

**Ministry of External Trade and Foreign Investment
Havana
Cuba**

**Royal Norwegian Embassy
Havana
Cuba**

PROJECT DOCUMENT

Development of Sustainable Marine Aquaculture in Cuba

**Phase 2 (2010-14) of the Cuban - Norwegian cooperation in Aquaculture,
a follow-up to the project
“Competence building and development of mariculture 2003-2005”**

A cooperation project between

MINCEX , Ministry of External Trade and Foreign Investment
Havana, Cuba

and

Norad, Norwegian Agency for Development Cooperation
Oslo, Norway

to be implemented by the continued cooperation of

Centro de Investigaciones Pesqueras, Havana, Cuba
and

Centre for Development Co-Operation in Fisheries/ Institute of Marine Research,
Bergen, Norway

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EXECUTIVE SUMMARY

Cuba and Norway has previously cooperated in a 3-year project ‘Competence building and development of mariculture’ implemented by Centro de Investigaciones Pesqueras, Havana, Cuba and Centre for Development Co-Operation in Fisheries at the Institute of Marine Research, Bergen, Norway. This project was completed by the end of 2006. The main project achievement was the building of new scientific and technical competence related to farming of marine fish. CIP has now a core group of researchers and technicians capable of conducting experiments aimed at developing methods for marine fish farming. A comprehensive process of evaluation resulted in selecting cobia (*Rachycentron canadum*) as the most suitable fish species for mariculture in Cuba.

Now a new project is proposed. This project is designed on the basis of development priorities determined by Ministerio de la Industria Alimentaria and Centro de Investigaciones Pesqueras of Cuba and with a view to facilitate the development by contributing special competence and equipment available in Norway.

The development objective is: *Increased Cuban production of local marine fish species by using reliable, environmentally sustainable aquaculture methods to achieve maximum benefits for the country and for the region as a whole.*

The immediate objectives (purposes) of the Project are:

- Establish a sustainable on-growth production at a semi-commercial scale of cobia (*Rachycentron canadum*) in sea cages from juvenile size to full market size following procurement of operational equipment
- Establish basic handling and primary processing technology for cobia
- Evaluate economic, market and value chain aspects
- Provide the produced fish to the market
- Use any sales revenues for the further development of the production line
- Competence building of Project members and students in marine aquaculture
- Established suitable aquaculture protocols (complete life cycle) for marine finfish production in general
- Established a first small production of healthy juveniles of cobia following building of a small-scale, demo hatchery in a new attachment to the biological station

A project of this kind will support and supplement the national effort to develop aquaculture in Cuba and has been given a high priority by Cuban authorities.

In accordance with these objectives a pilot big cage farm should be installed on site in Cuba in compliance with the condition at the site and a transfer of operational knowledge should be undertaken enabling Centro de Investigaciones Pesqueras (CIP) to master big cage farming of cobia.

It is a clear aim to produce cobia, harvest, process and sell fish or fish fillets. CIP need assistance in handling these steps when doing it for the first time for a marine, aquaculture fish species.

It is also an aim to start building up Cuban competence producing cobia fry for later stockings of the pilot farm as well as a support to new Cuban farms.

The results obtained from the pilot activities will be transferred to the national aquaculture industry to facilitate expansion of cobia farming. Thus, the pilot farm will be used as a training centre in these respects.

The practical activities situated in Cuba will be supported by competence building activities and hence Cuban fisheries biologists should undertake master and/or PhD programs.

It is important for Cuba that the regulatory framework is modified along with the introduction of modern farming. Hence it is planned to have a seminar in Cuba covering fish health, environmental aspects as well as the general regulatory framework for modern cage culture.

The sales revenue from the farm harvest will be used for the benefit of the further project development. Cuba will use the pilot facilities as a key aquaculture centre after closure of the Cuban-Norwegian cooperation project. This shall ensure the sustainability of the project initiative.

Project indicators are elaborated as well as the means of verification of such indicators. A list of key risk factors and ways of mitigating such risk is also developed.

The present project will have an external contribution financed by the Fund for the Cooperation of the Norwegian Embassy in Cuba for a total of 16.7 million NOK (2.3 million CUC, i.e. convertible Cuban pesos (“convertibles”). The Cuban part will contribute 230 665 CUP (Cuban pesos) and 36 927 CUC altogether, approximately 350 000 NOK. The budgetary details are specified later on in the present document.

For the development of the project, Centre for Development Co-Operation in Fisheries will be related with Centro de Investigaciones Pesqueras as the official partner and executioner for the development of the present project.

The duration of the project will be 4 years starting when receiving the funds to contribute by the foreign partner. The project will be take place in areas of Centro de Investigaciones Pesqueras, located in Havana City and its Experimental Station located in Mariel, La Habana province, or alternatively at the Boca Ambuila Station, located in Cienfuegos province, as well as in facilities of the IMR in Norway. The direct beneficiaries are the staff of research scientists and technicians at Centro de Investigaciones Pesqueras linked closely to the work related with fish culture.

BACKGROUND

Previous cooperation

The 3-year project 'Competence building and development of mariculture' between CIP and IMR was completed by the end of 2005, except for studies by two Master students, one at the University of Bergen and one at the University of Tromsø who finished their degree on time in June 2006. The project received a total grant of NOK 3 millions (about 430 000 CUC) from the Norwegian Agency for Development Cooperation (Norad) and the Government of Cuba provided a considerable input by means of manpower and logistics.

The main project achievement was the building of new scientific and technical competence related to farming of marine fish. CIP has now a core group of researchers and technicians capable of conducting experiments aimed at developing methods for marine fish farming.

A comprehensive process of evaluation resulted in selecting cobia (*Rachycentron canadum*) as the most suitable fish species for mariculture in Cuba.

Practical training was given at the CIP's station at Boca Ambuila, partly upgraded through the project. Boca Ambuila is located close to Cienfuegos City.

A series of workshops were held during the project period, which great attendance on the Cuban side as well as from neighbouring countries. An extensive mariculture report was published including both Cuban and Norwegian contributions. Courses in English and teaching of students formed also parts of the project activities.

Members from CIP visited IMR Austevoll research station to gain hands-on knowledge of hatchery protocols.

The project met all the deliverables as agreed upon in contracts, except for the arrangement of a workshop in marketing which the parties felt would be more appropriate to include at a later stage. Thus, this project focused more on the aquaculture production as such although not ending up with a *physical* production line for cobia.

Cuban Aquaculture

The total annual marine catch in Cuba is about 23 000 tons of which finfish accounts for about 60%. Any increase in the supply of fish and shellfish must come from aquaculture. This was reflected in the strategic plan of the former Ministry of Fisheries. The aquaculture in fresh water will mainly be aimed at producing lower cost fish for domestic consumption, while the marine aquaculture will be directed towards producing high value products such as shellfish and certain finfish for export or the local tourist industry.

The development of fresh water aquaculture in Cuba began in the 1960s with the support of the former Soviet Union. The main species at that time were carp (*Cyprinus carpio*) and silver carp (*Hypophthalmichthys molitrix*). In the 1970s tilapia and American cat fish (*Ictalurus punctatus*) was introduced. In 2000 the African cat fish (*Clarias gariepinus*) was introduced too. Today more than 1 000 ha of earth ponds are used for this type of fish cultivation. The Cuban shrimp aquaculture has been in operation for more than 20 years producing the species *Litopenaeus schmitti* and from 2003 *Litopenaeus vannamei*. Today 2267 ha are in use with 8 to 10 ha earthen ponds and two hatcheries for seed production. The average production in the last years was 4 000 tons with yields of 800 kg/ha approximately. At this moment, all the food needed for shrimp aquaculture is imported.

Cuba has good insight in the biology of local marine species, especially snappers (lane snapper, mutton snapper, yellowtail snapper) (*Lutjanus* spp.) and their reproduction and broodstock management (see below). There is also some experience in broodstock management of snook (*Centropomus undecimalis*) (see below). Some pilot studies have been conducted on mullets (*Mugil cephalus*) regarding spawning, growth and polyculture with shrimps. Juveniles of yellowfin mojarra (*Gerres cinereus*) have been produced in large numbers.

Mangrove oyster (*Crassostrea rizophorae*) has been cultivated at an industrial level by traditional farming, i.e., collecting seed from the wild (mangrove branches) and on-growth in the sea. In the 1980s artificial seed production techniques were developed and three hatcheries were constructed for the purpose. Production was stopped after 1995 due financial problems but today there is again a production of cultivated mangrove oyster.

'Exotic species' have been brought to and studied in Cuba. An example is the work on red drum (*Sciaenops ocellata*). Eggs were introduced and the fish cultivated until commercial size (500 – 1 000 g). Also, there was an introduction of sea bass and sea bream juveniles for further on-growth until commercial size (more than 500 g) in cages. This was undertaken by a commercial enterprise with hatchery, cages and industrial facilities located in the Granma province (east Cuba).

Fisheries activities in Cuba including aquaculture is carried out by three managerial groups of Ministry de la Industria Alimentaria (MINAL):

INDIPES: This group consists of 22 enterprises, located throughout the country with 11 400 workers with the aims: 1) Culture, catch and freshwater fishes processing; 2) Industrialization of canned, fresh and frozen foods, and 3) Sales to the internal market in CUC.

PESCACUBA: This group has 12 900 workers in 16 enterprises in all parts of the country. The ones that are dedicated to marine aquaculture are: PESCAHABANA (La Habana Province), EPICIEN (Cienfuegos Province), EPISAN (Sancti Spíritus Province), EPIGRAN and EPINIQ (Granma Province). Their activities are capture and processing of lobster, sea shrimp, fish and other species that represent the main source of exportable funds of the fishing sector. Recently, this group has incorporated to its objectives the culture of species in the sea.

GEDECAM: This group has 1 550 workers that employed at different places to culture and process shrimps held in sea water. Their enterprises are: Yaguacam (Cienfuegos Province), Cultizaza (Sancti Spíritus Province), Cultisur (Camagüey Province), Sanros (Las Tunas Province), Guajaca (Holgín Province) and Calisur (Granma Province).

Fig. 1. Sites for aquaculture; Cabañas and Mariel near Havana

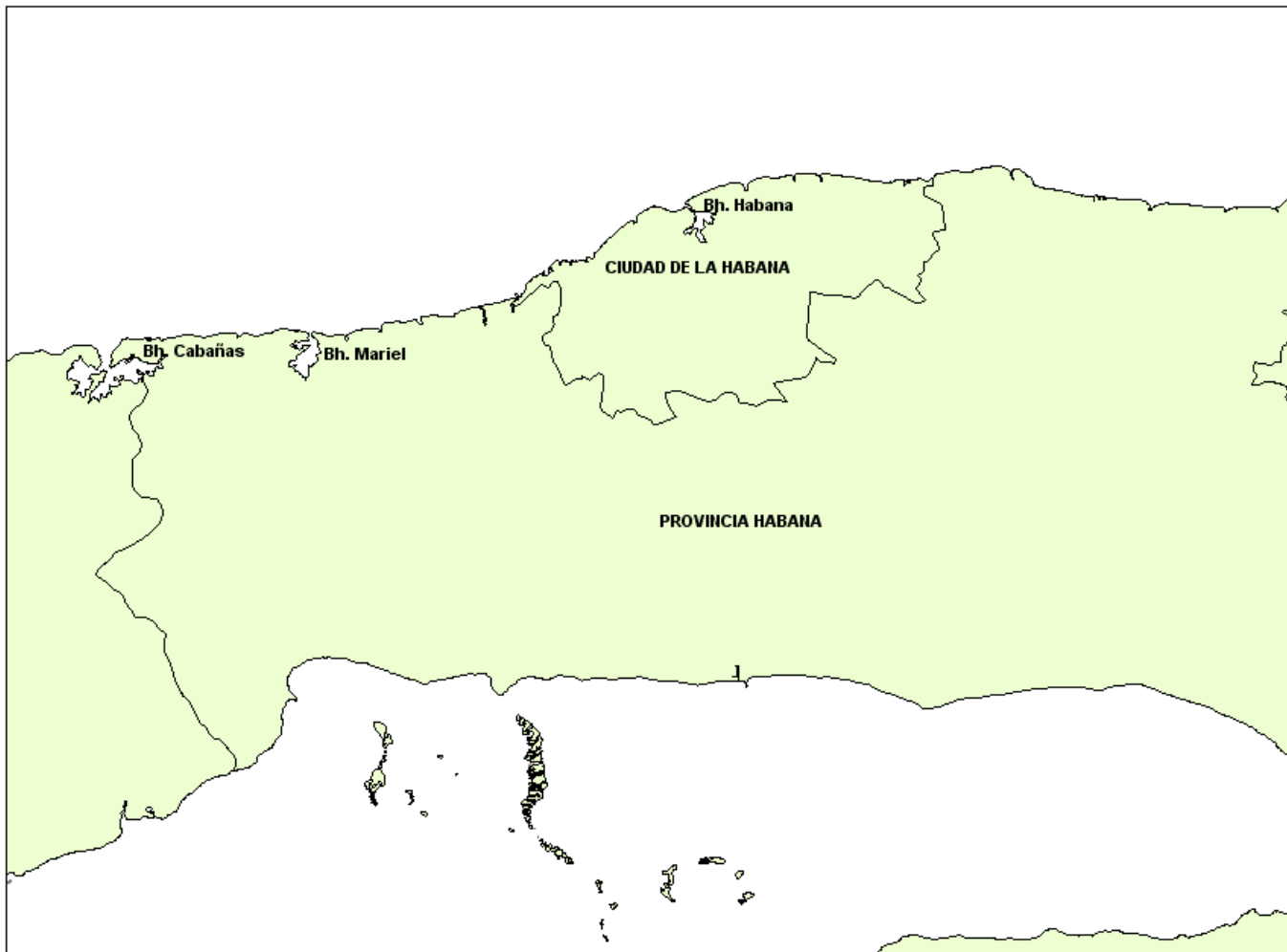


Fig. 2. Sites for aquaculture: Boca Ambuila Station and Cienfuegos Bay.



PARTNER DESCRIPTION

Ministerio del Comercio Exterior y la Inversión Extranjera (MINCEX)

This Ministry has been given the role to follow up political statements of the State and the Government in the fields of foreigner investments and economic cooperation to strengthen the economic and social development of Cuba. Thus, it is the official body of the Government of Cuba in international cooperation with FAO, other multilaterale organisms, governments (to form bilaterale agreements) and NGOs, all within the field of economic cooperation.

There is a system of avoiding tariffs and customs to be charged co-operation programmes. Besides co-operation programmes and financial transfers, MINCEX is responsible for foreign personnel in Cuba. MINCEX also assures that separate bank accounts will be opened for different projects and handled either by the Cuba side, the Norwegian side or both in co-operation. Necessary administrative issues such as work permits, establishment of bank accounts etc. will be taken care of by the Ministry and the Ministry will act as a connecting point for the co-operating parties.

Ministerio de la Industria Alimentaria (MINAL)

MINAL is the body in charge of executing the rules of the State and of the Government in terms of development of the alimentary industry, including the branch of drinks and liquors, as well as research investigations, cultivation, processing and commercialization of all fishing resources. The industry is organized into production enterprises within different areas with delegated control of most day-to-day productive activities and services. Each of these organizations again consists of a number of sub-organizations with responsibility of special operation or services.

This Ministry contains a 'Direction of International Relations' which, among its different roles, focuses on the successful implementation of co-operative projects with external partners.

Centro de Investigaciones Pesqueras (CIP)

CIP is a research centre under MINAL. Its main objective is to do research and offer scientific services and make technological transfers in management, cultivation and industrial processing of aquatic organisms, and supporting socio-economic gains on sustainable criteria, based on a high quality system.

The centre was re-established in 1959 and counts today 250 employees. Of the main activities it can be mentioned that CIP is doing stock assessment of the various marine resources and that it is involved in programs for the protection of endangered species like the sea turtle. For aquaculture CIP is involved in programmes to develop and improve the bio-technical marine culture as well as health management. Other important programmes are within the field of developing and improving industrial processing as well as capturing technologies.

The general competence building in all fisheries and cultivation related fields as well as scientific and technical information services are central topics for CIP. These comprise activities such as analysis and preparation of fisheries products, ecotoxicology, sanitary certification and quarantines, general documentation on aquaculture, fisheries and industrial processing and diagnosis of the status of the marine resources.

The present research programs are:

- Integral study for marine shrimp exploitation in Cuba
- Integral management for lobster exploitation in Cuba
- Management of fin fishes and other marine resources of commercial interest
- Development of mariculture
- Development, improvement, and innovation of scientific and technical services in the fishing industry
- Food quality control and aquaculture sanity

The 250 workers of CIP are grouped into these staff categories: 49 research scientists, 80 technicians, 20 'scientific reserves' and 81 administrative staff members as well as others.

CIP has nine laboratories: Molecular Biology, Sensorial Analysis, Microbiology, Food Chemistry, Hydro-chemistry, Histopathology, Parasitology, Bacteriology, Hematology and Hemochemistry and Bioassays. Other facilities are Computer Center, two classrooms, a lecture hall, a library, two boats and three mariculture experimental stations located at Santa Cruz del Sur, Boca Ambuila and Mariel (Mosquito).

Due to its present interest, the Marine Culture Division (División de Camaronicultura y Otros Cultivos) is described in more detail below:

The Marine Culture Division focuses on two research topics: shrimp culture and marine finfish culture. Shrimps and their productivity in captivity have been studied since the early 1970s, while studies of marine fish in aquaculture have recently been initiated.

The division has in total 82 employees including staff at the three biological stations. The main research activity within the division is related to shrimp culture, including live food methods, nutritional aspects, environmental impacts, food processing and harvesting techniques. CIP is a reference laboratory in Cuba for micro-algae (houses a standing stock of 30 species). All cultured shrimps in Cuba today are produced in a semi-intensive way (see above), while the goal is to switch to intensive systems (using more productive ponds of 5, 3 and 2 hectares). Feed costs are very high, about 70 % of the total budget for the farm. The feed is mainly imported from Mexico. There are plans to increase the local production of feed including the replacement of fish oil with soya.

For marine finfish culture, CIP has until now selected two local species as candidates in addition to cobia, namely common snook (In Spanish: robalo) and mutton snapper (In Spanish: pargo) (see above). Both get a good price in the market. Live individuals of pargo have been brought from the sea to the laboratory to be broodstock in future experiments. Pargo produces small larvae and is generally more fragile to handling than robalo, and thus would require more specialized conditions. Robalo is naturally adapted to large environmental fluctuations, including in salinity, and can reach large sizes. JICA (Japanese Development Agency) is presently funding a five-year project at Santa Cruz del Sur, east Cuba, totally 1.5 mill. CUC (1 CUC = 0.8 US\$). The project has been on-going for about one year but the station was recently destroyed by a tropical storm. So far no eggs/larvae have been produced (hormonal injections are required to make the adult female spawn) but the Japanese research scientists are very dedicated to the job and are experts in their field, and, not at least, stay in Cuba for 4-6 month each time and speak Spanish fluently.

Institute of Marine Research (IMR)/ Centre for Development Cooperation in Fisheries (CDCF)

The Institute of Marine Research in Norway conducts research on marine resources, the marine environment and aquaculture.

The principal objective of the Institute is to undertake marine research and provide scientific advice in the above areas to the authorities, industry and society as a whole.

The Institute of Marine Research is answerable to the Ministry of Fisheries and Coastal Affairs, and the duties are:

- Monitor and carry out research on life, the environment and interactions among living organisms in coastal waters and the ocean
- Generate new and updated knowledge of marine resources of importance to fishing and aquaculture
- Develop technology and greater biological understanding as the basis of rational, future-oriented fishing and aquaculture industries
- Offer advice to the authorities and industry regarding management of the marine environment and its resources
- Disseminate the results of research in order to promote the interests of the research community, fishing and aquaculture industries and of society as a whole.

The work of the Institute is primarily concentrated on the ecosystems of the Barents Sea, the Norwegian Sea and the North Sea, as well as the Norwegian coastal zone.

With a staff of about 700, the Institute of Marine Research is the largest marine research institution in Norway, and in many areas of research it plays a leading role at the international level.

Most of the activities are carried out in Bergen, but the Institute also has a department in Tromsø and research stations at Matre and Austevoll near Bergen, as well as at Flødevigen near Arendal. The Institute operates four large multipurpose research vessels.

The Institute is also an executing agency for development cooperation projects funded by the Ministry of Foreign Affairs. Major development projects in Africa and Asia cover aquaculture and fisheries research and management operated jointly with the Directorate of Fisheries and coordinated by the Center for Development Cooperation in Fisheries, CDCF.

OBJECTIVES

Development objective

The Project is designed on the basis of development priorities determined by MINAL and CIP of Cuba and with a view to facilitate the development by contributing special competence and equipment available in Norway.

The development objective is:

Increased Cuban production of local marine fish species by using reliable, environmentally sustainable aquaculture methods to achieve maximum benefits for the country and for the region as a whole.

An indicator for reaching this objective is the maintenance of a greater and more profitable long-term production by the aquaculture sector, reflected in the statistics prepared by MINAL.

Immediate objectives

The immediate objectives (purposes) of the Project are:

- Establish a sustainable on-growth production at a semi-commercial scale of cobia (*Rachycentron canadum*) in sea cages from juvenile size to full market size following procurement of operational equipment
- Establish basic handling and primary processing technology for cobia
- Evaluate economic, market and value chain aspects
- Provide the produced fish to the export market and/or local hotels
- Use any sales revenues for the further development of the production line
- Competence building of Project members and students in marine aquaculture
- Established suitable aquaculture protocols (complete life cycle) for marine finfish production in general
- Established a first small production of healthy juveniles of cobia following building of a small-scale, demo hatchery in a new attachment to the laboratoris near Havana (Mariel) or Cienfuegos (Boca Ambuila).

A project of this kind will support and supplement the national effort to develop aquaculture in Cuba. The marine living resources in the Exclusive Economic Zone of Cuba are considered fully utilized. Hence, any increase in the supply of fish and shellfish must come from aquaculture. The aquaculture in fresh water is mainly aimed at producing lower cost fish for domestic consumption, while the marine aquaculture is directed towards producing high value products such as shellfish and certain finfish, including cobia, for export or the local tourist market.

Target groups

The main and direct beneficiaries of the Project are the scientific and technical staff of CIP and other institutions under MINAL. In line with CIP policy, men and women will be given equal opportunities to benefit from training and education provided

through the Project. The next important target group is farmers to spread the competence and technology to appropriate locations in Cuba.

PROJECT OUTLINE

In the planning of the activities described below, CIP invited IMR to new project discussions in Havana 19-28 May 2009 following acceptance by Norad. All activities are the results of joint agreements based on in-depth considerations. This draft Project Document is the consequence of the mission to Havana and subsequent electronic exchange of information.

The project is a concentrated effort to achieve the goal of producing cobia in net cages and also starting producing cobia juveniles in a biological, environmental and economic sustainable way supported by associated student programs and workshops and by the establishment of a unit for training in the production of marine fishes through aquaculture.

The activities can be grouped into those related to the production line as such (ranging from procurement of equipment, broodstock capture to realized adult production, sales and export) and to the ones focusing on competence building *per se* and project management.

The inclusion of a competence building program is considered important not only for the project and the personnel selected but also for the long-term strengthened linkages between persons and institutions in the two countries. Candidates for the studies will be members of the staff at CIP and/or students at the Universidad de la Habana. They are supposed to be supported by the project while undertaking specific Master or PhD training courses of relevance to their work within one of the activities of the project. The other persons planned for training are established researchers at CIP.

The initial year will contain a period of finalizing agreements and planning of future activities. Hopefully one could finish the site classification work and do the necessary preparatory work for tender in early 2011, assuming the project starts in the near future after the present date.

In the first ordinary year of the project, 2011, the focus will be placed on establishing the pilot sea cage farm, training the farm management on site and starting farming fish. In addition there will be basic construction by CIP and planning work needed for starting up the demo hatchery in 2012. The student program will be implemented in 2011, 2012 and 2013.

In 2012 fish is expected to be harvested, processed and sold. The hatchery equipment should be installed, and the first modest trial of producing juveniles should start.

The next year, 2013, will focus on farming and harvest of the second crop as well as undertaking production of fingerlings in the hatchery.

The operations both in the sea and on land will continue in 2014, the final year of the project. Reports have to be made as well as other publications.

Advice on regulation and licensing, rules governing fish health and environmental aspects should be addressed on a seminar in Havana in 2013 or 2014.

The Norwegian experts and research scientists selected for participation in the project will be international experts in their field of interests within marine aquaculture. The Cuban experts trained by the project shall as far as possible not be replaced by other colleagues in a short- or medium-term scale.

Due to limited resources and lack of relevant competence at the operational level, the immediate further development of *de facto* sustainable marine finfish (cobia) production in Cuba is heavily dependent upon this project and its various activities as outlined in this project document.

The aim is that the CIP crew will master operation of the cages, farming, harvesting, processing to sell and export fish by 2013. Hence Norwegian expert assistance may be reduced to a low level within these fields. Cuba will then continue using the pilot farm for training of new farmers.

Activity 1: Transfer of know how - fish farm management

Cuba wants to develop modern marine fish farming. The plan is to set up a pilot farm and secure transfer of know-how of operation of such a farm. The aim of the transfer is to enable the CIP crew to master the various necessary activities of big cage farming as:

- site selection
- further species selection
- cage assembly
- cage installation
- net change
- net cleaning
- bottom ring operations
- tank transportation of fish
- stocking with fingerlings
- data registration and regular farm reports (growth, morts, temp., oxygen, predators etc.)
- dead fish removal
- feed and feeding including storage
- predator handling
- parasite treatment
- crowding
- wet haul operation
- grading
- harvesting
- slaughtering
- adopt agreed fish sampling protocols incl. undertake blood collection
- cooling/ use of ice
- packaging
- (processing)
- (sales and export)

An important, however secondary aim, is to produce fish for sale and generate sales revenue to support the on-going of the project. The complete exercise will be a first test of the feasibility of modern farming in a Cuban context. The proposed scale is to be able to harvest up to 50tons of cobia per cycle after the start-up period.

A site investigation has to be undertaken before installation of the cage farm. Assistance is very much required in cage assembly, installation and starting up of operations.

At first the farm will be run without any fish focusing on net performance, current impact, net change, net cleaning and monitoring of fouling.

Preparation has to be made for stocking with fish. This is planned to take place in autumn of 2011. The first stockings with cobia fingerlings will all be purchased from abroad. A total of approx 12.000 fish will be purchased for each stocking. Contacts have been made with Eric Wagner manager of the wellknown company Troutlodge Marine in Florida. This company offers to deliver batches of juveniles to cover the

needs of the project. Contacts has also been made with Samir A. Kurir, Ocean Farm S.A. in Ecuador and this company states that they can send the quantity of fingerlings needed in Cuba.

The next phase of transfer of know how will cover feeding, fish monitoring, fish handling and treatment.

The Norwegian assistance will be scaled down in accordance with Cuban competence build up covering the various elements of operating a fish farm. Hence, the training of the Cuban personnel will be hands-on and practically orientated on the site and on the farm itself. Further training of Cuban staff at fully operational, commercial cobia farms abroad will be considered if required and logistically possible.

Fish farming involves substantial risks and one should expect to meet with unforeseen challenges. These have to be solved jointly by the Cuban and Norwegian participants. CIP wants the Norwegian specialists to produce the written procedures for each operational activity to facilitate both the running of the pilot farm as well as a tool in the planned training of Cuban fish farmers.

Practical fish health management has to be a key part of this activity. Parasite attacks and occurrences of diseases should be expected. A plan shall be made for coverage of disease prevention as well as treatment if and when disease or parasites occur. Cuba needs further assistance in technically mastering treatment of disease and/or parasites in big cages using liner skirt or eventually other methods. External parasites represent a major concern and are difficult to control. Handling of the big cages for treatment and control of the fish parasites requires experience and skills. Guidance and technical assistance from specialists are needed.

A major cost component will be high quality feed which has to be imported. The first feed purchase has to be covered by project funding. Thereafter sales revenue generated from the harvest and sales should be used in this respect.

The transfer of know-how as well as all the operational advice will be undertaken by expert visits each visit covering on average 14 workdays. In all 14 such visits are planned for out of which 11 is related to cage assembly, installation, start up of operations and first harvests. In addition advice will be given by other means of communication based upon work hours in Norway or another country depending upon the expert involved. These expert visits is necessary to undertake transfer of know how at the subsequent steps involved in cage farming from stocking up to harvest including facing the site specific challenges.

The cost of the first feed batch is estimated to NOK 1 million covered by Norwegian funding. The sales revenue is supposed to fully cover for subsequent feed purchases. The project is a first ever in relation to big cage farming in Cuba and it seems reasonable to include a budget for “unforeseen cost”, here stipulated to NOK 1.000.000 for 2010-2014. The cost of fingerlings is in total budgeted to NOK 920.000 covering 4 stockings.

The total cost of activity 1 will then be NOK 5.85 million covering the period 2010-2014.

Activity 2: Procurement of cages and operational equipment for marine farming

The aim of this activity is to secure design and purchase of a pilot sea cage farm including necessary equipment, ship it to Cuba, and undertake the assembly and installation at the chosen site.

Cage farm design has to be based upon a proper site classification especially wind, wave and current conditions. A study of the chosen site has to be undertaken before design, tender and purchase can be done. Hurricanes represent a special challenge in Cuban waters and this eventual problem has to be analysed.

It is planned to arrange a tender by IMR for the purchase of a turn-key pilot farm consisting of 3 poly ethylene cages (50 m circumference) with necessary accessories. This should include;

- double floating pipe systems
- sinker tube rings (bottom rings)
- a mooring system
- 4 fishnets (small mesh size)
- 6 fishnets (big mesh size)
- 3 predator nets
- 3 shade nets
- a harvesting net
- a ball line
- one liner skirt for parasite treatment
- one wet landing net
- plus various minor components
- freight cost
- assembly and installation supervision cost

In addition to the farm itself and the above mentioned parts, more operational equipment is needed for the running of the farm. CIP should arrange for a barge to be included as well as some smaller boats and storages. One should try to find a solution for purchase or rent of a Cuban boat for modification to serve as a simple workboat.

There is need for a generator, transportation tanks, air blower, oxygen meter and equipments for water quality measurement, pipes for grading fish, a high pressure net cleaner, a fish pump (small size), a grader, a feed blower (small), a net washer (small) and a modern current meter.

The procurement of the farm and the operational components should take place in 2011 after receiving the site classification report.

All procurement shall be handled by IMR representative as well as the container freight to Cuba.

CIP has to arrange for the use of a proper quay, trucks, towing boat, boat for handling heavy anchors (1 tons) as well as other equipment needed for assemble and installation.

The cost of this activity is mainly related to the cages including moorings and nets plus the equipment needed. It is here budgeted with a total of NOK 2.8 million. Then there will be cost related to freight, assembly of the various cage parts at the quay in Cuba, and installation of the cages on site. The site classification will involve a commercial company undertaking such work. The tender process itself will require work in relation to the actual competing suppliers. The total budget for this activity is NOK 4.15 million.

Activity 3: Advice and assistance on post-harvest activities

The aims of this activity is to assist in handling, transport, sales and export of the fish produced at the pilot farm as well as transferring knowledge within these fields to CIP and their Cuban partners.

CIP with partners need various assistance in post-harvest handling of fish to be sold as fresh products i.e.

- slaughtering
- cleaning
- cooling
- eventually processing (fresh filets)
- packaging
- transportation
- marketing
- sales
- export

CIP with partners also need some assistance in post-harvest handling of fish to be sold as frozen products i.e.

- processing (filets/portion cuts)
- packaging
- freezing
- container shipment
- marketing
- sales
- export

Experts from other cobia producing regions should be invited to participate in giving advice to CIP and MINAL in this respect.

Value chain analysis and questions related to markets and economics should be addressed at meetings and eventually also in a workshop in Cuba. There should also be an evaluation of the questions related to cost of production, processing and distribution on the basis of large scale farming.

Cobia has a rapid growth and a potential of becoming a low cost commodity produced in big cages. The competition is expected to be tough, hence, production, processing and distribution cost levels will be critical.

CIP partners i.e. MINAL enterprises, are expected to be fish processors and exporters from Cuba.

The cost effectiveness of Cuban cobia production should be analyzed by expert with experience in this field.

The first sales are expected to happen in 2012. There is a budget of NOK 950.000 covering all advice, assistance and analysis for the period 2011-2014.

Activity 4: Broodfish and development of fry production

CIP wants in due time to develop modern intensive fry and fingerling production. The aim of the activity is to develop CIP skills in marine fry production using small brood fish and hatchery units. Hence, the aim is limited to build the foundation for a subsequent Cuban fry and fingerling production. The reason for this is partly the need to focus within the proposed Cuban-Norwegian cooperation project as well as expected funding constraints.

The detailed aims of this activity are limited and represent a build up for the Cuban crew to master the modern intensive hatchery production;

- keeping of broodfish
- egg production
- live feed production
- startfeeding
- controlling of bacterial loads
- weaning, first on-growth
- water treatment
- technical operation of a modern hatchery.

The plan is to install a broodfish unit as well as setting up of a demo hatchery for marine fish. This plant has to be designed in detail in 2011. A consultant, aqua engineer, will be hired for making a status report of the facilities as of today, a design of up-grading including drawings as well as a detailed investment and running cost estimates.

CIP already plans to set up a hatchery building of approximately 400 m² with header-tank and basic water supply and drainage infrastructure to host this demo hatchery. The hatchery building will according to Cuban plans be established close to Mariel 26 km outside Havana or in Boca Ambuila Station (300 km from Havana). There is a need to undertake site analysis before starting construction and operations.

The demo hatchery should eventually cover a small recirculation system and units for water treatment, live feed production, larval rearing, pre on-growth and others. These elements have to be supported by internal Cuban project funding. The present project budget is stipulated to cover the basic requirements of a small demo hatchery given that CIP covers all cost related to buildings, water supply and drainage as well as operational costs.

CIP needs assistance to master intensive production of fingerlings of cobia and other selected species for stocking in cages. Modern cage farming requires the ability of supplying large numbers of even sized fingerlings at one point in time. These fingerlings have to be of high quality, disease free and well adapted to formulated feed as well as the environmental conditions at the actual sites as current speed. Hence, an integration of fry and fingerling production has to be made in accordance with the need of the Pilot Farm as well as eventual further expansion cage farming.

Key elements in building of competence in connection to fingerling production are:

- Keeping of brood fish, egg production
- Live feed production
- Larval production protocols
- Pre-on-growth in a nursery system/ tank system for fingerlings
- Introduction and mastering of technical equipment
- Water treatment

There will be a need of importing various kind of feed for the production in the hatchery.

Norwegian and other foreign experts and others will assist CIP in undertaking these activities. Design, purchase and installation of the demo hatchery have to be undertaken and/or supervised by international experts. Start up of operations will also require expert assistance and supervision.

A major cost component will be the demo hatchery parts which have to be imported. The budgeted figure is NOK 1.2 million.

The feed for the hatchery and the broodfish has to be covered by project funding and the budget is NOK 200.000.

The transfer of know-how as well as all the operational advice will be undertaken by expert visits each visit on average covering 14 workdays. In all 6 such visits are planned. In addition advice will be given by other means of communication based upon work hours in Norway or another country depending upon the expert involved. The number of expert visits is a minimum in view of the complexity of a modern hatchery and the need to master all of the subsequent steps in juvenile production.

The total cost of Activity 4 will then be NOK 3.2 million covering the period 2010-2014.

Activity 5: Competence building in aquaculture

To achieve the goals, CIP needs to be able to handle modern fish farming, this require strengthening and capacity building of fisheries biologists.

The Project will provide elements of competence building and transfer of skills by “on-the-job-training”. There is also a need to strengthen the research capacity of CIP. In this respect, more formal and academic education will be arranged. The Project therefore includes provisions for one Cuban person to take courses in Norway as a part of a Master degree as well as one person to study for a PhD degree. It is necessary that the students selected for the study have a good proficiency in English language since lectures, textbooks and students reports at the relevant programmes are in English.

The most relevant topics suggested for a thesis included in the studies are connected to juvenile production and on-growing.

The final selection of the topics must, however, be further discussed and agreed at a later stage before the studies commence in August 2011.

A Master and PhD study will take 2 and 3 years, respectively . This means that the students will finish in June 2013 and 2014. It is foreseen that the degrees are completed at a university in Cuba. The length of stay in Norway will be limited.

The budget for this activity is NOK 1.1 million.

Activity 6: Seminar in regulation, governance of fish health and environmental issues in connection to fish farming

Cuba also holds the view that the project should cover the fields of public governance especially regulation framework, a fish health management system and an environmental monitoring system. The existing Cuban systems should be examined.

Aquaculture is already regulated in Cuba. However, supplement and modifications will be needed for developing large scale cage farming. These issues will be addressed at the seminar in Havana.

For the development of cage culture, an applicant (in our case MINAL) has to request for a license to the Ministry of Science, Technology an Environmental (CITMA) and the National Center of Biological Security (CNSB), showing the specific characteristics of both the place and of the project. An applicant has to present:

- Location.
- Characteristics of the environment of the area.
- Social characteristics.
- Alternatives of sites.
- Short description of the project with the technology to use.
- Environmental impacts.

- Characteristics of the species to culture and possible diseases.

Imports of live organisms are also regulated. There are regulations about the development of quarantines of imported organisms, by the National Center of Biological Security, who gives the license to the entity that apply for permission. The sanitary permission to import is given by the Department of Veterinary Services of Frontier of IMV. A sanitary certification from the exporting country is needed to secure that the imported organism are free of specific pathogens and in good state of health. These certifications Quarantine can be enforced. When the quarantine is finished, CIP requests a permission to IMV to transport the animals, showing the results of analysis during the period of quarantine proving that organisms have been good health.

Regulations needed for the project phase are in place and are enforced.

A workshop should be undertaken in Havana covering these fields bringing in international experts. It is very much of interest to make a comparison of the Norwegian and Chilean systems and situations.

Cuba needs advice where to locate big cage farms “aquaculture areas” and regarding the initial set of rules for farm operations to comply with. Cuba also needs advice in order to establish environmental quality standards as well as an appropriate monitoring system for marine cage culture.

In a long term perspective CIP and the Cuban government want to further develop deep water big cage culture in Cuba, and would like to bring this up as a topic of discussion. Such a culture represents challenges in health management due to the high stocking densities and large number of fish stocked in each cage. Parasites, bacteria and viruses can infect fish anytime at any stage of culturing. No vaccine is yet available for the warm water species, and this represent a very different situation compared to Norway, where all fingerlings are vaccinated before stocking in the net pens. Hence in Cuban waters one has to rely on farm management and fish health management by using regular inspections, screening of fish for diseases and early diagnosis to be able to prevent and control disease.

The target group is Cuban government officers as well as researcher and people engaged in the aquaculture industry.

It is planned to invite 4 international experts to participate in the seminar covering the regulatory, fish health and environmental issues. The total budget is NOK 427.000.

Activity 7: Project management

The Project will be implemented by CIP in cooperation with IMR. There will be a Cuban Project Director, Dr. Rafaél Tizol from CIP (Tizol is the Managing Director of CIP), and a Project Manager from CIP, MSc. Eduardo Raúl Flores. IMR will have a Project Manager, Dr. Olav Sigurd Kjesbu, responsible for the overall project.

The Project will cover the cost of administrative assistance to the managers, translation of instruction material, manuals etc., telecommunication, stationery and travel between substations, headquarter and experimental localities. A project car is needed in this respect.

CDCF (IMR) will administer the project activities on the Norwegian side. This includes visits to Cuba by the Norwegian coordinators for meetings and CDCF administrative support to the project. Funds will be transferred to cover for CIP project management costs including visits to Norway.

The total budget is NOK 1.030.000 out of which NOK 200.000 is for covering Cuban administrative cost plus NOK 200.000 for a car for transport within the project.

OUTPUTS AND ACTIVITIES

Activity title	1.Transfer of know-how – fish farm management
Time	Dec 2010 – Dec 2014
Outputs	Cuban managers capable of operating big cage fish farms Test of the feasibility of big cage farming in Cuban conditions Knowledge about methods of disease prevention and treatment of parasite attacks and diseases outbreaks in big cage culture Fish produced and harvested
Activities	Norwegian experts to supervise planning Norwegian experts to supervise all pilot farm operations. Writing of operational procedures for the fish farm operational activities. Assistance on feed purchase and import Assistance on fingerling import Assistance in fish health management; prevention and treatment of fish diseases in a big cage culture setting On-job training of Cuban crew at local site On-job training of Cuban abroad, if required and feasible
Budget	NOK 5.628 million
Remark	CIP covers all cost related to Cuban man power needed for the cage operations CIP to arrange for boat assistance to operations IMR to arrange for the first feed purchase(s) on behalf of CIP Sales revenue to be spent on subsequent feed purchases and other input for the joint project CIP to arrange for feed storage CIP shall allocate a fish health specialist to the project CIP shall allocate a specialist on nutrition to the project
Indicators	Cuban management established and running the farm Procedures established covering all key elements of farm operation Fish produced and sold – 50 tons per cycle/year

Activity title	2. Procurement of cages and operational equipment for marine farming
Time	Jan 2011 – Dec 2012
Outputs	Site classification (needed for design of cage farm) Completion of cage farm incl. operational equipment
Activities	Site classification study Specification and procurement incl. tender for cages and necessary operational equipment. Shipment of cages and equipment Assembly and installation on site Boat acquisition and/or rental Site investigation
Budget	NOK 4.005 million
Remark	IMR shall hire site investigation company and CIP shall assist in the data collection and site investigation IMR arrange for tender(s) and purchases in Norway IMR to supervise shipment, assembly and installation CIP to arrange for assembly and installation assistance CIP shall supply boats for operating the cages CIP shall secure information and analysis of hurricane occurrence in the site area
Indicators	Site classification report Tender undertaken regarding procurement Cages and equipment installed or available on site

Activity title	3. Advice and assistance on post-harvest activities
Time	Jan 2012 - Dec 2014
Outputs	<p>Successful handling and processing of harvested fish</p> <p>Sales and/or export of fish and/or fish products</p> <p>Increased knowledge regarding post-harvest necessities and constraints</p> <p>Increased knowledge regarding value chain challenges</p> <p>Documentation regarding cost effectiveness</p>
Activities	<p>Assistance in post-harvest handling of fish to be sold as fresh products i.e.</p> <ul style="list-style-type: none"> • slaughtering, • cleaning, • cooling, • eventually processing (fresh filets) • packaging • transportation • marketing • sales • export <p>Assistance in post-harvest handling of fish to be sold as frozen products i.e.</p> <ul style="list-style-type: none"> • processing (filets/portion cuts) • packaging • freezing • container shipment • marketing • sales • export <p>Economic analysis and evaluation</p> <p>Value chain analysis and evaluation</p>
Budget	NOK 0.95 million
Remark	<p>A number of consultants or specialists may be needed. This should be managed by IMR.</p> <p>Experts from other cobia producing regions should be invited to participate in giving advice to CIP/other Cuban enterprises or bodies in this respect.</p>
Indicators	<p>Sales and Export of fish and fish product of 50 tons (live weight)</p> <p>Evaluation reports of customer acceptance, fish and product quality and value chain management</p>

Activity title	4. Broodfish programe and development of fry production
Time	Jan 2011 – Dec 2014
Outputs	<p>Completion of small demo hatchery</p> <p>Increased skill in production of eggs and fingerlings</p> <p>Cuban managers (CIP) capable of operating a small intensive hatchery</p> <p>Cuban managers (CIP) mastering broodfish handling and egg production</p> <p>Fingerlings produced</p> <p>Establishment of foundation for further expansion</p>
Activities	<p>Transfer of know-how through visits of experts</p> <p>Advice on live feed production incl. algae</p> <p>Advice on production of eggs, larvae, fry and fingerlings</p> <p>Design of a demo hatchery</p> <p>Specification and procurement of necessary operational equipment.</p> <p>Supervision</p> <p>International experts to supervise planning</p> <p>International experts to supervise all hatchery operations.</p> <p>Writing of operational procedures for the operational activities.</p> <p>Assistance on feed purchase and import</p> <p>Assistance in fish health management; prevention and treatment of fish diseases</p> <p>On-job training of Cuban crew</p> <p>Study of the site chosen by CIP</p>
Budget	NOK 3.23 million
Remark	<p>CIP covers all cost related to Cuban man-power needed for the broodfish and hatchery operations</p> <p>CIP is responsible for capture of broodfish</p> <p>IMR to arrange for the feed purchase(s) on behalf of CIP</p> <p>CIP shall arrange a proper feed storage</p> <p>CIP is responsible for finalization of the new hatchery building including infrastructure (water supply, drainage, header-tank and others) or to modify the existent ones</p> <p>CIP shall allocate a fish health specialist to the project</p> <p>CIP shall allocate an expert on early life stages to the project</p>
Indicators	<p>Cuban management established and running the hatchery</p> <p>Demo hatchery finalized</p> <p>Hatchery equipment installed or available on site</p> <p>Procedures established covering all key elements of broodstock holding and hatchery operations</p> <p>Fingerlings produced – 15.000 pcs</p>

Activity title	5. Competence building in aquaculture
Time	April 2011 – Jun 2014
Outputs	Increased knowledge among Cuban aquaculture specialists
Activities	Training MSc courses PhD courses Supervision by Norwegian experts Teaching Courses in Norway
Budget	NOK 1.08 million
Remark	The program has to be fine-tuned in accordance with Cuban regulations regarding student programs
Indicators	Cuban MSc degree Cuban PhD degree

Activity title	6. Seminar in regulation, governance of fish health and environmental issues in connection to fish farming
Time	Oct 2013 – December 2014
Outputs	Increased knowledge regarding the necessary regulatory framework Increased knowledge regarding governance of aquaculture within the fields of fish health and environmental concerns
Activities	Seminar in Cuba Writing of seminar report Disseminations PR activities
Budget	NOK 427.000
Remark	The seminar should be hosted by CIP together with relevant governmental partners
Indicator	Seminar report covering key elements for revision of the regulatory framework for Cuban aquaculture

Activity title	7. Project management
Time	Dec 2010 – December 2014
Outputs	Effective coordination of project implementation
Activities	Mid-term review Audit Support to CIP and CDCF to be responsible for project operations, progress reporting, accounting and liaison with superior national authorities. Project car transport PR activities
Budget	NOK 1.4 million
Remark	Acquisition of a car included in project budget
Indicator	Annual reports Workplans Financial statements Midterm review report Audit undertaken

PROJECT ADMINISTRATION

The Ministerio del Comercio Exterior y la Inversión Extranjera (MINCEX), Cuba and Norad/Norwegian Embassy in Havana will be the contracting partners.

Centro de Investigaciones Pesqueras (CIP) will be the implementing agency in cooperation with Center for Development Co-operation (CDCF), Institute of Marine Research (IMR). The Managing Director of CIP, Rafael Tizol, will be the Project Director of the joint Cuban – Norwegian project. CIP and IMR will appoint one project manager each. The CIP project manager will be MSc. Eduardo Raúl Flores and the Norwegian, Dr. Olav S. Kjesbu. The Project Managers will be given the responsibility to manage all the day-to-day Project operations on the basis of the project document and agreements.

The Manager is given the overall responsibility for producing the specified Project outputs aimed at the defined objectives. The Project Director assisted by IMR report to the Norwegian Embassy, Havana as the representative of the Government of Norway including the funding agency Norad, Norwegian Agency for Development Cooperation. The Project Director will also report to authorities in Cuba as required.

The approved Project document and budgets shall be followed unless unforeseen events make it necessary to rearrange activities or reallocate budgets. In such cases, the implementing partners should address these issues and propose actions to be approved by the Mincex and the Norwegian Embassy, Havana. Such decisions should be reflected in minutes of meetings.

The funds supplied by Norway will be administered by CDCF according to regulations set by the Norwegian Embassy.

Funds to be used by CIP shall be requested in writing to the Embassy/Norad by the Project Manager. The Embassy/Norad will transfer the requested amount to CIP by using specified bank accounts for funds relating to Project activities. Transfer of funds will only be made when proper accounting of previously transferred funds is made.

CDCF will recruit and contract Norwegian personnel participating in the Project. Working arrangements, salary, travel, subsistence allowance etc will be determined by CDCF following Norwegian Government regulations and “Agreement between the Norwegian Agency for Development Cooperation (Norad) and the Institute of Marine Research (IMR)/the Directorate of Fisheries concerning Technical Assistance within the Fisheries Sector”.

Accounts of the Norwegian Project funds will be kept by CDCF and audited by the local representative of the Norwegian Parliament Auditor General. Accounts of funds transferred to CIP shall be audited by an Auditor appointed by MINCEX and approved by the Norwegian Embassy.

Audit cost is budgeted as a part of the Project management cost.

The cost of undertaking a mid-term review is also budgeted as a part of the Project management cost.

An Agreement between the Norwegian Ministry of Foreign Affairs and MINCEX shall be elaborated regarding Norwegian assistance to the project.

An “Institutional Cooperation Contract” has to be elaborated between the Norwegian Institute of Marine Research and Centro de Investigaciones Pesqueras (CIP) to cover the present project.

**BUDGET: REQUESTED NORWEGIAN CONTRIBUTION
AND PROPOSED CUBAN FUNDING**

CUBAN - NORWEGIAN COOPERATION AQUACULTURE PROJECT

NORWEGIAN PROJECT CONTRIBUTION 2010-2014

The Budget (NOK 1000)							
Project activities and modules							
Act.	Project activity name	2010	2011	2012	2013	2014	Total
1	Transfer of know-how – fish farm management	220	1 516	2 051	1 151	690	5 628
2	Procurement of cages and operational equipment	0	3 505	500	0	0	4 005
3	Advice on post-harvest activities	0	0	350	250	350	950
4	Broodfish and development of fry production	0	605	1 310	1 060	255	3 230
5	Competence building	0	0	540	540	0	1 080
6	Seminar on regulation	0	0	0	0	427	427
7	Project management incl. midterm review/audit	100	400	400	200	300	1 400
Total		320	6 026	5 151	3 201	2 022	16 720

CUBAN PROJECT CONTRIBUTION 2010-2014 (CUC)

Items	2010	2011	2012	2013	2014	Total
Stimulation	504	504	504	504	504	2 520
Clothes Module	380	380	380	380	380	1 900
Maintenance	140	140	140	140	140	700
Auxiliary services	871	3 484	3 484	3 484	3 484	14 807
Constructions		8 500	8 500			17 000
TOTAL	1 895	13 008	13 008	4 508	4 508	36 927

CUBAN PROJECT CONTRIBUTION 2010-2014 (CUP)*

Items	2010	2011	2012	2013	2014	Total
Salaries	10 174	40 695	40 695	40 695	40 695	172 954
Provisions	463	1 852	1 852	1 852	1 852	7 871
Maintenance		960	960	960	960	3 840
Constructions		23 000	23 000			46 000
TOTAL	10 637	66 507	66 507	43 507	43 507	230 665

*1 CUC = 25 CUP

CUC = Convertible Cuban Pesos

CUP = Cuban Pesos

1 USD = 0, 80 CUC

1 USD = 6, 03 NOK

1 CUC = 7, 54 NOK

RISKS AND ASSUMPTIONS

MINCEX/CIP and CDCF/IMR have prepared the Project together and are committed to carry out the activities and deliver the outputs. The experience from the cooperation in the previous project indicates that the institutions and the persons involved will meet the Project challenges with enthusiasm and a good working spirit.

Required Project funding will be guaranteed by the Government of Norway if the Project is approved. Additional support from the Government of Cuba, in kind and money, are also confirmed by MINAL/CIP including the use of the sales revenue from the harvested fish from the Pilot Sea Cage Farm for the direct Cuban - Norwegian aquaculture project development.

The Project depends on a number of key persons, in Cuba and in Norway, that are or will be specially trained for the survey work. Project operations will become difficult if such persons leave their positions.

Aquaculture always involves substantial risks. There are biological risks related to disease and influences from the environment. Such effects could cause loss of fish and even crisis mortality. Attacks by predators could have a similar effect. The occurrences of hurricanes create a specific risk when doing fish farming in Cuban waters. The farm has to be of high standard and able to withstand strong currents, high waves and strong wind.

Management is another risk category. Mismanagement could cause severe problems and failures. Technology malfunction is in general always a risk. The successful operation of the Pilot Sea Cage Farm also relies upon CIP commitment in supplying various equipment, boats, personnel resources, infrastructure components, buildings as well as Cuban experts. IMR commitment is also important to secure the success of operations.

Processing and sales/export involves risk. In addition, there will always be a general market risk and it is very difficult to foresee the future price developments in the global fish market.

The risk should be managed through proper management and a substantial Norwegian expert assistance at start up of operations. Below is a list of risk factors and their mitigation.

Risk factor	Mitigation
Funding	Execution of the terms and quantities agreed in the PD by the involved parts
Project administration	Project management with global fish farming experience
Procurement of cages and equipment	Known technology and product quality Project management experience from similar projects
Delivery of equipment/ import	Known import regulations and freight options Securement of custom clearance
Construction and installation	Project management with experience from similar projects Documented technical procedures and use of highly qualified technical staff in installations
Training	Project management with experience from similar projects and training programs
Fingerling input	Investigate optional suppliers Implement a fingerling supply strategy
Feed input	Make list and investigate suppliers and logistics Produce a farm feed input strategy
Production: disease and parasites	Project management with international experience from development and implementation of farm health management programs Investigate local/regional experience Implement systematic health/disease surveillance program to farm operation Use of foreign experts as needed
Production: predators	Project management with global fish farm experience Investigate local/regional experience Implement predator protection strategy
Production: theft	Implement guard surveillance program
Production: man made errors	Project management with previous experience in staff management and implementation of technical-biological protocols and farm risk programs
Production:	Experience with selected species Implementation of protocols and farm risk program Frequent reporting routines
Harvest and processing	Project management with experience from harvest and processing procedures Investigate and use regional/local options
Sales and export	Defined sales and export strategy incl logistics Engagement of a dedicated sales company/institution
Market	Market and sales plan
Broodfish	Access to wild stocks (fishing vessels etc) Investigate global experience with optional species

Hatchery production	Establish and implement staff training program
Water-supply and quality problems in the hatchery	Project management with technical/biological know how Investigate regional/local experience and water quality parameters Implement well known procedures for water treatment
Live feed problems	Project management with experience from similar projects Access to qualified hatchery staff
Stability of management	Investigate local working culture Implement working procedures and protocols
Hurricanes	Known statistical probability Established action plans and procedures Install sea cages that withstand high waves Place the sea cages in sheltered waters
Political	Defined project plan and project management

EXIT STRATEGIES, PROFITABILITY AND SUSTAINABILITY

The follow up project is very much in line with the plans of MINAL and CIP. It is of key interest to the Cuban Aquaculture Authorities and MINCEX to develop cage farming based upon the experience and results from the pilot sea cage farm.

Exit

There is a clear exit strategy inherent in the PD with respect to Norwegian expert involvement. The Cuban management should be able to run the cage farm by 2013. The Norwegian involvement in the initial start up of hatchery production should ideally cover a longer time period than 2011-2014 although a sound start up can be obtained by the use of Norwegian expertise. The Norwegian involvement in the other activities should be sufficient to get the Cuban farming, processing, sales and governance on a “right track” although not solving all challenges and possible problems.

Profitability

The suggested cage farm is of very small scale and designated to be run by a research institute. The first years of operation must be seen as pioneering activity aiming at transfer of competence to enable Cuba to run modern cage farms on our own. Such a setting is clearly not a commercial one but rather a pre-commercial stage necessary for further development.

The experience from the cage operation, cycle 1 (2012) and cycle 2 (2013), can yield important input for an economic evaluation. Hence, it is possible to demonstrate a commercial potential based upon the results obtained in real Cuban farming.

The long term profitability will depend on many factors. Sensitivity analysis generally show that profitability in fish farming mainly depends on sales price, mortality and production cost. The project will aim at low cost production with low mortality levels. Sales price is given by global market prices. We do not know the future price levels of cobia. There is a potential for long term profitability of cobia farming. However, a switch to another species would be the solution given that global market prices should be to low too make Cuban cobia farming profitable. One can even switch locality from the marine environment to a lake to use the cages for producing tilapia.

The hatchery operations will be low scaled and can only represent an initial stage in developing a Cuban hatchery production. An up-scaling of the hatchery should be market driven i.e. an increasing demand for fingerlings and based upon mastering of the various stages from egg to fingerling.

The project may commence from 2011 with a first harvest of fish in 2012 and two subsequent harvests in 2013 and 2014. Hence, 3 cycles may be possible within the time limit of the project.

Sustainability

CIP will continue the activities after the exit of the Norwegian experts and at the same time encourage and support a commercial expansion of farming. CIP will in this respect undertake training of farmers, site investigations, supply fingerlings and advice new farmers in all matters related to cage farming. Cuba needs a national resource center for cage farming and the joint Norwegian Cuban project constitutes the basis for such a center. Hence, the sustainability of the joint Norwegian Cuban ventures should be secured by Cuban authorities giving priority to the center.

The pilot cage farm and the demo hatchery will be a key part of training of farmers and the development of marine fish farming in Cuba.

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Havana, Cuba September xx 2010
for
CIP
Centro de Investigaciones Pesqueras,
Havana, Cuba

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for
Ministry of External Trade and Foreign Investment
Havana, Cuba

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