

DISCUSSION PAPER

Optimum Yield for C. opilio North of 58° N in the Bering Sea
for the
North Pacific Fishery Management Council

Alaska Sea Grant Program
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SUMMARY

The draft Fishery Management Plan (FMP) has set the optimum yield (OY) for the tanner crab C. opilio at the level of the 1977 foreign tanner crab harvest (12,500 mt.). This paper is designed to provide council members with a review of the current status of the C. opilio markets, project effects of various OY options, and discuss possible price considerations and market interaction.

The major markets for C. opilio are in Japan where approximately 30,000 mt. are being supplied. It is estimated that approximately 12,000 mt. will be supplied from the Japan Sea and hopefully 1,000 mt. from the developing U.S. fishery in the Bering Sea. An additional 17,000 mt. will be required just to maintain the Japanese supply. Various options and their implications for OY are centered around this 17,000 mt. An OY value of less than 17,000 mt. could have the following effects:

- . Substitution of other seafoods in the Japanese diet;
- . Decrease in export of C. opilio from Japan;
- . Accelerated development of Soviet Union fishery; and
- . Accelerated development of U.S. C. opilio fishery.

An OY value of greater than 17,000 mt. could have the following effects:

- . Continued increase in consumption of C. opilio in Japan;
- . Development of new export markets;

- . Retardation of development of both U.S. and Soviet Union fisheries; and
- . Acquisition of data on economics of harvest of resource from the Japanese.

Price considerations and associated welfare implications are not addressed with regard to the specific options. It is noted that the United States does not presently control world price of C. opilio.

A lower world price could have the following effects:

- . The U.S. consumer of imported crab will be better off unless imports are restricted.
- . Providing the C. opilio fishery is cost competitive, the members of the C. opilio fishery will be better off in the long run if they can overcome any potential bottlenecks to production expansion.
- . The domestic C. bairdi fishery could be put at a competitive disadvantage unless imports of C. opilio are controlled, if they are strongly competitive product forms.
- . The members of the U.S. fishery for C. opilio could be made better off in the long run if they gradually take over the C. opilio markets the Japanese develop in the U.S.

Possible market interactions between C. bairdi and C. opilio are presented.

INTRODUCTION

Concern has been expressed by members of the North Pacific Fishery Management Council with regard to the justification given in the first draft of the Fishery Management Plan (FMP) (July 11, 1977) for setting the Optimum Yield (OY) for the C. opilio in the Bering Sea at the level of the 1977 foreign tanner crab harvest (12,500 mt.). The draft FMP establishes that the MSY for C. opilio in the Bering Sea as 151,000 mt. Approximately half of this resource is located south of 58° N latitude. Enforcement and gear conflict problems associated with the harvest of C. bairdi by the U.S. fleet, have resulted in a prohibition of foreign harvest of C. opilio south of 58° N. This leaves an MSY of 75,800 mt. of C. opilio north of 58° N for which an OY and Expected Domestic Annual Harvest (DAH) must be established. The DAH is then deducted from the OY to establish the Foreign Allowable Catch (FAC). The draft FMP indicated that the DAH north of 58° N will be minimal during 1978. Therefore, the FAC would be equal to the value established for OY.

In establishing the OY in the draft FMP for C. opilio north of 58° N two principal socio-economic factors are given as justification. They are:

- (a) "United States policy, through a series of bilateral agreements over the past several years, has been directed at improving the conditions for developing the U.S. tanner crab industry. As a result of these agreements, foreign nations have been prevented from tanner crab fishing in the Gulf of Alaska and have

either reduced their take of tanner crab in the eastern Bering Sea or withdrawn from the fishery altogether. The policy has accommodated a favorable investment climate for a growing U.S. catching, processing, and marketing capacity."

- (b) "The U.S. markets for tanner crab are in an early stage of development with exports accounting for a substantial portion of U.S. production. Industry representatives have repeatedly drawn attention to the volatility of markets for shellfish and repeatedly stated that increases in foreign allocations of tanner crab will weaken U.S. domestic and export markets."

Both of the above excerpts from the FMP address the demand and marketing of tanner crab within the U.S. and worldwide. They imply that if large amounts of foreign caught tanner crab are allowed into the market, the market for U.S. caught crab will be weakened and thus the investment climate will suffer.

Based upon these implications the OY for C. opilio north of 58° N has been set at 12,500 mt. in order to insure that there is no increase in the total foreign harvest of tanner crab within the area of U.S. jurisdiction. No specific data are provided in the draft FMP which would give credence to the above assertions.

The Alaska sea Grant Program has undertaken a study of the demand and marketing of tanner crab. Although this study has only been

underway since June 1977, limited data has been compiled which allows an examination of the validity of the above assertions. This discussion paper is designed to provide council members with a review of the current status of the C. opilio markets, project effects of various OY options, and discuss possible price considerations, and market interactions.

First it should be pointed out that the Preliminary Management Plan (PMP) stated that careful monitoring would be carried out during the year to determine any adverse consequences on the U.S. markets of raising the C. opilio foreign allocation to 7400 mt. To date, to our knowledge, a monitoring report has not been issued. If this information is available it should be reviewed before any action is taken relative to this report.

There are three policy goals (not necessarily compatible) involved in the determination of OY of C. opilio which will be examined in this report. These are: world tanner crab price stabilization, the maximization of the welfare of U.S. consumers who utilize imported C. opilio and the maximization of the welfare of members of the U.S. fishery for C. opilio and C. bairdi tanner crab. There are three major domestic markets of concern: the U.S. export market of C. opilio, the U.S. import market of Japanese caught C. opilio, and the markets for domestically caught C. bairdi. How the three policy goals affect these three domestic markets is of prime interest in determining the optimal OY for C. opilio north of 58° N.

WORLD SUPPLY, HARVEST, AND DEMAND

To examine the potential success of these policy goals, the larger world sources of supply of C. opilio need to be reviewed.¹ In the

Japan Sea the MSY for C. opilio is estimated to be in the vicinity of 10,000 to 12,000 mt. These stocks have been heavily exploited by the Japanese and it is felt they will require greater protection to restore them to former levels of yield. The stocks in the Okhotsk and western Bering Sea (Olyutorshi and Navarin areas) are assumed to be quite large, although specific information is not available. The other major source of C. opilio is the eastern Bering Sea where it is estimated in the draft FMP that the MSY is in the vicinity of 151,000 mt. (based upon the mature component of the population).

It is expected that the Japanese will continue to harvest approximately 10,000 to 12,000 mt. of C. opilio from the Japan Sea. The Soviet Union has excluded the Japanese from fishing within their 200-mile limit and it is expected they (Soviet Union) will subsequently develop their own fishery for tanner crab within their waters. To what extent the Soviet Union will export their catches of C. opilio is unknown at present, but they could conceivably saturate the Japanese market (if the Japanese allow it) providing severe competition for U.S. exports and a price situation over which the U.S. would have little control.

X It is expected that the U.S. will harvest C. opilio during the 1978 season but the amount and the proposed market is unknown. No doubt this harvest will be minimal. It is possible that the crab will be exported to Japan.

The major demand for C. opilio is in Japan. During the 1971 to 1974 period 30,600 to 36,300 mt. tons of raw crab were supplied. Note that totals may have included approximately 230 mt. of canned crab (1,380 mt.

raw whole crab) which are exported, about half of which came to the United States. It should also be noted that the per capita consumption trend of tanner crab in Japan is rising. Assuming that the Japanese harvest 12,000 mt. of C. opilio from the Japan Sea and import 1,000 mt. from the U.S., then an additional 17,000 mt. will be required just to maintain the Japanese supply.

The current demand for C. opilio in the U.S. is unknown. Japan exports 115 mt. of canned tanner crab (assumed to be C. opilio) to the U.S. It is also known Southern California imports from Japan 85 mt. of tanner crab as frozen sections and meats (species unknown).

OY OPTIONS AND THEIR PROJECTED EFFECTS

Given both the lack of specific knowledge regarding the maximum economic yield of C. opilio and the fact that Japan is the largest consumer of C. opilio, the Japanese crab requirements will be used as a benchmark for evaluation of alternate values of OY. It is assumed that the Japanese total supply is 30,000 mt. of which 12,000 mt. will be harvested from the Japan Sea. Additionally, it will be assumed that 1,000 mt. will be provided by the developing U.S. fishery and that no crab will be provided by the Soviet Union to meet Japanese needs. Therefore, options of OY will be considered as less than or greater than 17,00⁰ mt. It should be noted that these possible effects are by no means all inclusive and that additional effects can be added by the reader.

LESS THAN 17,000 MT.

Possible effects:

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- A. Other seafood products would be substituted for C. opilio in Japan if alternative sources of supply were not forthcoming.
- B. Japanese exports of C. opilio could decrease.
- C. If the shortage of crab causes Japan to allow the import of Soviet Union caught crab, it could provide the impetus for accelerated development of the Soviet tanner crab fishery.
- D. The development of the United States C. opilio fishery could be accelerated if the crab is allowed to be imported into Japan.

GREATER THAN 17,000 MT

Possible Effects:

- A. Per capita consumption of C. opilio in Japan could continue to increase.
- B. Exports of C. opilio from Japan could increase along with new markets being developed. It is conceivable that some of the additional exports will end up in the U.S.
- C. The development of both the United States and Soviet Union C. opilio fishery could be slowed down.

- D. Additional information collected by the Japanese fishery could be made available on the economics of harvest and concentration of the resource.

The trade-offs between these possible effects will need to be evaluated by the council and are based upon the council's findings regarding the ability of the U.S. fleet to enter the fishery and the political considerations of world marketing.

PRICE CONSIDERATIONS

It should be noted that the above effects do not include any resultant increase or decrease in prices of C. opilio on the world market.

Price considerations and associated welfare implications specific to particular options cannot be addressed other than hypothetically due to present lack of quantitative estimates of demand and demand elasticities in the relevant C. opilio markets.

Further, it should be added that the U.S. does not presently control the world price of C. opilio even though they manage the eastern Bering Sea resources. The reasons are: (1) the U.S. is not currently a major harvester of C. opilio, and (2) there is uncertainty involved as to who will harvest the future increases in world supply.

Assume hypothetically that increasing the foreign allocation will, in fact, (for mentioned or unforeseen reasons) lower the world price of C. opilio. What effect will this have on the three groups of people

(United States C. opilio and C. bairdi fishery members and U.S. consumers of imported C. opilio) for which the council is trying to maximize benefits?

For the consumers of imported C. opilio the result of a decrease in C. opilio price is twofold. It will increase real income of the consumer and it will also cause him to substitute more C. opilio for other goods in his consumption bundle. The combination of these two effects will increase his total welfare.²

The effect of lowering world price of C. opilio on members of the C. opilio fishery (effects on C. bairdi fishery are addressed below) will depend on three interacting factors:

1. the elasticity of demand for C. opilio,
2. how world price for C. opilio compares with average total cost in the C. opilio fishery in the U.S., and
3. the bottlenecks to expanding production in the U.S. fishery for C. opilio.

The crucial question to be asked at the outset is why is the C. opilio fishery in the U.S. not in existence at this time? If the answer to this question is that the price of C. opilio is below the average variable cost of production at any output level thereby making the earning of an economic profit impossible then lowering the world price will only serve to widen the gap between costs and returns and make entry into the industry even less desirable.

If, on the other hand, the U.S. C. opilio fishery is cost competitive on the world market and production has not begun for other reasons such as inadequately developed markets then the interaction of factors 1 and 3 above will determine the outcome of a hypothetical price reduction. Whether or not total revenue in an industry will expand, contract, or remain the same as a result of a price reduction depends on whether the elasticity of demand is greater than, less than, or equal to 1. If the elasticity of demand is greater than 1, total revenue will increase, if less than 1 it will decrease and if equal to 1, it will remain the same. Early computer runs on an exvessel demand model³ for C. bairdi crab using Kodiak data indicate the elasticity of demand is significantly greater than 1. Despite the fact the data applies to C. bairdi, one would intuitively suspect elasticity for C. opilio would be even greater relative to C. bairdi as it is a less developed fishery in the U.S. For an industry already in production, this would imply that a price reduction would increase total revenue and thereby increase welfare of the participants in that industry. In the case of the C. opilio fishery it must be kept in mind, however, that if bottlenecks occur to expanding production to the appropriate level to take advantage of increased total revenue, welfare increases to the industry participants will not immediately accrue. These bottlenecks could very likely occur in this case due to the fact the United States C. opilio fishery is in its infancy.

MARKET INTERACTIONS

There is another issue of prime concern to be considered and monitored with caution. In 1976, 85 mt. of frozen tanner crab (30% legs and 70% meat) was imported to Southern California from Japan. Currently it is

not known if the crab was C. bairdi or C. opilio. This crab was inferior in meat quality and packaging and sold at a lower price than frozen U.S. caught C. bairdi. If, this 85 mt. of imported frozen crab is C. opilio, there could arise a significant competitive problem with domestic C. bairdi markets if an increase in foreign allocation of C. opilio should result in increased imports to the U.S. It has already been demonstrated that the U.S. consumer of imported crab will be better off with a larger volume and lower price. But the members of the United States C. bairdi fishery face an inelastic supply of C. bairdi due to economic concentration factors of the resource. To compete effectively, they would have to increase volume and lower price of their product. This they cannot do. If frozen C. opilio imports rise because of an increased C. opilio allocation to the Japanese, the council could be left with a welfare trade-off problem of whether the increase in consumer welfare which results makes up for the loss in welfare incurred by members of the U.S. fishery for C. bairdi.

The alternative to this uncomfortable position is, of course, to restrict imports of frozen meat. It must be recognized, however, that these are obvious difficulties involved in instituting import controls both from the standpoint of lag-time involved and balance of payments problems.

It should be remembered at this juncture that while the frozen meat and legs market for Japanese imported crab is of crucial concern, the primary market for imported C. opilio from Japan is the canned product form. Increases in canned imports could likewise cause competitive problems with C. bairdi canned product but cautions expressed in the

previous paragraphs must be weighed against the possible advantages of allowing the Japanese (through an increase in C. opilio foreign allocation) to develop an expanded market for canned C. opilio in the U.S., a market which the U.S. could gradually take over as the United States C. opilio fishery develops.

FOOTNOTES

- 1 This information is contained in the Bering Sea Tanner Crab Resource: U.S. Production Capacity.

- 2 It is assumed here that crab is a normal good, i.e., a lowering of its price will increase its consumption.

- 3 Work on exvessel demand is in progress for tanner crab in connection with the Market Demand and Market Channels study undertaken by the Alaska Sea Grant Program.