental care and the protection of the biocultural wealth of Mexico (CONAHCYT 2023). In these bases, social impact or incidence is considered as one of the fundamental axes for the development of science. Considering the context and the evaluation required by the technology produced

in a CONAHCYT PRC, it is also necessary to reflect on whether this technological production has indirect impacts, including social incidence (Aguilar-Navarro, 2023).

In the case of the three PRCs, the research carried out with aquatic species is oriented by simple specific weight in the search for food sovereignty. According to Vázquez-Elorza (2023), one of the fundamental pillars of institutions is the recognition that the results of researchers have high levels of impact, especially in the generation of human resources, the transfer of knowledge and the generation of value in the search for food sovereignty. However, this same author mentions that in order to analyze the phenomenon of food insecurity, both internal and external factors must be taken into account, which makes this analysis complex. Among the factors that he identifies and that are related to this study are two that should be closely related: i) Production: Reduced levels of production, productivity and sustainability for national demand, ii) Science and research: Lack of projects focused on regional needs to address food insecurity. Aguilar-Navarro (2023) mentions that there are few studies dedicated to accurately determining whether technology developed by the PRCs has had a positive impact on reducing inequality gaps in the different regions of the country. In the PRCs included in this study, there are few projects that are characterized by having social incidence as the common thread. However, apparently it has begun to be an aspect that the centers are beginning to attend to, since the projects detected that involve it are more noticeable in their statistics.

The only project that could be detected in the information provided by the TUs, which includes a native fish in social incidence, is with *Seriola rivoliana*, Longfin yellowtail, at CIBNOR, which demonstrates the interest in transferring its culture technology to population groups traditionally vulnerable. All the remaining projects with evident social incidence, detected in CIBNOR and CIAD, are carried out with an exotic species: tilapia. It is worth asking if these centers will be able, in the immediate future, to increase projects with native aquatic species and with a clear social incidence.

## CONCLUSIONS

This investigation reveals that the CIBNOR, CICESE and CIAD TUs do not have organized information that can be transferred to the public in an orderly and simple manner. Based on the information provided, it has been possible to carry out an analysis of the projects directed to the investigation of aquatic species, financed by CONAHCYT. However, this study may not be complete due to the scant information managed by the TUs. All three centers have engaged in significant research with native species through funded projects. This demonstrates the clear interest in developing farming technologies for regional species. However, a good part of the budget granted by CONAHCYT has been for the investigation of exotic species with a proven invasive nature. There is a core of highly prestigious researchers who have been repeatedly benefited, some with very high budgets. The social incidence is barely perceptible in the projects proposed and financed by CONAHCYT and, for the most part, directed to the cultivation of tilapia, an exotic species, rather than native species, with only one registered project.

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