NUMBER 27
MAY. 2021

El Ifopino

IFOP INFORMATION BULLETIN

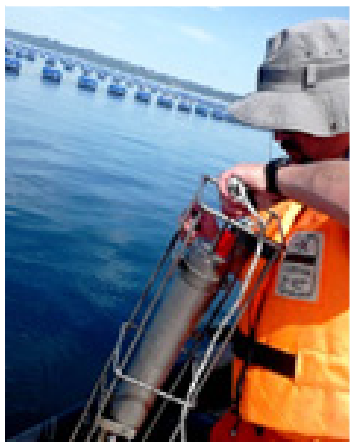
IN THIS NUMBER

IFOP celebrates its 57th anniversary

Fishing Development Institut , IFOP was created in 1964 by Production Promotion Corporation, CORFO, and National Fisheries Society, through an international technical assistance project in fisheries matters between Chilean Government, United Nations Program for Development, UNDP, and United Nations Organization for Agriculture, FAO.

Fisheries Development Institute (IFOP) strategic role is based on the ability to generate, develop and transfer useful knowledge, which allows our country to position itself, competitively and sustainably, in the aquaculture and fishing sector, especially due to its research of high public value.

Luis Parot Donoso Executive Director of IFOP explained “IFOP develops comprehensive consultancies for decision-making in Fisheries and Aquaculture and research projects on status and evaluation of sustainable exploitation strategies, estimation of total allowable quotas of resources of commercial interest, evaluation and monitoring of benthic resource management areas, hydrobiological health programs, environment, restocking and crops and an aquaculture and fisheries knowledge node with emphasis on digital preservation, access and visibility of knowledge.



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Thanks to IFOP's work, the State is offered with necessary information to manage and regulate resources capture, to establish an integrated management of fisheries, deploy a management model and technical assistance, develop sustainable aquaculture and fishing.

We are present from Arica to Puerto Williams, we have 10 regional headquarters and our scientific observers are in practically all the coves and ports of the country".

Pedro Alvarado Scientific Observer

Chile and IFOP accredited internationally their Scientific Observers Program

At the ninth Convention on South Pacific Ocean High Seas Fishing Resources Conservation and Management Commission (SPRFMO) meeting, IFOP / Chile Scientific Observer Program accreditation was formalized in this intergovernmental organization, whose action scope applies to Pacific Ocean international waters outside national jurisdiction areas, which together represent approximately a quarter of the high seas areas of the planet.

Erick Gaete, in charge of IFOP Fishing Promotion Institute's accreditation process, indicated that "this is an important milestone in terms of work carried out by IFOP over decades with its program of scientific observers for data collection. in ships, plants and fishing ports throughout the country, since established standards for this accreditation process are among the most modern and demanding worldwide, in terms of guaranteeing observers independence in their functions development, regulatory framework, work safety aspects, observers and instructors training and competencies, logistics and administrative support program structure, as well as periodic reviews of recorded data processes and validations, all of them aspects exhaustively evaluated / reviewed by MRAG Ltda company. (United Kingdom), winner of the international lease to execute reviews and evaluations processes of different observer programs of member or cooperating states that opt for this specific accreditation".

"Along with Chile, Australia and New Zealand participated in this process, which also successfully accredited their national observer programs, and it should also be noted that, from 2024, when they carry out fishing activities in the convention area, the 15 member countries and 3 collaborating states may only deploy program observers or providers (of observers) accredited to SPRFMO. The foregoing in order to be able to comply with different coverage requirements established for fisheries that are carried out there ", Erick Gaete explained.

Leonardo Caballero, IFOP Sampling Management Department Head, pointed out that South Pacific High Seas Regional Organization for Fisheries Administration (ORP-PS) is an intergovernmental organization that was created in November 2009 and was officially iforced on August 24th, 2012. Its mission and commitment is the conservation and long-term sustainable use of fishery resources and marine ecosystems protection and its main commercial resources caught in the area are horse mackerel and giant squid in the Pacific southeastern and deep-sea species associated with seamounts in the southwestern Pacific.

Through time, Chile has been a pioneer in certain fishery resources care and conservation matters and

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was one of international RFMO-PS treaty promoters. It also has a scientific observers staff on board with knowledge, trajectory and experience, suitable to carry out biological-fishery samplings that are required in fishery.

The EEZ area was recognized and approved as such in 1982 by United Nations Law of the Sea Convention (UNCLOS) and came into force in 1994 after years of negotiations that began in the 1950s. Chile , Ecuador and Peru, signed the Maritime Zone Declaration, known as Santiago de Chile Declaration on August 18th, 1952, within Conference on the Exploitation and Conservation of the Maritime Riches of the South Pacific framework in which they proclaimed " exclusive sovereignty and jurisdiction that each of them corresponds to over the sea that bathes the coasts of their respective countries, up to a minimum distance of 200 nautical miles from the aforementioned coasts ". Subsequently, other countries extended their territorial seas to 12 nautical miles.

This founding document signing gave rise to South Pacific Permanent Commission (CPPS), to which Colombia later joined in 1979. All these intergovernmental organizations and concepts of conservation and sustainable use at international level, year after year is consolidatig.

Luis Cocas, in charge of the process by Undersecretariat of Fisheries and Aquaculture explained that "for our country it is a great achievement to have obtained this accreditation because Chile was one of the main promoters of SPRFMO measure that established the Observer Program since its origins, as well as demands that made it one of the highest standards on the planet in matters of security, training and information quality. This measure contains 3 annexes that establish; 1) observers minimum standards, including broad rights and duties that recognize their work importance, 2) fishing operators, captains, and crew members duties and rights to ensure sampling work in an environment of respect and safety, and 3) minimum standards for accreditation of programs under SPRFMO. This last annex contains 13 subjects against which the national program was evaluated and describes standards of Impartiality, Independence and Integrity, qualifications and training, data validation process, coordination and shipment, security teams, dispute resolution and security, among others, all successfully approved by the Chilean scientific observer program that is administered by IFOP.

IFOP investigates ichthyotoxic microalgae *Heterosigma akashiwo* Flowering in Comau fjord, April 2021

Within FIPA 2020-08 " Inactivation techniques validation for main FANs causing microalgae project "framework. Dr. Jorge Mardones and his team made up by Dr. Javier Paredes and Juan Carlos Unión from CREAN-IFOP. They carried out research work sampling and experimentation during ichthyotoxic raphidophyte microalgae Heterosigma akashiwo intense flowering, in Comau fjord between April 4th and 6th, 2021. In situ work contemplated water column physical-chemical characterization (salinity, temperature, oxygen dissolved and fluorescence) and bubble curtainsevaluation as mitigation measures for toxic microalgae through high repetition rate fluorometry experimental use (FRRf).

Post-event currently being conducted research include:

1) *H. akashiwo* isolation and culture,
2) Measurement of ichthyotoxic flowering potential by using a bio essay with branchial cell lines.
3) Nutrient analysis,
4) HPLC photosynthetic pigments determination
5) Metagenomic evaluation of microbial assembly present in bloom. Among in situ observations

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high cell abundance observed under the light microscope

(Photos: Jorge I. Mardones).

"Brown" patch caused by the high cellular aggregation of H. akashiwo in the Comau fjord

made by the team, H. akashiwo (max. 70,000 cells / mL) high abundance stands out, with a monospecific and highly concentrated character in the first 5 meters of water column, especially in coastal zone. East of the fjord, in patches of hundreds of meters, potentially associated with water retention zones, said Dr. Mardones.

Possible causes

Regarding causes that originated the phenomenon, it should be noted that Comau fjord presents a high water retention, as recently published by our working group in Science of the Total Environment (Disentangling the enviromental processes responsible for the world's largest farmed- fish killing harmful algal Bloom: Chile, 2016) journal, which means that "what enters" this fjord "stays" there for a long time.

It is vitally important that this type of oceanographic condition of several fjords in northern Patagonia (eg, Comau, Reloncaví and Puyuhuapi) is related to rainfall decrease in the area, with temperature increase and nutrients exogenous income.

Scientific advances in our country in this matter are low, so it is necessary that there be awareness of the problem's urgency and more funds be invested in multidisciplinary research of Harmful Algal Blooms (HABs) that are affecting in more intense and frequent in southern Chile.

The interest in research to better understand marine ecosystems should be everyone's concern and is the way to correct mistakes and develop a more friendly and environmentally friendly aquaculture.

Comau fjord work conditions during COVID-19 quarantine period in Hualaihué city were difficult, so IFOP 's team is grateful for CERMAQ company logistical support which facilitated its land site in "Caleta Soledad "for sampling and experimentation operations.

IFOP and Explora Valparaíso launch short capsules to broadcast marine scientific research

It is about "Science to protect the sea", a campaign made up of audiovisual content with sign language, which seeks to bring the ocean closer to all citizens.

Fisheries Development Institute and Explora Valparaíso Project, wich belong to the Science, Technology, Knowledge and Innovation Ministry, launched through their social networks "Science to protect the sea", animated content in which scientific research that It is carried out in Chile and in the Valparaíso Region for the protection of the oceans and marine species is broadcasted.

Luis Parot Donoso, Fisheries Development Institute Executive Director, explained: for us to be part of this important campaign is a source of pride, since it allows us in the month of the sea to bring the ocean closer to the entire community, the capsules show IFOP performed fishing and aquaculture research, teaches in a fun and didactic way, the importance of protecting our

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marine resources and invites us to raise awareness about our ocean care.

The project, which had previously been released in billboards format in Valparaíso Metro train stations, has now been adapted to an audiovisual format and with sign language, in order to reach different audiences and be shared with all citizens. In this way, each of the nine capsules that make up "Science to protect the sea" lasts an average of a minute and a half and in them you can learn about the work carried out by specialists from various scientific areas to understand marine species behavior and to get toknow details of its reproduction and distribution, in order to promote ocean care and responsible fishing.

For Mabel Keller, Explora ValparaísoDirector, with this type of content "we seek to share knowledge with people of different ages in order to bring science closer to everyone", Keller also points out that "as a Project we seek to strengthen scientific culture in Valparaíso's Region, and in order to approach this products creation such as this campaign become key issues, in which, thanks to design, playful format and animation, we manage to bring together diverse knowledge in a creative and understandable way for all audiences ".

It should be noted that, to carry out presented contents, the campaign was coordinated by Explora Valparaíso team and researchers team work from Fisheries Development Institute, and its design team. Likewise, contents were animated by Alias Film production company.

Find "Science to protect the sea" capsules and more scientific resources by following the social networks @exploravalpo and @ifop_periodista on Facebook, Twitter and Instagram.

IFOP-SOFAR Strategic Alliance allows smart buoys deployment to measure waves, temperature, currents and wind

Fisheries Development Institute (IFOP) made a strategic alliance with Sofar Ocean (Sofar) to deploy Drift Marine Buoys in national waters for waves measurementss and currents estimation. The first shipment of 10 buoys was received at IFOP's offices in Valparaíso, by Hernán Reyes, Oceanography section chief, who explained "then they will be shipped and deployed on Abate Molina Research Vessel. The buoys are part of an oceanographic study sponsored by the US Naval Research Office (ONR) and once launched, Sofar will share wave and wind data from its global network of buoys ".

These buoys will be deployed along the Chilean coast in Acoustic and Bioceanographic cruises carried out by the Oceanography Department (DOMA) and IFOP's Fisheries Research Division Direct Assessments Department . These drift buoys will mainly send wave and trajectory data using satellite communication and are part of IFOP developed actions to monitor Climatic Change with the aim of contributing to fisheries and aquaculture sustainability.

Brad Parks, Olaunu Vice President and consultant with EDF, explained that "innovative characteristics of miniaturized components, sensors as well as the materials with

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which they are built, make these buoys optimal to contribute to research data requirements. National and international associated with Climatic Change warning systems and monitoring. This type of low-cost, scientific-quality instrument will provide data that will allow monitoring the ocean's surface state as well as feeding and validating numerical models that generate future projections ".

Sebastien Boulay, Sofar Business Development Director, indicated that "these buoys will be part of Sofar Ocean's real-time ocean intelligence platform, which is powered by thousands of offshore and coastal drift buoys that cover the oceans of the world and that provide real time data on waves, wind, temperature, currents ".

Dr. Letelier, Fisheries Development Institute head of DOMA, revealed that "particular indicators derived from data from these buoys in South East Pacific will contribute unique data to Climatic Change data monitoring and visualization system, prototype system built on the project basis "Interoperable Information System, which systematizes and integrates fishing, aquaculture and climatic change data" (www.ifop.cl) ".

Sergio Palma Silva, EDF Océanos Chile Senior Manager, stated that "this strategic alliance allows the incorporation of new and unique information to climatic change monitoring system that IFOP is developing and that together are a key national piece in the" Alert System, Prediction and Observation (SAPO) for fisheries resilient to climatic change in Humboldt Current Great Marine Ecosystem "which, coordinated by EDF, is being built by IMARPE from Peru, INP from Ecuador and IFOP from Chile; with the aim of positioning Science as a key actor for decision-making and in various public policies development regarding fisheries management and mitigation and adaptation alternatives for climatic change, where technological Systemsare are part of social and economic challenges

Didymo the invasive microalgae that is here to stay

Today, Friday May 7th, webinar "Invasive Exotic Species: from a comprehensive view" is held, organized by Sernapesca, in which Dr. Alejandra Oyanedel, from the Fisheries Development Institute (IFOP) participates with the talk Didymo la microalga invader that is here to stay.

Dr. Oyanedel explained "Didymosphenia geminata, commonly called 'didymo' or 'rock mucus', is an invasive exotic microalgae that proliferates rapidly and develops massive blooms in rivers and lakes that have a low nutrient load. In this way, this microalgae can affect large areas of the aquatic habitat through the formation of a dense cover of yellowish brown or whitish color, cottony in appearance and resistant to the touch, which strongly alters trophic webs, reproduction in fish, value aesthetic of the landscape, impoverishing freshwater diversity on a local and regional scale, thus constituting an environmental problem that requires attention.

Didymo was recorded for the first time in 2010 in a river system in southern Chile. After its detection, it was declared a pest species by the Undersecretary of Fisheries and Aquaculture in attention to the S.D. (MINECON) N ° 345 of 2005. Since then, a constant prospecting and monitoring activity has been maintained, in addition to various dissemination campaigns aimed at preventing the spread of the plague to new bodies of water. Since the end of 2016, Fishing Development Institute (IFOP) executes a program called " Plague species Didymosphenia geminata monitoring in water bodies of central, southern and southern Chile" that allows knowing updated geographical distribution of this invasive microalgae, the effects on other biological components and allows to investigate its relationship with environmental variables at different spatial scales ".

"IFOP's monitoring is based on samplings carried out twice a year, covering rivers and lakes located between the Maule and Magallanes regions. Part of the findings on the presence of Didymo were included in Exempt Resolution No. 719/2021 (SUBPESCA) which reports 109 subsubbasins in the Plague category (ie with the presence of didymo in benthos) and 18 subsubbasins in the Plague Risk category. (ie with the presence of

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Dra. Alejandra Oyanedel

didymo in the water column). In addition, based on the most up-to-date information generated by IFOP, which will be included in the next Pest Areas Declaration, it shows that didymo is found in 24 new sub-basins, adding a total of 151 sub-basins in the country that present this pest, the which are located along a latitudinal range of approximately 2000 km, where there is great environmental variability, different degrees of anthropogenic disturbances, and also affecting some units of the State Protected Areas System", explained the IFOP professional.

"Given this species current distribution, its potential to invade new aquatic systems and that it is a pest, the actions that tend to prevent its dispersal become relevant. All the people who use the water for the development of recreation, research, productive and subsistence activities, must apply basic biosecurity measures: remove, wash and dry, indicated by SERNAPESCA. Especially if people have the ability to move to different systems, distant and in a short time. Additionally, it is advisable to use PVC wading boots without textile non-stick as they allow efficient washing with chlorinated solutions and rapid drying, simultaneously preventing the didymo cells from being lodged in the fibers and being transported to other pest-free systems. It is also recommended to use a commercial detergent and bleach solution, rigid plastic brushes for washing, and to rinse all implements with clean water. Finally, people are urged to consult which rivers and lakes are contained in the declarations of plague areas, to observe their surroundings and to report the presence of this plague", explained Oyanedel.

Abate Molina Scientific Ship set sail to investigate anchovy and common sardine

On May 8th, with a crew of 27 people, Fisheries Development Institute's Abate Molina Scientific Vessel set sail from Valparaíso's Port to evaluate and characterize anchovy and common sardine stock resources present between the regions of Valparaíso and Los Lagos, through hydroacoustic method, during maximum recruitment period and immediate fall.

In this scientific journey, the ship's captain is Takashi Abe and as cruise's head is fishing engineer Álvaro Saavedra.

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Specific objectives

- To estimate anchovy and common sardine resources stock's size and their spatial distribution in maximum recruitment period to fishery present in researched area.
- To characterize and analyze in a spatio-temporal context, demographic composition and its interannual variation of evaluated stocks by biological indicators means.
- To characterize and analyze bio-oceanographic conditions present in the study area and their relationship with spatial resources distribution.
- To characterize anchovy and common sardine resources aggregations in researched area.
- To determinate stomach content and to characterize common sardine and anchovy specimens trophic behavior in the study area and period.

Ecological information gathering to advance fisheries ecosystemic management based on; Integrated anchovy's trophic behavior analysis oriented to key species classification of low trophic level, according to MSC standard.

https://www.ifop.cl/buques-cientificos-chilenos/

Setting sail for fisheries and aquaculture adaptation to climatic change

Climatic change is an ongoing process that is affecting our planet, in which marine ecosystems cover more than 70% of surface. Temperature's increase, dissolved oxygen and seawater acidification decrease, as well as extreme events such as storm surges and El Niño intensification, are examples of threats to these ecosystems and services they generate. Among the latter, fishing and aquaculture stand out, which will have to face risks of lower landing, variables, new fishing resources appearance , geographical displacement or lower harvests in farming centers. In this scenario, the most vulnerable sectors are coastal communities associated with artisanal fishing and small-scale aquaculture. In Chile, there is consensus at national level that the best strategy to face climatic change consequences is preparation or adaptation of potentially affected communities based on scientific data.

In the context described, from 2017 to June 2021, " Climatic change Strengthening adaptation capacity in Chilean fishing and aquaculture sector" carried out project, executed by Fisheries and Aquaculture Undersecretariat (SUBPESCA) and Ministry of Environment (MMA), and implemented by United Nations Food and Agriculture Organization (FAO), with Global Environment Facility (GEF) funding.

The main objective of this initiative was to reduce vulnerability and increase the capacity to adapt to climate change in the artisanal fisheries and small-scale aquaculture sector.

The Project addressed three areas of action: (i) public and private institutional capacities strengthening in order to support fishing and aquaculture adaptation process (ii) Adaptation capacity of artisanal fishing and small-scale aquaculture improvement through pilot initiatives; and (iii) strengthening knowledge and awareness about climatic change in fishing and aquaculture communities in order to integrate them into fishing and aquaculture adaptation process.

The adaptation actions were implemented in four pilot coves: Riquelme in Tarapacá, Tongoy in Coquimbo, Co-

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liumo in Biobío and El Manzano-Hualaihué in Los Lagos.

Below are some examples of initiatives implemented at pilot sites.

In Caleta Riquelme, a development of special interest tourism strategy and action plan was prepared, with a focus on environment and sustainability integration in activities. Ricardo Williamson, Caleta Riquelme Corporation president, points out “we see in tourism an alternative to adapt to climatic change and for this we need public and private sectors collaboration. We already have an interior tour that gives an account of our cultural and natural heritage and thanks to Ministry of Economy, Enviroment, SERNATUR, fishing companies and port, we beautify the cove façade”.

In Caleta Tongoy, stands out the first experience developed by women cultivating Japanese oysters (Crassostrea gigas). With this practice, this group of fisherwomen began in aquaculture, an activity carried out mainly by men in the cove. This initiative was a success, in addition to cultivating the resource, they innovated adding value through the production of canned oysters, all this was the basis for this group of women to become a Cooperative with the aim of continuing to develop the activity and scale it commercially. Devora García, said “It was not easy, but we managed to carry out the project, it was a new experience. Today we can think of transforming this knowledge into a stable source of work with oyster farming, which fills us with pride and creates new challenges for the future ”.

In Caleta Coliumo, Eric Torres Colla, a young fisherman with his family dedicated to extracting sardines, has seen seasonal changes and a decrease in the resource over time, which could be explained by overfishing and behavior facing environmental and climatic variability. Eric comments: “every time fees are smaller and seasons are more variable and last longer. We prepare for the future. We began to diversify with my brother Victor. Today, with the adaptation approach and added value practices given to us through the project , many of us already produce saw, pippin and other smoked products. This opens up a range of opportunities for us to generate local identity products ”.

In Caleta El Manzano-Hualaihué, institutional and public capacities strengthening , and training on climatic change are highlighted. Alejandro Naiman hake fisherman and local leader comments on governance: “neighborhood councils, school, indigenous communities, unions, federation, Zonal Directorate are involved, we are a complete team that is taking interest and finding an explanation for what we could not, together with perseverance to achieve the goal of understanding that climatic change is here to stay, even if we don’t like it and hopefully it will continue, giving girls and boys the chance to get involved in the issue “.

This pioneering initiative at the country level has revealed coastal communities vulnerability to climatic change, promoting an adaptation approach in decision-making and incorporating this variable in public policies design and implementation. Likewise, it has managed pilot experiences of productive diversification, strengthening artisanal fishing sector and small-scale aquaculture adaptation capacity facing climatic change effects. Thus, results and products of the Project complement different public policies aimed

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at promoting artisanal fishing and small-scale aquaculture integral and sustainable development .

At the national level, stands out an Institutional Training Program implementation on adaptation to climatic change in fishing and aquaculture, led by COPAS Sur-Austral Center of Universidad de Concepción (UdeC). During the development of the Program, seven workshops were held, with 130 experts participation ; Likewise, 8 workshops were held with authorities and decision makers, adding a total attendance of 122 participants; In addition, a blended course / Diploma of 204 pedagogical hours was carried out, aimed at public officials linked to 15 public institutions that participated, in one way or another, in fisheries and aquaculture management, reaching a total of 172 students who they finished the course.

On the other hand, within the national project framework, Fisheries Development Institute (IFOP) was entrusted with the task of designing an "Interoperable Information System that systematizes and integrates fishing, aquaculture and climatic change data", however IFOP team's experience , led by Dr. Jaime Letelier, was such that they managed to go beyond requirements, arriving at a "functional prototype" linked to a restructured institutional database, which has the contribution of data from the Navy Hydrographic and Oceanographic Service (SHOA), Navy Meteorological Service (SERVIMET), Meteorological Directorate of Chile (DMC) and the National Fisheries Service (SERNAPESCA). This platform allows artisanal fishermen between Ecuador and the Magallanes region to obtain daily information on Sea Surface Temperature and the concentration of sea surface chlorophyll, to direct their fishing operations or make decisions regarding their coastal activities. On the other hand, the system also makes it possible to monitor long-term trends of environmental variables and indicators that characterize main national ecosystems and fishing resources that inhabit them so that the sectoral authority seeks the sustainability of the fishing resources and their ecosystems, therefore, the sustainability of artisanal fishing and small-scale aquaculture.

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