

formación que se tiene es fragmentaria y basada únicamente sobre observaciones incidentales e inspecciones de corta duración.

Han habido varias conjeturas acerca de la posibilidad de la existencia de peces en aguas profundas del Caribe Central. En la actualidad se cuenta con evidencia que demuestra que peces migratorios como el atún, pez espada, marlin y pez vela, ocurren en cantidades considerables en aguas profundas que no se les ha prestado atención. Un ejemplo es la presencia de cantidades de atunes de aleta amarilla sobre grandes extensiones del Golfo de Méjico, descubiertas por el bajel explorador Oregon. Las pescas más grandes hechas por el Oregon parecen estar asociadas con la corriente central del Golfo, la cual entra en el golfo con proveniencia del Caribe. Es casi indudable que pescas comerciales de atún ofrecen muy buenas posibilidades en las regiones del Caribe.

DISCUSSION

Caribbean Session

Discussion Leader: F. G. WALTON SMITH

Discussion Panel: CARLOS G. AGUAYO, DUDLEY W. WILES,
WINSTON MENZEL, JOSE SUAREZ

Fluctuations in Abundance of Red Snappers (*Lutjanus aya*) in the Gulf of Mexico

C. ISAAC CAMBER

- Q. Howell Rivero: Do you know if any one has tried to fish for snappers around 80 to 130 fathoms with long lines?
- A. Camber: I am familiar with attempts to fish with reels at such depths, but not long lines. Deep fishing with reels has proven to be successful and the catches include mainly *Lutjanus vivanus*.
- Q. Rivero: Here, I have tried several times to use long lines for deep snapper fishing. I have regular long lines with 100 hooks each working in 80 to 170 fathoms. The average catch of snappers in good condition have been around 30 to 35 for each long line of 100 hooks. Do you think it would be profitable to use this on a commercial basis?
- A. Camber: The long line was tried in the red snapper fishery quite a few years ago. One of the drawbacks was the predation by sharks, so the method has been abandoned.
- A. Whiteleather: We fished some long lines in the Caribbean during the war and we found great difficulty in working this gear on the type of rough bottom that snappers frequent. A lot of gear was lost and when the amount of gear lost was compared to the amount of fish caught the method did not seem feasible.

- Rivero
(Comment): I have tried long lines on the north coast of Havana eastward of Cardenas. Gear losses have been light and I feel that long lines should be tried more intensively to see if they would be of commercial value.
- Q. Broadhead: You mention the 30 month cycle of highs and lows and also a seasonal drop in catches each summer during the spawning period. Do extremely poor catches result when both the cyclic and the regular seasonal low coincide?
- A. Camber: Occasionally. In 1951, the low in the 30 month cycle coincided with the summer low and this resulted in a considerable decrease in yield of fish.
- Q. Osorio: Can *Lutjanus aya* from *Lutjanus campechanus* be separated taxonomically?
- A. Camber: It is impossible to identify the snappers according to the descriptions in keys offered by Jordan and Evermann. There is no distinction between *L. aya*, *L. blackfordii* and *L. campechanus*. As Bloch (1797) suggested the original name *L. aya* this should stand until a further revision of the group is done.
- Q. Osorio: You are trying to appraise the red snapper fishery on the Campeche Banks according to the landings in Florida and the United States. Fishermen of three countries, U. S., Cuba and Mexico are engaged in the fishery. Mexican landings of red snapper from Campeche can be conservatively estimated about 2,000,000 pounds per year. It would be desirable to know the combined catches for the three countries fishing in this area. How representative of the red snapper fishing fleet is your sample used in the section of your paper on fluctuations in abundance?
- A. Camber: As you say, there are three countries involved in the fishery, and I have made a persistent effort to obtain data on the catches by the Cuban and Mexican fleet. I have not been successful in obtaining detailed records. I understand that few Mexican boats are engaged in the offshore fishery for snappers. There are roughly 39 American vessels operating in the Campeche Banks. I analyzed the catches of 28, which represented about 70% of the total American fleet. The records were accurate and meticulously kept by the companies concerned.
- Q. Aguayo: Cuban schooners that fish in Campeche catch more grouper than snapper. Is it not the reverse with the American vessels?
- A. Camber: That is correct.
- Q. Aguayo: How can you explain this situation?
- A. Camber: Towards the southern part of the Campeche Banks there seems to be a higher concentration of snappers. I noticed that boats coming from the Arcas region, for instance, come with 95 to 97 percent of the catch snappers. The ratio of snapper to groupers is about 2 to 1 in catches

between Alacran and Arcas. But, if the fishermen operate north of Alacran towards the 100 fathom line, due north of Progresso, the catch is predominantly groupers. As a matter of fact, I saw about 17 or 18 Cuban boats work these grounds consistently for a period of about 2 weeks in 1951.

- Q. Wald: Have you attempted to correlate bottom samples with the movement of the fish?
- A. Camber: I have tried to use the Bendix Echograms for this purpose and it is obvious that the fish congregate over rocky coral bottom, where there is eel grass. Feeding habits and the direction of the current also influence their movements. The fish may be on one side of the gully during one tide, and on the other side after the tide changes.
- Q. Wiles: Have any examinations been made of the stomach contents of red snappers?
- A. Camber: I have found that the fish are all carnivorous and their stomach contents included crabs, shrimp and bottom fish. I also found that the small snappers have an exclusive diet of shrimp.
- Q. Mowbray: Have you made any attempt to correlate the efforts of the shrimp fleet off Campeche with that of the total catch of red snapper? It appears to me that since shrimp fishing has begun, the catch per unit effort in the snapper fleet has been lower.
- A. Camber: The shrimp boats appeared on Campeche in 1951 and catches of red snapper at that time were reduced. Since the snapper catches consist of fish over three years of age I don't think the decrease in catch, if caused by the activity of the shrimp fleet, would be evident until several years after shrimp fishing started.
- Q. Wiles: Has there been an increase in catch per unit effort with the introduction of wire lines?
- A. Camber: One captain adopted electric reels and wire lines in 1950. His catches, with the same crew, about doubled, possibly due to the shift to deeper waters, made possible by the electric reels and wire lines. The catches of snapper contained a high percentage of *L. vivanus*, the yellow eye snapper.
- Smith
(Comment): I think that there are a number of interesting things inherent in this paper. The question of young snapper feeding on shrimp brings up some rather interesting questions which may not be entirely theoretical. I remember quite some years ago we drew attention in a report to the fact that the snapper on the west coast of Florida frequently had shrimp in their stomachs, at that time pointed out the possibility of a shrimp fishery along the west coast of Florida as far down as the Dry Tortugas, and as you know, subsequently such an area was discovered. Since, presumably it takes somewhere in the order of 10 times

as much shrimp to make a pound of snapper, it is obviously much better in the long run to catch shrimp than the snapper, but by a strange paradox it may be better to catch the snapper in order that we may catch the shrimp. It might not be wise to restrict fishing for snapper, as any increase in the snapper population might result in reductions of the more valuable shrimp stocks.

The Commercial Species of Penaeidae in Cuban Waters and the Development of the Shrimp Industry in Cuba During its First Year

ISABEL PEREZ FARFANTE

- Q. Lindner: At what depths are the boats now fishing for shrimp in the Cuban fishery?
- A. Farfante: Two to 12 fathoms.
- Q. Lindner: In May when they started fishing did the boats go into deeper water?
- A. Farfante: Not as a rule.
- Q. Lindner: There is always the possibility that at that time of the year those species go off shore to spawn and perhaps fishing in deeper waters would be profitable.
- A. Farfante: The rocky bottom resulted in a high gear losses and those boats that tried the deeper waters found it uneconomical.
- Q. Lindner: Have you been able to establish any correlation between rainfall and shrimp production?
- A. Farfante: We have tried, with little success as yet.
- Q. Anonymous: Shrimp boat captains operating in the zone of La Broa and Santa Cruz believe that rains affect the production of shrimp. Has anyone investigated this matter or are they contemplating on sending the research vessel *Don Carlos*?
- A. Farfante: Yes. We have studied the correlation of rainfall with shrimp production in Cuban waters with little success. For example, last year was a year of high rainfall and this year during the rainy season production was very limited. We have no conclusions, but we are observing the phenomena.
- Q. Anonymous: Has the *Don Carlos* conducted any investigations in connection with this matter?
- A. Farfante: Not yet, although it is now being considered to send the ship to the area between Santa Cruz and Manzanillo.
- Lindner
(Comment): Gunter and Hildebrand reported recently on relationship between rainfall and the catch of shrimp two years later. We are finding on the west coast of Mexico, in one area primarily, with *Penaeus*, that a relationship exists between rainfall and catch of shrimp. Rains of June and July, at the beginning of any season, when the rainfall is high, result in high fall catches that year.

- Q. Vien: Do you think that temperature could be an important factor in the production of shrimp?
- A. Lindner: I have some data ready to be published on that. There is a relation in Buenos Bay between catch and rainfall when the temperature of the air drops below about 20°. Above 20° C. there seems to be no relation between catch and rainfall.
- Q. Anonymous: Are there any economic investigations being conducted in connection with attracting foreign capital for the exploitation of our shrimp in the area of Batabano?
- A. Farfante: No. I don't think so.
Kahn
(Comment): To interest American capital in the shrimp industry of Cuba, one must answer certain basic economic questions. It is to a certain extent astonishing that we do not have the economic data. We have good production records but naturally as an economist, I am interested in prices, costs of transportation, and other economic data. Without this basic information it is difficult, if not impossible to obtain financial assistance in exploitation of the new Cuban shrimp fishery.
- Farfante
(Comment): Some of the producers have been kind enough to give me their personal data. Officially no records are at present being taken. So, I have obtained from one large dealer and from several owners of small boats the catch record every year since the first year of the shrimp industry in Cuba. We have been unable as yet to establish the official organization to collect data on the shrimp industry.
- Canet
(Comment): As an officer of the Banco, I would like to make a few comments on this matter of finances. It appears that at present the largest buyer of shrimp in the world, the United States, is going through a crisis in their own shrimp fisheries and it would be inopportune to attempt to attract foreign capital from the United States at this time. Prices in the American market are scarcely covering production costs. The thing to do is to continue with the investigations within the limited funds available to the Centro de Investigaciones Pesqueras and the other sections of the Banco devoted to the development of fisheries. We have on record that in the year following the discovery of our shrimp areas, there was an investment of about \$900,000 in ship equipment and other gear in the hope that this would lead to a further development of the fisheries. Unfortunately, reduction in price and of production in Cuba has raised doubts amongst Cuban investors that perhaps the wealth of the shrimp beds has disappeared.
- Menzel
(Comment): Several years ago the oyster, *Crassostrea virginica*, from the United States was introduced in Cuba, but was not successfully established. This may have been due to the

fungus, *Dermocystidium marinum*, which according to the research of Dr. Macken, Dr. Ray and others, does it's most damage in temperatures about 20° C. I believe your temperatures are usually above that level. I would suggest before additional work be done on introduction that you investigate the biological aspects carefully.

Farfante
(Comment): We have been working on the biology of the *Crassostrea rhizophora* here in order to establish the spawning time and the growth rate of the oyster. We are aiming to find settling strata for the oysters and so far I have tried bamboo and royal palm without any success. Such experiments with drain tile and floor tiles has been successful. The oysters attach in large quantities and grow very well.

Q. Anonymous: I was not in accord with a closed season in the shrimping areas of Cuba. Do you believe that such a system should be changed in future years?

A. Farfante: The point of view was maintained that we were working with a shrimp population of unknown magnitude. Fishing has not been conducted with an intensity that would result in depletion of the grounds.

Q. Anonymous: Wouldn't you think that if we must have a closed season at all that said closed season should be established during the summer months which in the past two years the catch was at a minimum? Do you believe that the Banco is going to discuss a change of such a closed season with the Department of Agriculture?

A. Farfante: Of course more biological work is necessary before we can intelligently regulate the fishery. In the meantime, I think it would be opportune, and as a matter of fact, it is already decided, to prohibit fishing in inland waters, that is waters close to the coast, for the protection of the young.

Survey and Appraisal of Living Aquatic Resources

KESTEVEN AND OSORIO-TAFALL

- Q. Wiles: Do you have your publications printed in English?
A. Osorio: Yes, we have some printed in English.
Q. Kahn: Do you emphasize cooperative movement among fishermen or do you more emphasize individual enterprise?
A. Osorio: We try to emphasize the cooperative movement since we feel that it offers the best protection for the fishermen.
Q. Diez: Has the United Nations an interest in increasing the consumption of fish as a source of protein and if so are they promoting this aspect of the problem?
A. Osorio: FAO is furnishing on request advice on programs to increase the consumption of fish commodities.

Another Look at the Caribbean Fisheries

R. T. WHITELEATHER

- Smith
(Comment): It seems apparent that in a rather considerable body of water like the Caribbean it would appear that there should be, at least on the surface, a greater fishery production than there is. As Mr. Whiteleather pointed out, there is a very limited extent of shallow water and therefore the production of fish is bound to be limited. On the other hand, and this has been shown by recent developments in the Gulf of Mexico, the pelagic migrants stocks may be more important, and that this is where one should look for a future fishery.
- Q. Bottemanne: Have you any data, notion and ideas about the possibilities of a shrimp fishery in the Serinan?
- A. Whiteleather: The shrimp possibilities off of the eastern, northeastern coast of South America in the Guiana current and on the broad continental shelf would offer the best promise. In our work around British Guiana we did not catch shrimp in any large quantity, although we didn't spend much time working there.
- Q. Wiles: Do you think that there is any relation between the pressing away on the Amazon and Orinoco rivers on the British Guiana and South American coast which will carry food into the current which eventually passes south or north east of Barbados and right through the Caribbean islands?
- A. Whiteleather: I'm not an oceanographer, however I don't believe that there is much information on this nutrient material that is carried in to the Caribbean.
- Wiles
(Comment): We find that there may be a lull in the fishing activities from the dry season on, especially at that dry season as prevails on the British Guiana coast. If British Guiana has a rainfall of 9 to 10 we can look for a productive fishery in the Barbados area. I feel that the large rivers are to some extent carrying food further away from the South American coast and eventually get into the Caribbean area.
- Q. Canet: Are there any other fishing grounds for red snapper and grouper in the Caribbean area comparable to that of Campeche?
- A. Whiteleather: I don't know of any in the Caribbean. A little south off the continental shelf of British Guiana and Venezuela in the Guiana current there are a reasonably good red snapper grounds now being fished by British Guiana. However, I don't think it has the production potential of Campeche.
- Smith
(Comment): Some two or three years ago with the excellent assistance of two members of the Cuban Navy, Lt. Brooks and Lt. Franco, I worked out the areas of divergent water mat-

ters in the Gulf of Mexico and found that there was a very considerable area of high divergence on the Campeche Banks and I think that that is where one would look for such a fishery, but there are no similar known areas in the Caribbean. I believe that the most productive areas are in those shallow areas where there is probably considerable river drainage, such as in the Gulf between Trinidad and Venezuela.

Q. Bottemanne: I learned that in Barbados there has been considerable development of the flying fish fisheries. Would you consider the possibility of this fishery being extended to other areas of the Caribbean?

A. Whiteleather: I'll ask Mr. Dudley Wiles to answer this question.

A. Wiles: It has always been my opinion that flying fish in commercial quantities exist up to Florida. I have recently been able to survey the area near the island of Antiga, approximately 600 miles north west of Barbados. We made catches up to 5000 fish with one small boat and I am convinced that at least the ground between Barbados and Antigua would be productive if exploited.

Whiteleather
(Comment): I think that Mr. Wiles is correct in suggesting that it is a fishery that needs exploring. In the broad area of the Caribbean we must obtain some of this basic information, otherwise our talk is sheer speculation.

Smith
(Comment): I would like to second Dick Whiteleather's plea for more practical exploration, without in any way minimizing the importance of the so-called fundamental studies of biology, oceanography and the sciences related to fisheries. It does seem that the greatest development of fisheries in the future will come if we make use of the already existing knowledge to directing or delimit the operations of exploratory expeditions.