STUDENT PROJECT REPORT TO THE

UNIVERSITY OF HAWAII MARINE OPTION PROGRAM

To obtain hands-on experience
at an aquaculture facility

DURATION

June 1, 1982-September 1, 1982

PROJECT PARTICIPANT

Wendell K. C. Au

ADVISOR

Dr. James A. Wyban
Zoologist
Haleiwa, Hawaii
[redacted]

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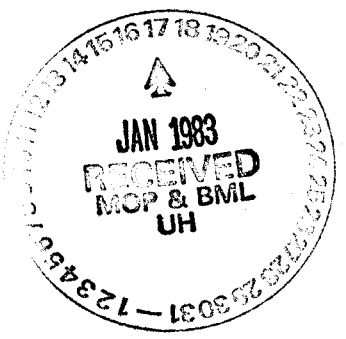

Lokoea fish pond is located in the heart of beautiful Haleiwa. Situated inconspicuously behind a gas station, the six acre facility is managed by Dr. Wyban and his family. As one passes through Haleiwa by car, only the large pond(5 acres) can be seen; unnoticed though, a keiki pond(.25 acre) and a middle pond(.75 acre) are vitally joined to the large pond. The average depth of the main pond is between three and four feet and California grass surrounds the majority of the water body.

As before, when the Hawaiians managed it, the pond is brackish water with the majority of the fishes being herbivores. Because the pond is family operated, business is run on a small scale with particular attention being paid to quality of product. Under Dr. Wyban's management modern techniques have been instituted to assure a profitable operation, yet a balance of man and nature, similar to one existing in old Hawai'i, has been attained.

Support from MOP made the benefit of this project three-fold. First, MOP will benefit with the knowledge gained and presented here in this report, next Dr. Wyban has benefitted from my labor and duties on the facility, and lastly, I have profitted from this fine opportunity to learn and experience the many diverse aspects in this interesting field.

In order to successfully attain "experience" and know-how on Dr. Wyban's facility, nine major and several minor goals were achieved. Each of these were self-contained as a unique field or discipline within itself, yet all were interrelated and corresponded in total harmony on

the five acre pond. What proceeds is a report of the nine areas that were dealt with.

1. Handling of live stock: fry mullet(Mugil cephalus), ahōlehōle(Kuhlia sandvicensis), and papio(Caranx ignobilis) were stocked into auwais and then into the pond. Juvenile tilapia(Sarotharodon mossambica and S. melanotheron) were transferred into holding channels--undesirable fish were disposed if they were sick or didn't look good. Adults were taken to market after cleaning and icing, and Samoan crabs(Scylla serrata) were taken live to market after tying and isolating them--one crab per bucket.

The handling of fish and crustaceans required some taxonomic skills. Three species of tilapia, two species of mullet, two species of papio, two species of prawns, awa'-awa, awa, ahōlehōle, kākū, and Samoan crab were identified. Also, a taxonomic scheme was often used to identify unknown species. Using the HANDBOOK of HAWAIIAN FISHES(Gosline and Brock, The University of Hawaii Press, Honolulu, 372 pages, 1960), one such species was identified as Lentipes concolor(a goby).

2. Harvesting of main crops: all three tilapia species(S. mossambica, S. melanotheron, S. macrochir), both mullet species(Mugil cephalus and Chelon englii), one species of papio(Caranx ignobilis), and Samoan crab(mentioned earlier) were caught with the fish traps. During high tides of more than 2.0 feet, the mākaha was used in harvesting mullet and papio. A seine net was also employed to entrap the fish in the auwai.

3. Trapping techniques: 3-inch gill nets(involves the process of paipai--a technique used in corralling fish together by hitting the water with any instrument and thus scaring the fish into one direction.) were used when the pond was being drained, a fine mesh nehu net was employed with the mākaha, fish traps were used as mentioned before, and scoop nets were employed daily. For a period of time, the traps were baited with okara(soybean waste), and the ones near shore with prawn pellets. The traps were 3ft.x3ft.x4ft., had a one inch eye, and were made with a coated wire. According to Dr. Wyban, traps seem to show a better success with a one-cone-in-the-middle design--a cone on one of the traps was moved to the center and showed this relationship.

4. Feeding techniques: fish were fed okara and prawn pellets twice daily in selected areas to promote a regularity of congregating to eat. This pattern was beneficial in at least two ways. First, fishes could be observed in schools and big groups--general health and condition could be monitored, and second, this process trained the fish to eat at a regular time(usually in the early morning and late afternoon), and provided them with an additional food source. Also, keikis were fed crushed pellets as to promote good digestion and a force-feeding technique was utilized with success in feeding the marketable tilapia.

5. Marketing skills: perhaps the quintessential area where most experience was obtained was here. Here, the reality of a product converted to cash came to fruition. It was exciting and certainly rewarding to receive cash for the

mullet, papio, tilapia, and crustaceans that we had raised and cared for. On several occasions, Dr. Wyban and I went to Chinatown and Tamashiro Market to sell fish and crabs. The pricing varied as a fuction of supply and demand. On the average, mullet(Mugil cephalus) sold for $2.25-$2.50, papio for $2.50-$2.75, tilapia(S. mossambica and S. melanotheron) for $0.50-$1.00, and Samoan crab for $3.50-$3.75/lb. Again, prices fluctuated if there were too many, not enough, or just enough fish at the market. The time to sell a species would be when the market was depleted of it; however, forecasting such an occasion is virtually impossible. As a general rule, though, the best time to sell fish was two-three hours before the market opened to the public.

As for quantitative marketing, the ideal quantity of fish to sell was never ascertained. The best thing to do was to bring all the fish in and proposition two or three markets and hope that all the fish would sell. Seasonal prices were also never realized as the fish that we sold this summer were in good supply and did not reflect a seasonal market.

The next consideration and probably the most important one in marketing fish was a marketing strategy. A good system followed in this manner: ice fish immediately and add a little brackish water as to cause the ice to melt at a lower temperature, make sure the vigorous ones are packed well under the ice so they don't injure themselves and the other fishes, avoid overhandling them, and keep them on

ice until they arrive at the market. Here, great care was taken to preserve the original appearance of the fish and to insure that they "looked good". As for preparing Samoan crabs for the market and implementing a scheme to sell them, they were first tied in a special way so that their pincers were immobilized, and secondly, upon traveling to market, they were each put in a bucket with no water. The absence of water in this case actually preserves their lives(they can stay like this for 24-36 hrs.).

6. Nutrient analysis: four samples from the pond and one from the estuary were taken and analyzed at Analytical Services in Kaneohe. When the samples were taken, no fertilization(P_2O_5) was used in the pond, and on 7/17/82, sea water was let in. The results are as follows:

location	date	PO_4	NO_3	NH_3 **
pond	7/15	1.62	50.88	7.24
pond	7/21	1.32	28.64	3.77
estuary	7/21	6.62	29.60	18.64
pond	7/25	0.68	30.88	2.83
pond	7/28	0.73	38.40	9.27
*Kaneohe bay water		0.2	3.0	1.0

*provided by Analytical Services for general comparison to sea water

**units in μg-at/l

Here, PO_4 was the rate-limiting nutrient. Interpretation of data: when sea water was let in, the water from the estuary and ocean fertilized the pond causing an algal bloom; this of course, was in the facility's best interest, and therefore is a continual occurence.

7. Water analysis: four parameters were measured: temperature, salinity, water clarity, and pH(table 1).

Table 1. Water ality at Lokoea pond on t succesive days.

date	station*	temp.°F	S‰	pH	depth ft.
7/15/82	a	81.1	8	7.9	
	b	83.7	6	8.9	
	c	82.0	6	9.3	
	d	82.0	6	9.3	
	e	78.0	2	6.9	
	f	73.0	4	6.7	
	g	76.2	3	6.5	
7/16/82	a	82.0	6	7.7	1ft. 5in. (7/29/82)
	b	83.0	6	8.9	1ft. 10in.
	c	85.0	5	9.0	1ft. 10in.
	d	85.0	6	9.3	1ft. 10in.
	e	73.0	2	7.1	
	f	73.0	2	7.0	
	g	75.0	4	7.1	
average:		79.43	5	8.0	1ft. 8in.

*stations a,b,c, and d were in the five acre pond(large), station e was in the middle pond, and stations f and g were in the keiki pond.

8. Tilapia hatchery techniques; knowledge was gained on sexing the fish, handling and collecting juveniles, tank-culture, and caring for the brood stock. Tank(water) aqua-culture was the most critical factor to account for. Water was changed once a week(sometimes twice), an air pump was installed to provide additional oxygen, and much attention was given to cleaning out the detritus and benthic algae, thus assuring good water quality.

9. Management: management of this facility required a good relationship with the neighbors(to kindly but firmly enforce "no trespassing" and "no fishing" signs), with the local market, and of course with hard labor. Every facet of operations mentioned thus far was always preceded by a type

of preparation, .d little things like pull g California grass or repairing a net really accounted for a smooth operation.

In this project, priorities dictated what was to be done when, and finite funds drew the limit on certain resources, yet all efforts and energies either paid off or were not realized because of management. So with each new day during the project, Dr. Wyban and myself collaborated on ideas for better management which would stimulate economic growth adn biological efficiency. In summation of management procedures, my conclusion in running such a facility is that the day to day menial tasks such as: feeding, handling, and monitoring the health of the fish, as well as the large scale operations like harvesting with the mākaha or gill nets, require a great amount of delicacy and sensitivity in order that the fishes, the neighbors, and the proprietor's pocketbook are kept happy.

In all, the project went smoothly and offered more educational and personal rewards than anticipated. In addition to the objectives reached, other project-related opportunities were taken advantage of. Field trips to Aquatic Farms, Mr. Hong's facility, and Richard Fassler's office where interesting and informative with Dr. Wyban's comments and opinions. I would like to send a warm Mahalo to the Wybans(Jim, Carol, Jason, and Tai), MOP coordinator Sherwood Maynard, and the MOP for providing this opportunity, and making this project a real stepping stone for a young aspiring zoologist.