V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Aquaculture

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
135	Aquatic and Terrestrial Wildlife	10%		10%	
136	Conservation of Biological Diversity	10%		10%	
301	Reproductive Performance of Animals	10%		10%	
302	Nutrient Utilization in Animals	15%		15%	
307	Animal Management Systems	15%		15%	
308	Improved Animal Products (Before Harvest)	10%		10%	
315	Animal Welfare/Well-Being and Protection	10%		10%	
511	New and Improved Non-Food Products and Processes	10%		10%	
608	Community Resource Planning and Development	10%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	4.0	0.0	3.0	0.0
Actual Paid	7.8	0.0	7.9	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
195120	0	390641	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
16954	0	14000	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

PCC: Series of larval rearing trials were conducted to produce crablets of mangrove crabs and rabbit fish fingerlings. These crablets were given to local farmers for grow-out trials in ponds and cages. Some of the rabbit fish fingerings produced were given to local farmers for grow-out and the rest were kept in the hatchery for nursery and grow-out studies and for display to visitors. Meetings with fish farmers were held and recommendations were given on how to grow crabs, rabbit fish, and milkfish. A partnership between PCC and a local aquaculture company was established for implementation of the newly approved project on milkfish fry production funded by the Center for Tropical and Sub-tropical Aquaculture. College and high school students were accommodated for internship, hands-on training and summer work program.

CMI: Three runs for the production of pearl oyster spats were conducted; spats were continued to deliver to the three sites, two that are now established in the main island. Like in previous years some were kept at the college's farm waiting for shipment to other potential farmers. Continued maintenance of marine species is ongoing, when reaching their mature stage they are then release either in the lagoon or the ocean.

COM-FSM: Discussions were held on the need for an aquaculture hatchery facility to serve as a resource for research and extension. A MOU identifying facilities, objectives and roles was developed and signed to institute this collaborative effort. Several workshops/trainings on sandfish sea-cucumber, half-pearl seeding, and micro-algae culture were carried out at the Marine Laboratory and other demonstration sites. Training included: hatchery work protocol; spawning induction and spawning procedure for sandfish; handling of larval and grow-out juveniles; feeding of larvae, and monitoring of their development; and half-pearl seeding.

Two marine science students trained on general hatchery operation, spawning induction, ocean-grow out, and micro-algae culture. Six brood stock searches and surveys were conducted for sea-cucumber on coastal reefs where population has been decreasing.

Spawning trials on sandfish sea-cucumber were carried out yielding 15,000 juveniles. Eight framed cage units, ready for occupancy, were placed in three areas. One hundred ten brochures on pearl farming

and sea-cucumber farming were distributed to walk-in clients and workshop/training participants.

2. Brief description of the target audience

PCC: The target audience includes the existing hatchery operators, mangrove crab and fish farmers, people who are interested in fish farming, students, traditional leaders, government officials and policy makers.

CMI: Program continued to work with children, students, youths, adults, local governments, national government, community members and traditional leaders.

COM-FSM: Target audiences include school groups, individuals, fishermen, farmers, and resource owners, private entrepreneurs, businesses, government agencies, and non-government organizations. Traditional leaders and organized community groups were given special focus.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	7310	9356	1032	3094

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total

Actual	0	1	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of demonstration farms established.

Year	Actual
2014	23

Output #2

Output Measure

- Number of publications for lay use.

Year	Actual
2014	3

Output #3

Output Measure

- Number of conference paper and publication/presentation.

Year	Actual
2014	2

Output #4

Output Measure

- Expected Professional Journal publications.

Year	Actual
2014	1

Output #5

Output Measure

- Expected Gray Literatures.

Year	Actual
2014	2

Output #6

Output Measure

- Expected publications for lay use.

Year	Actual
2014	4

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increase awareness in the communities and prospective and existing industry about sustainable, site-specific, and low energy aquaculture technologies.
2	Adoption of sustainable aquaculture technologies by commercial and community groups.
3	Number of established aquaculture operations.

Outcome #1

1. Outcome Measures

Increase awareness in the communities and prospective and existing industry about sustainable, site-specific, and low energy aquaculture technologies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	523

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

PCC: Crablets and rabbit fish fingerlings were successfully produced but farmers lack proper knowledge on growing them. There is no reliable supply of imported milkfish fry according to milkfish farmers.

CMI: Clients lack the knowledge and understanding to do the work affectively and sustainably.

COM-FSM: Community members are not aware of the effects of invasive species, loss of bio-diversity and the impending economic effect of the loss of compact funding.

What has been done

PCC: Farmers were given hatchery-produced crablets and rabbit fish fingerlings and grow-out techniques were demonstrated. Farmers were informed about the new milkfish fry production project.

CMI: Presentations were conducted in communities and in schools.

COM-FSM: Trainings on hatchery techniques and ocean grow-out for sand fish sea cucumber, half-pearl and micro-algae culture, for skills improvement and invasive species control.

Results

PCC: Farmers realized that mangrove crab and rabbit fish could be raised to marketable size using the proper grow-out methods. Milkfish farmers have supported the idea of establishing local fry production.

CMI: The basic knowledge and understanding shared to the people, provided them with information and better prepared them in safeguarding the environment and the ecosystem.

COM-FSM: Two student-interns improved skills of aquaculture technologies. More than 30 trainees learned the basic skills for pearl farming. Eight trainees learned pearl seeding techniques. Two pearl farmers sold half-pearl products. The half-pearl seeding technology was extended to the Marshall Island extension. A private hatchery currently produces giant clam juveniles for restocking the reefs. Several communities have become aware of the tilapia problem and are seeking ways to address it or have taken effort to control by capture and removal.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
307	Animal Management Systems
308	Improved Animal Products (Before Harvest)
315	Animal Welfare/Well-Being and Protection
511	New and Improved Non-Food Products and Processes
608	Community Resource Planning and Development

Outcome #2

1. Outcome Measures

Adoption of sustainable aquaculture technologies by commercial and community groups.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	296

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

PCC: Farmers lack ideas on how to produce and grow crablets and rabbit fish fingerlings. Production of milkfish relies on imported fry.

CMI: Many people do not have the motivation to start a fish farm, pearl or other potential aquaculture project. Scarcity of marine food is because of overharvesting.

COM-FSM: Community members are not aware of the effects of invasive species, loss of bio-diversity and the impending economic effect of the loss of compact funding.

What has been done

PCC: Improved seed production and grow-out techniques were demonstrated to crab and rabbit fish farmers. A milkfish broodstock facility was established and spawning was monitored.

CMI: With follow-up presentations and face to face sessions, more clients adopted the system of preserving and conserving of depleted marine species.

COM-FSM: Internship training attracted interested students and community members. An agreement was signed to provide a research and demonstration facility to support entrepreneurs and guide control of invasive species.

Results

PCC: Farmers became interested to grow mangrove crabs and more requests for crablets were received. Existing hatchery operators showed interest to adopt the hatchery techniques for mangrove crabs and rabbit fish. Milkfish farmers participated in the establishment and monitoring of milkfish broodstock.

CMI: Clients sent representatives for the trainings in order to have the necessary skills to establish and manage their farms. These same clients have requested materials and supplies for the establishment of aquaculture farms.

COM-FSM: Thirty-six individuals participated in the internship program to improve skills and adopt new aquaculture technologies.

A site was selected and a MOU has been signed with a State Government for a period of ten years for a hatchery facility. A community fishpond was reconditioned and stocked with wild-caught rabbit fish juveniles. A simple survey of tilapia population in a community indicated that the capture and removal efforts were successful. Tilapia infestations were not found in the mangroves.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
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Outcome #3

1. Outcome Measures

Number of established aquaculture operations.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	29

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
PCC: There is a limited supply of mangrove crab and rabbit fish in the local market. There is no reliable source of fry for milkfish farmers.

CMI: It is a challenge to do and sustain an aquaculture farm because of money, commitment and the motivation.

COM-FSM: Economic security for Micronesia is critical.

What has been done
PCC: Crablets and rabbit fish fingerling production was continued and grow out techniques were disseminated to farmers. Milkfish broodstock was established and proper management was implemented.

CMI: Continued outreach education and extension to clients is seen to be effective in winning their interests to look into starting a farm of their own.

COM-FSM: Proper maintenance of pearl farms led to sales of half pearl products and the provision of pearl seeding training in the Marshall Islands.

Results
PCC: Seventeen farmers have established their crab farms and were able to monitor the growth of crabs. Five more farmers were interested to start crab farming and rabbit fish. A hatchery operator was also interested to start crab, rabbit fish and milkfish seed production in their facility. Four high school and college students became interested in fish farming.

CMI: One traditional leader has established land owners club for the development of aquaculture projects in their respective communities.

COM-FSM: Two families earned wages from this and it?s an alternative source of income in two communities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
307	Animal Management Systems
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V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

PCC: Unpredictable weather condition and extreme storms in Palau have adversely affected the seed production activities of mangrove crabs and rabbit fish fingerlings. Some of the milkfish and rabbit fish broodstock held in tanks died due to high turbidity of seawater source. Collection of good quality spawners became very scarce. Some facilities at the hatchery are already old and need to be replaced. Unstable electrical supply resulted to breakdown of water and air pumps that resulted in fish mortalities.

CMI: Transportation to reach the people in the outer islands is a major setback. A good and well equip lab will make it possible to complete research projects. Property is on a lease land and therefore might be an issue at the end of the contract expiration.

COM-FSM: Sites visits and monitoring have been carried out, though disrupted due to bad weather and transportation limitation, especially to the other outer islands. It took time to approve a MOU between all parties for the establishment of a research and demonstration facility in a new state location.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

PCC: The success in producing rabbit fish fingerlings and crablets has promoted the development of the aquaculture industry in Palau. Existing farmers were able to stock their farms and were assured of the source of crablets and fingerlings for future expansion. They learned proper methods in growing crabs and rabbit fish in ponds and cages. Milkfish farmers are hopeful that very soon their production will no longer be dependent on imported fry.

CMI: Two pearl grafting training had taken placed; spawning of pearl oysters is ongoing at Arrak hatchery. Trainees have gained the necessary experience in hatchery management and half pearl grafting.

COM-FSM: Feedback from the communities has been positive and encouraging. Numbers of trainees and inhabitants have been encouraged. They have acquired skills and

knowledge that would foster confidence and assurance to going into pearl and sea cucumber activities.

Key Items of Evaluation

PCC: There is a need to continue the crablet and rabbit fish fingerling production to support the growing interest of existing and prospective farmers. Transfer of technology to local hatchery operators needs to be continued so that the industry will be sustained. Further demonstration of grow-out methods to fish farmers need to be continued. To reduce the dependence on imported milkfish fry the establishment of milkfish broodstock facility in Palau is important.

CMI: College needs a good system of supporting the implementation of activities on the ground. A good lab and working environment must be upgraded. It needs to be cleared that challenges are very unique in an island setting as it is in a volcanic island setting. Missed out opportunities for people in the outer islands must be look at carefully and constructively.

COM-FSM: The half-pearl seeding technology and shell carving were extended as there is high local and international demand for the finished product and communities benefited from the value addition. The half-pearl seeding technology was recently extended to the Marshall Island. The sand fish hatchery technology was refined and improved by experience from the previous years. The hatchery had produced 15,000 juveniles from two spawning this year. Several cages of sea cucumber have been established in the communities to release sea cucumber for growth development and measurement.