

REVIEWS AND RECOMMENDATIONS ON CURRENT AND  
FUTURE RESEARCH ACTIVITIES FOR THE  
BIOLOGICAL INVESTIGATIONS ON MILKFISH

by

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Foreword

The notes written herewith are presented in compliance with the "Proposed Agenda Items for the Milkfish Workshop-Conference at Iloilo, Philippines, May 19-22, 1976", and given in the order as denoted in the agenda above.

It is mentioned that the reviews or impressions on the current research activities be limited mainly to the contents in Part III, "SEAFDEC-IDRC MILKFISH RESEARCH PROJECT. Milkfish (SEAFDEC) IDRC File 3-P-74-0146, 1975: 62 pp., Fig.", and also, that recommendations for future investigations be within the framework of the reviews or impressions for each agenda.

The present writer proposes to establish an additional agenda item, VIII. Documentation (Presentation and recording of works; Report writing; Bibliography).

I. Behaviour and bio-ecology of milkfish in the wild

A. Taxonomic considerations in relation to racial or sub-specific variabilities

It is believed that Chanos chanos occurring widely in the Indo-Pacific waters extending from the Red-Sea to the Mexican coast is represented by different races geographically or populations micro-geographically, although the problem had not attracted the attention of systematic ichthyologists. The present writer observed in Indonesia and the Philippines that there are two types of milkfish as shown by photographs taken, one with greater depth of body and higher lateral line scale count and the other with slenderer body and lower scale count. Since no examinations were made on the specimens the fact may be considered as accidental. The two seasons of appearance of fry of these different types along the coast if definitely determined, might suggest the different races or populations existing.

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Recommendation: In view of its importance to fisheries work, racial or population analysis will be needed for obvious reasons, and the analysis to be conducted may vary in scope depending on the configuration and extension of coastal line. From the standpoint of pure biology, a semi-global program in racial analysis of milkfish may be thoroughly evaluated.

The racial or population analysis of fish will be made possible under three methodological categories, morphological (morphometrical measurement and meristic counting), ecological and biochemical studies on various stages of the fish. The program of studies will be made by referring to the literature on salmon, sardine, herring, mackerel, etc. The methodology of studies is explained in an article by S.J. Holt (Report of the International Training Center on the methodology and techniques of research on mackerel (Rastrelleiger), Bangkok, 20 Oct. - 28 Nov. IPFC/C58/W28, 1958).

#### B. Migration pattern

The movement of the milkfish fry from the spawning ground toward the shore water is apparent. However, the present information about the migration is scanty and not supported by real evidence. Furthermore, internal and external factors responsible for the movement are not understood. The migration of adult milkfish in the sea is not known either, and the observations made so far are limited in the context of space and time.

The hypothetical comment for the migration in spawning of milkfish was presented by the present writer (K. Kuronuma and M. Yamashita, 1962), but the comment was derived indirectly through the appearance of the fry in shore water. There are many observations on the movement of young or sub-adult fish in ponds or in associated water systems, but it has not been confirmed whether they demonstrate similar behaviour in natural sea water.

The collection of fry made at Pandan (1975 Project, Pt. III) shows that those fish in offshore (otoshi-ami site) and those in shore waters are evidently identical as population. The apparent difference in size between the two lots of fry may suggest the growth which occur during migration. But the work does not give information on the migration of fry in sea water.

Recommendation: Similar to the population analysis noted in the previous section (IA), the subject on migration of fish from juvenile to sabalo may be treated from the local standpoint or on local population. Such limitation may be justified in view of fisheries research.

The migratory behaviour of fish from larvae to fingerlings can be traced by extensive and intensive collection of samples. Larva-net is commonly used. Depending on the facilities and gear available, the collection will be made by vertical hauling of net or towing of the gear in specific layers of water. The collection as such, attempted in different waters, will supply the data on which migratory behaviour may be understood. The size of stock among different waters may also be estimated.

The studies on moving or migration of fish from sub-adult to sabalo stages can be made by "marking-recapture" method. It may be needless to mention that the present method can be adopted under the condition that fishery regulation has been worked out and fishermen's collaboration has been promised. Perhaps the method will be an answer to the problem.

### C. Oceanographic conditions

The natural environmental conditions, physico-chemical and biological, influences, if not usually determine all the biological phenomena taking place in the water. Milkfish is not an exception in this respect. Thorough understanding of the life of fish can be hardly achieved without knowledge of environmental factors surrounding the fish.

In the field work at Pandan (1975 Project), temperature and salinity of the water were measured during the operation of otoshi-ami (over a few months). The water currents, tidal and sea, if measured during the work there might have supplied more valuable information for the understanding of fry and sabalo. Observations on wind, cloudiness, water-transparency and precipitation should also have been made.

Recommendation: It is considered as a general rule that oceanographical survey or observation if made without association with milkfish investigation would contribute little to the knowledge on bio-ecology of the fish.

The working program for oceanographic observation will be made very carefully depending on locally accumulated experiences and objectives, not speaking of technical problems involved. The survey vessels of the Department (SEAFDEC I and II) will play leading part in such project.

D. Age and growth studies (on sabalo)

Work has been started at Pandan (1975 Project, Sec. 3). It may be noted on age and growth at first that the term "morphological measurements" given in the title needs clarification. The term denotes measurements on various body parts of fish as understood among ichthyologists and fishery biologists, working especially on identification of species, races, population, etc. (See I.A., also paper by Liao [1971, Fig 1]). In the same report there are length-weight measurements, but not the morphological measurements.

As to the age determination of Chanos the report discussed the problem based on the reading of scales. Admitting that the techniques involved in fish scale reading are extremely complex, the determination attempted appears not fully convincing. The adoption of a paper on silvercarp was not explained. The spawning mark, if there is any, is not discussed. The age as determined in Taiwanese sabala (Liao, 1971) appears conflicting or not coinciding at least with that of Pandan fish.

Scale reading, if attempted on the milkfish culture in fishponds or lakes, might have supplied valuable background knowledge to the work.

The length-weight relationship in sabalo trapped by otoshi-ami (1975 Project, Sec. 3, Tables II and III) shows very wide ranges both in males and in females the fact being well noted if all the data are plotted on a graph. It may be worth trying to calculate the body weight of fish without gonad (gonad weight is subtracted from the total body weight), the length-weight relationship is sought. A linear relationship might be shown by doing the above.

The growth of sabalo appears hardly discernible because age determination is still ambiguous. The size-frequency method may hardly be applied to sabalo because of its catches.

The development of gonads examined on the sabalo at Pandan was treated in the report only preliminarily, and further analyses of the data may be recommended.

Recommendation: The methods adopted at Pandan Field Station are believed adequate. Some suggestions may be presented as follows: 1) effort will be expanded further for the collection of materials; 2) for the analyses of the data the workers will read more literature relevant to the subject concerned in order to make more accurate interpretation of the problem and full utilization of the data; 3) similar and collaborative studies may be implemented at different field stations including Hamtik, Oton, Pandan and possibly Naujan Lake. It must be remembered that the otoshi-ami is not the sole fishing gear to catch adult milkfish.

#### E. Food availability and utilization

Very detailed study was attempted for the subject by stomach content analysis (1975 Project, Sec. 4), presenting a valuable contribution to the biology of chanos.

A statement (p. 37) ". . . results of which may be used as background data for the milkfish seed production project" may not sound convincing, because the stomach content was examined only on sabalo, but not on fry or fingerlings in natural sea water.

Another personal comment raised by the present writer is as follows. 'Milkfish in the sea water is plankton feeder' is fully understood. The statement (p. 42)". . . they have no specific preference for plankton on any water level" deserves attention. The occurrence of various forms of plankton in sea water or their habitats were not studied nor explained based on existing literature.

Recommendation: The food habit of fish in natural environment is an important subject for study, and one of the techniques often adopted in the study is stomach-content analysis. There are a number of useful papers on the subject, of which 2 publications below may be useful as a reference. Lagler, K.F. (1952) "Freshwater Fishery Biology" and Pilley, T.V.R. (1952) "A critique of the methods of study of food of fishes", Journ. Zool. Soc. India, 4(2): 185-200.

Efforts should be made to study the food habits of chanos in fry and fingerling stage, and also to become familiar with literature along the same line.

## II. Maturation and reproduction in wild and captive fish

### A. Reproductive physiology

This problem had not yet been taken up in the SEAFDEC project.

Recommendation: The knowledge on milkfish, especially the biological problem may be said to be meager or almost nil, since the investigation on this problem is still new. The program of the study naturally will start from the survey of literature. Here again, there are many publications on this subject of fish biology, and the paper below may be found useful in the initial stage of literature review: Holiday, F.G.T. (1963) "The behaviour and physiology of herring and other clupeoids. In: Advance in marine biology, 1: 261-404, Academic Press. Also, contact and subsequent request for technical papers should be made from the Laboratory of Fish Physiology, Department of Hydrobiology, Institute National de la Recherche Agronomique. 78350, Jouy-en-Jones, France.

### B. Gonadal development

The problem on milkfish has been touched by examining ovaries and testes of fishes collected at Pandan (1975 Project, Sec. 3) and UPCF Inland Fisheries Project. The studies made so far may be said to be still in its initial stage of work as to its scope and technique.

Recommendation: The techniques required and the interpretation of the data will be studied at first by reading the publications given below. Holt, S.J. (1956) "Report of the International Training Center on the methodology and techniques of research on mackerel (*Rastrelliger*). IPFC/C58/WP 28". Breder, C.M. and R.E. Rosen (1966) "Modes of reproduction in fishes. Am. Mus. Nat. Hist." K. Yamamoto (1966-1968) "Collection of papers on the reproduction of fish, Tokyo, Japan.

### C. Mating behaviour, etc.

The problem has not yet been touched up to date beyond prospects or imagination concept.

Recommendation: Similar suggestion can be given to refer to the following: Kuo, C.M. and others (1974) "A procedural guide to induce spawning in grey mullet (Mugil cephalus Linnaeus). Aquiculture, 3" Liao, I.C. (1970) "Experiments on induced breeding of the grey mullet, Mugil cephalus L. A paper in Coastal Aquaculture Symposium, IPFC 14th Session, Bangkok, Nov. 18-27, 1970".

D. Natural and/or induced spawning, etc.

Same as in the previous section as the problem has not been touched.

Recommendation: Same as given above (I.C.).

E. Examination of spawned fish

The problem dealt with in this section may be better focused on the subject of how to keep sabalo under captivity. The present writer believes that actual work on the subject is carried out currently at Pandan, of which he is unfamiliar. However, he has been informed that several researchers of the Department made observation tours to Honolulu (Oceanic Institute) and Taiwan (Tungkang Marine Biology Station), and in each institution, experiments are being done to keep sabalo in tanks. It is hoped that the observations made by them will produce valuable information on the works now going on at Pandan and elsewhere in the future.

Recommendation: The present writer has no particular suggestion to make at the moment aside from reporting the following: At the Oceanic Institute (Honolulu) where he made a visit in September 1975, several sabalos nearly one meter long were kept in wooden tanks fed by running sea water. The sabalos were swimming in circle very calmly probably because they were content with the water and food (vegetative) provided. Some of the sabalos kept in the tank were said to have been taken from fishponds in the island, and this should interest the workers in the Philippines.

III. Egg and larval surveys

A. Identification of milkfish eggs and larvae

The eggs and larvae of the species were described by Delsman more than 40 years ago. Since then, no detailed studies on the morphology have been made. This fact alone will require to include full description of eggs and larvae with fine illustrations in the report

(1975 Project). The fact that local fishermen and fry dealers of milkfish are well acquainted with their commodities they will not be confused with the significance of scientific documentation.

Recommendation: Full description and illustration (photograph and drawing) will be made on eggs and the larvae in successive stages based on the materials collected in sea water or reared in tanks. One paper noted here may supply a valuable suggestion to the work above. Matsubara, K. (1942) "On the metamorphosis of a clupeoid fish, Pterothrissus gisu Hilgendorf. Journ. Imp. Fish. Inst., Tokyo, 35(1); 16 pp., 6 figs."

#### B. Occurrence of larvae

The milkfish fry were collected in 1975 at Pandan, Hamtik and Oton by the Department, and the report (1975 Project, Sec. 2) covers the work done at Pandan only. The present writer received a copy of the draft report by P. Gabasa entitled \*Milkfish fry investigation on the Antique coast, Panay Island, Philippines, May - June, 1975\*, 14 pp. and a number of figures.

A few comments on the report from Pandan may be given herewith. On Fig. 2 (p. 21) the ranges in the size (T.L.) of larvae are different in the samples scooped in otoshi-ami from those seined in beach water, the former represented by smaller fishes at least in May and June. Whether the difference in size is reflected by gear selectivity or is it indicating the growth of fry is not explained. Oceanographical conditions are not presented thus making it difficult to analyze the occurrence of the fry in relation to environmental factors. Apparently, tidal fluctuation does effect the abundance of shoals both in offshore and shore waters, but the picture at Hamtik is not so simple. In the report from Pandan, milkfish fry were worked on but no other fishes which should have also been collected were mentioned, nor plankton community in the local sea water explained.

Recommendation: The investigation of Chanos fry will have to be programmed on a national scope because of the importance of the industry. The program could be formulated through careful and detailed planning of field work required: In the planning, the following items may be considered -- site selection, period of operation, unit-collecting-gear, unit-effort, land facilities, not speaking of manpower. In this connection, the experience of the present writer (Kuronuma, K. and M. Yamashita, 1962) may supply some useful suggestions.



The final report of milkfish fry investigation in 1975 will have to incorporate all the works done by the Department presenting the data with care.

#### IV. Egg incubation and larval rearing of chanos

Within the limited knowledge held by the present writer, the problems involved in the subject have not been touched, nor are published information available. Therefore no commentary notes can be afforded at the moment.

Recommendation: Since the studies on incubation techniques and rearing of larvae are now projects so-to-speak in the Department, the study will start from the planning of the study program, but not from 'happy thoughts'. As emphasized repeatedly by the present writer the consultation with literature will be the starting line in the planning, and he will suggest to become familiar with some publications on mullet and herring as introduced elsewhere in the present writing. It may be predicted that the Station at Tigbauan will be the center of actual experiments, where shrimp will be successfully hatched and its larvae will be reared with high survival rate. It is to be remembered that this type of experiments is highly influenced by the facilities provided in addition to techniques.

#### V. Pathology and physiology

The above subjects may be said to be practically unknown in so far as Chanos is concerned.

Recommendation: Since the subjects are broad and quite heterogeneous besides being rather different from other subjects discussed before, an entirely new project will be established or created. The present writer believes that the project will not be undertaken together with other subjects. The Department will also need professional biologists if the project should be taken up at this time.

#### VI. Status of present research

#### VII. Future plan of action

The two above-mentioned problems are better treated within the same category of considerations and ideas, that he also expressed his evaluation, comment and recommendation of each subject mostly from technical points of view in previous pages. Further, it seems apparent that the two problems will have to be treated or considered

from two angles, technical and administrative as well as political in a sense. However, the concepts held by the writer will be given here in the order of original agenda items, but with more bearing on administration.

(1) Researches conducted within the Department

(a) The system in the actual conduct of researches will have to be more solid so that each worker engaged in milkfish investigations can identify himself on the nature and level of the work he is involved in the over-all study conducted by the Department. A pyramidal system of works will have to be formulated more clearly.

(b) Researchers will have to utilize library facilities more extensively. The library on the other hand will make effort to collect publications needed by researchers.

(c) Research vessels will be placed under the maintenance section of the Department, but the captain will be detailed with the research section.

(2) Researches conducted at the national level

(a) Intimate collaboration is needed among research institutions, or organizations existing in the nation -- SEAFDEC, UPCF, BFAR, MSU and probably SCSFDCP.

(b) At present it is observed that the same subject of study is carried out by different institutions with apparently no mutual understanding. The joint studies and the studies shared will have to be defined clearly.

(3) Prospects of international collaboration

(a) It may be easily understood that international collaboration on milkfish investigation is a golden rule.

(b) Conducting a campaign among other nations will have to be made based on an attractive prospectus reinforced by technical aspects of highest quality. The timing of the campaign must be cleverly calculated.

(c) The campaign will be extended to broad areas of the Indo-Pacific and not confined only to the Southeast Asia.

(d) The campaign will be made more efficiently through the channels of international organizations like IPFC, IOFC, SPFC, SCSFDCP, PSA, FAO, etc.

(e) For the time being the present writer is inclined to believe that it is appropriate to hold a meeting in an international level tentatively entitled "International Training Center on the Technique of Milkfish Biological Research", which will follow the present Workshop Conference.

(f) It is to be remembered that IPFC have had a sub-committee within the organization in the past.

## VIII. Documentation

### A. Presentation and recording of works

The Aquaculture Department of SEAFDEC has started actual work since 1973 or so at the MSU Biological Station in Mindanao. Now, it is apparent that records on many works had been drafted. The records are not limited to those describing the works conducted, but also include other types of recordings on the activities of the Department personnel, study and training tours abroad and locally, lectures delivered or attended, etc.

Under such circumstances it will be highly recommended to exert effort to assemble all kinds of records regardless of the nature of its contents. The records, will be properly classified and deposited in the library and be accessible to reading or examination.

Referring to the format of various records issued by the Department the present writer observes that those which have been circulated so far are too bulky, and they are not classified as to the nature of substance. In some cases, administrative content is combined together with research substance, resulting in some criticisms that the Department is a research and training institution.

### B. Report writing

The type of reporting on the researches conducted may be classified roughly into two -- Progress Report and the (final) Report. In this sense the reports on the works done and issued so far by the Department may all fall on the so-called Progress Report.

It is hoped that some of the works conducted (e.g. Chanos fry collections in 1975, and shrimp rearing in the pen) will be published as a final report as well as a real scientific paper. It is also hoped that such a report will be printed in a Journal published by the SEAFDEC AQUACULTURE DEPARTMENT.

C. Local common names of Chanos chanos

This writer made some compilation of common names of the milkfish used in several countries and different places in the Philippines. The list is attached as Annex 1.

D. Bibliography

It is needless to emphasize here the meaning of bibliography in any research activity, and the present writer observes that a scientific paper or book which is not reinforced by a review of literature is very often unacceptable.

In this sense the library must be well provided with publications, and the researchers must always open their eyes widely in literature hunting.

Attached as Annex 2 is a bibliography compiled by this writer.

Local Common Names of Chanos chanos

compiled by K. Kuronuma

Awa-Awa (Hawaii)

Baulo, Bolu (Celebes)

Belanak-sembawa (N. Borneo)

Binni Al-bhr (Iraq)

Milkfish (English)

Banglis (Philippines)

Bangles (Philippines)

Banglot (Philippines)

Banglus (Philippines)

Bangus (Philippines)

Bangos (Philippines)

Ca Mang (S. Vietnam)

Ga-tin (Burma)

Bandang (Malaysia)

Jangos (Malaysia)

Pisong-pisong (Malaysia)

Pla-Nuah-Chan (Thailand)

Plai-meen (Ceylon)

Pal-meen (Tamil)

Ikan Bandeng (Java)

Vaikka (Sinhaleese)

Sabalo (Spanish in Mexico and Philippines)

Sabahee (Taiwan and Japan)

Note: Correction and addition highly appreciated.