RESTRICTED

INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES

Serial No. 2898
(A.a.4)

ICNAF Comm.Doc. 73/3

ANNUAL MEETING - JUNE 1973

Memorandum by the US Commissioners on the regulation of fishing effort
(as presented to the Special Commission Meeting - January 1973)

Proposal

1. The United States believes there is a demonstrable need for immediate action to control the total fishing intensity within the Northwest Atlantic fishing area, and that the situation is of particular concern and urgency in the southern portion of this region. It therefore proposes, for consideration at the January 1973 ICNAF Meeting, the following actions for Subareas 5 and 6:

I. That the fishing effort be reduced to the level which corresponds to the fishing intensity required to provide the total maximum sustainable yield of finfish (recognizing that this yield will not be achieved immediately by adoption or imposition of effort or any other type of controls).

II. That the allowable amount of fishing effort to achieve this objective, as determined by STACRES, be obtained by an appropriate percentage reduction of the effort that was applied in 1971. US calculations indicate that the effort in 1971 was 31% greater than that corresponding to the MSY level. However, the fishing effort in 1972 probably increased again and therefore the required reduction of effort applied in 1972 would have to be greater. The actual reduction will be based on the estimates obtained from STACRES.

III. That the appropriate units of effort for management be determined by the Commission based on the advice of STACRES such that they provide for the most effective control of fishing intensity within the constraints of administrative and enforcement practicalities. The reduction would apply to all gears designed for or capable of catching significant quantities of finfish.

IV. That the allocation among countries of the allowable effort be accomplished according to principles developed and applied by ICNAF in setting previous catch quotas. This would include factors such as historic effort levels, recent increases in effort, coastal state interests, developing fisheries, relatively immobile vessels, and recent entrants. In the circumstances, new entries should not be a significant factor.

V. That application of the above criteria, including coastal state interests, absence of significant increases in effort, and relatively immobile vessels, indicate that coastal fisheries should not be reduced.

VI. That the catch quotas, mesh regulations, and closed areas now in effect or proposed for 1973 be retained as parts of the comprehensive regulatory effort.

VII. That the reduced level of fishing effort is to be implemented on an urgent basis. Members will be expected to move immediately to reduce their effort demonstrably pending entry into force of the proposal adopted in January 1973.

VIII. That the allowable effort regulation should provide for review and adjustments as necessary at each Annual Meeting.

2. The United States does not propose consideration of the problem exclusively in the southern part of the region. We do appreciate that the reductions in effort discussed above might produce diversion of effort to other portions of the ICNAF region which might not be desirable, or that effort reductions may be necessary in these portions based on information not currently available to or analysed by the United States in this memorandum. Thus, the above regulation might specify that the effort reduced should not be diverted to other portions of the Convention Area, or the January Meeting might decide to adopt additional effort regulations for other portions of the region.

3. Background and Discussion

4. In its memorandum of October 6, 1972, circulated to all Commission Members, the United States called attention to developments now threatening prospects for effective resource management in the Northwest Atlantic. In that document, the United States once again pointed to the dramatic increase in the level of fishing effort deployed in the ICNAF Convention Area. This increase has been continuous and consistent over the last ten years, although US effort has remained almost constant (Fig. 1). The total effort deployed in Subareas 5 and 6 reached the level which could produce the maximum yield by 1965 and had exceeded it significantly in recent years. This is a matter of serious concern.

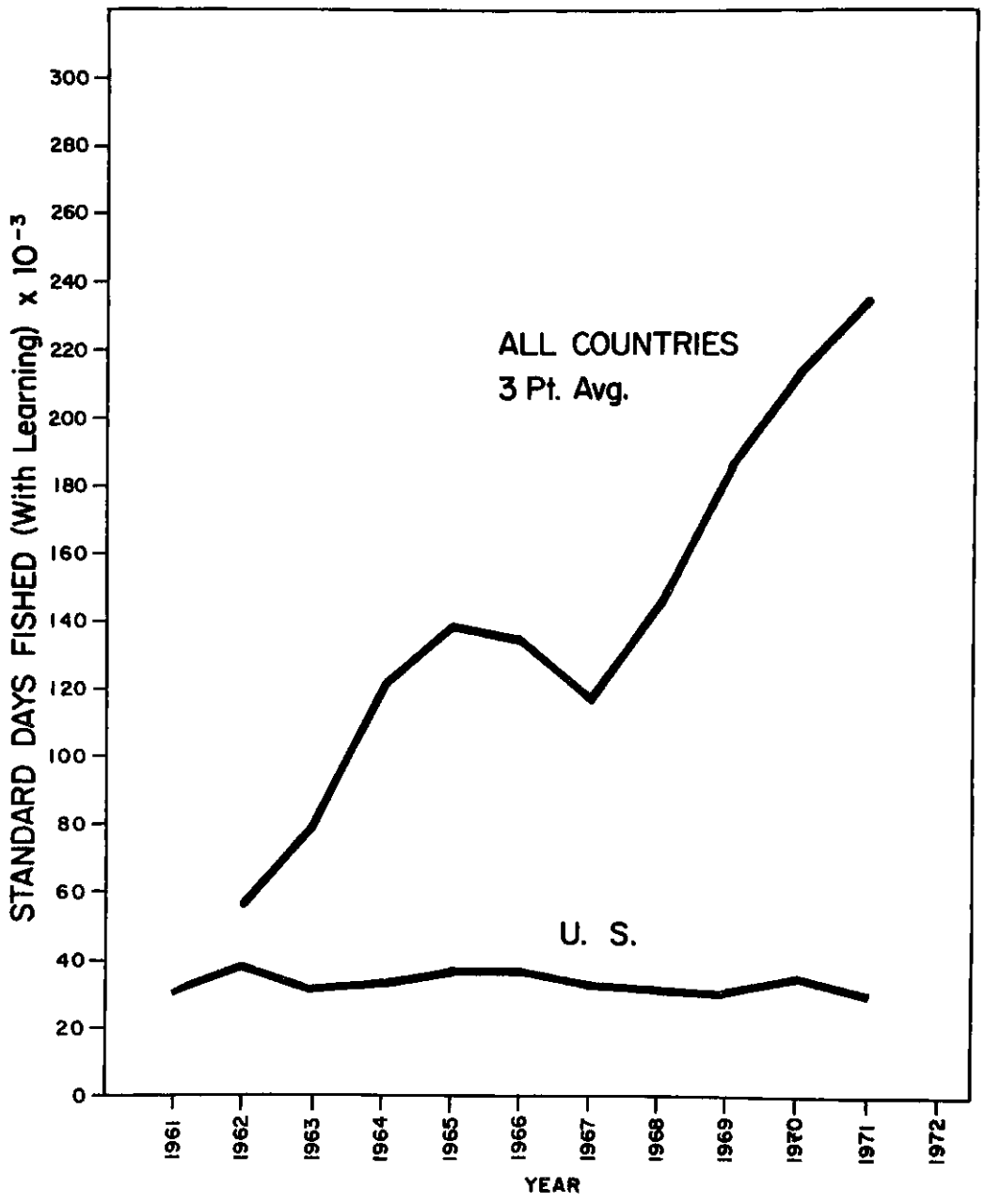

Fig. 1

5. The United States has, in its earlier document, presented the findings of its scientists indicating that the increase in total effort deployed in Subareas 5 and 6 accelerated at an even more alarming rate during the first half of this year. Specifically, it was noted that available evidence indicates an increase of 20% during the first 7 months of 1972 over the same period in 1971 in the number of non-US fishing vessels deployed in ICNAF Subareas 5 and 6. The United States noted that such an increase should be viewed as all the more critical in the light of the fact that total effort in this portion of the Convention Area was already excessive in terms of the maximum potential yield of the total available biomass of all finfish.

6. Increases in total effort of this order not only run counter to the conservation goals of the Commission, but jeopardize the positive steps recently taken with the institution of national catch quotas for herring, and the initial agreement reached this June on similar quotas for 15 separate fish stocks in the Convention Area. First, excess effort subverts the effectiveness of the quotas already agreed upon since it results in the taking of excessive amounts of regulated species as incidental catches. Second, stocks not currently under regulation can be rapidly depleted by application of this excess effort once allocated quotas of regulated species are reached. Third, it is generally recognized that intense application of effort in a short period can disperse stocks or reduce their availability to other members fishing with moderate effort, if not physically certainly economically. Fourth, it makes far more complex the regulatory process, because it increases the potential for crisis situations developing and requires more intensive and frequent review of existing regulations.

7. Introduction of additional quota allocations for unregulated stocks cannot resolve all of these problems. First, the problem of stock dispersion reducing the possibility of some members being able to maintain a viable fishery would remain unresolved where excess effort was applied by others.

8. Second, there is the species mix situation in Subareas 5 and 6, which serves to insure the incidental catch factor in virtually all directed fisheries. The Assessments Subcommittee concluded in its report presented to the 1968 Commission Meeting that Subareas 5 and 6 are characterized by a much greater species mixture than other regions in the Northwest Atlantic. The list of species caught and the description of fish distribution from research vessel surveys demonstrates this fact clearly. The report concluded that none of the main fisheries can be prosecuted on the basis of a single species. Further definition of this feature will be forthcoming, but it is obvious that incidental catches of species not sought are generally significantly high. Even though the proportions of incidentally caught species may be low, the absolute magnitude is often high relative to the productivity of the population concerned. That is, a species could well be overfished as a by-catch.

9. It is axiomatic that the productivity of a given species is related to that of other species through prey-predator relations, competition, and other factors. It is, from this standpoint, irrational to expect to accurately predict total potential yields for the sum of all components of the population based on independent assessments of each of the components.

10. Because of this state of affairs, management of the fisheries through extending single species quotas is not sufficient. Excess effort would continue to create large incidental catches of regulated species despite the institution of additional catch quotas. The inability to regulate catches precisely is particularly significant in relation to valuable species which have already been severly depleted, such as haddock on Georges Bank. It has been indicated for this stock that the uncontrolled incidental catch at the present time is greater than the production. There appears to be little chance of recovery of stocks in this condition under the present regime of quota control.

11. Third, even if it were possible to regulate and maintain the catches of many species near the desired levels, the Assessments Subcommittee had advised on many occasions that adequate assessment of all species could not be accomplished within the time rate of development of the fisheries. Under these circumstances, we would in most cases implement conservation measures only after the stock has been depleted. This is all the more true since those sotcks not under regulation will be subject to greater rates of exploitation more rapidly as more stocks are regulated, particularly when available fishing capacity is increasing.

12. Thus there is a clear need to reduce effort directly as a supplement to quota allocations. It is recognized that quota allocations of themselves can serve to limit effort in some circumstances. However, it is possible that a quota system by itself will encourage net additions to total effort in order to catch specified quotas in a shorter period of time. In addition, so long as there is the opportunity to fish for other, unregulated, species, effort will tend to increase. In these circumstances, further excess effort may be encouraged and economic benefits lost. Hence, catch quotas cannot be relied on to achieve the required effort reduction.

13. In short then, continued application of excess effort as has been deployed recently threatens to undermine the Commission's conservation efforts:

I. by taking such quantities of regulated species as incidental catches as to limit the effectiveness of the quota allocation schemes themselves,

II. by depleting unregulated species to which excess effort is directed, and

III. by preventing some members from taking their allocated quotas because of dispersal of stocks.

The adoption of appropriate controls on total effort is, in the US view, a necessary step toward the solution of such problems.

14. There are additional advantages to this approach. One, economic; important cost savings do occur when excess effort can be removed from a fishery. Two, with direct control of effort, catches will vary properly in accordance with annual fluctuations in recruitment, hence securing the benefits of good recruitment and avoiding the danger of excessive catches. The adoption of total effort limitation as a supplement to national catch quotas will mean that annual adjustments in specific quotas is less critical. Three, management capability is enhanced; the amount of effort may be fixed in advance, and the fishing vessels on the grounds can be directly observed and fishing activity directly enumerated.

15. In considering this problem it must also be recognized that the fishing effort deployed in Subareas 5 and 6 consists of a mix of (1), highly mobile effort which can readily be deployed to other areas, and (2), relatively immobile effort which can only be employed locally. Moreover, the increase in total effort is readily discerned to be attributable to the highly mobile effort deployed in the area. In fairness, this highly mobile effort should be redeployed to fishing grounds in areas where conservation problems are not critical.

16. Because so many of the stocks in the Subareas 5 and 6 are so intermingled that effort applied to one has a direct and immediate bearing on others, and because so many of the stocks migrate between Subarea 5 and Subarea 6 or generally occur on both sides of the division line, it is essential that effort controls be applied to the entire region. Effort control limited geographically without regard to the extent of the stocks would only result in transfer of the problem from one place to another.

17. The above discussion indicates a reduction in total fishing intensity is both necessary and desirable to provide for a viable fishery. A range of options for regulating the fisheries may be exercised to achieve this objective. The choice should be selected so that fleet efficiency, simplicity in application, and enforcability are maximized within the constraint of reasonable precision in achieving the desired overall fishing intensity.

18. A new approach to remedy the defects of the regulatory program in the southern part of the ICNAF Area must have as a central element direct restrictions on fishing effort. This requires the selection of basic units for measuring the fishing effort to be regulated. The possible units are fishing vessels, trips, time on grounds, or time fishing, all of which can be specified by class or vessel (based on size related to efficiency) or more uniformly on a ton-day basis. Further, refinement to number of sets or hauls fished, again specified by type or size of gear, may increase the precision of controlling fishing mortality, but increase greatly the difficulty of monitoring and enforcement.

19. The problems associated with determining the fishing intensity generated per unit of effort and the intercalibration of different types and sizes of gear and vessels have been considered at length. Man's ability to catch fish constantly improves. Indeed, we do not want to inhibit this. The problem of monitoring these changes is alleviated to some extent by the fact that they are related to a distinct, observable change in gear. Thus, they can be quantified and calibrated as they occur. It perhaps should be a requirement that new gear be calibrated before its introduction. Scientists have demonstrated an ability to measure the appropriate factors with some degree of accuracy and precision. In our judgement, this is sufficient to achieve our objective, particularly when evaluated relative to the present regulatory regime.

20. The present state of stocks in Subareas 5 and 6 requires not only a limitation on total effort, but also certain ancillary regulations to permit recovery of stocks within reasonable time periods, and to prevent selective fishing from reducing certain desirable species. Fishing effort can be directed to some extent to or from specific fish stocks by setting or retaining quotas on individual stocks, or areas. Closures of certain areas, completely or seasonally, to permit more rapid recovery of extremely low stocks, may be necessary. When population abundance has recovered to desired levels, and the fishing intensity is at the proper level, some ancillary controls may not be necessary.

21. The imposition of controls on overall fishing intensity also enhances the benefits of mesh regulation, which depend on the fishing mortality rate. It has been concluded that the low spawning populations of some stocks has led to a very much reduced probability of good year-classes. Also, the benefit of quotas set assuming stable effort and age compositions may be negated by harvesting fish at smaller sizes. Thus, it is highly desirable to set some uniform minimum mesh size to cover all species of fish. In addition, where it is desirable and possible to increase yield per recruit for some species, larger minimum mesh sizes or size limits may be set or retained for haddock, cod, flounders, and herring. A uniform minimum mesh size of 2 or 2½ inches would be of considerable benefit in alleviating the present tendency to catch many very small fish either directly or incidentally, both to increase yield per recruit and to increase escapement of pre-recruits.

22. Relative abundance of finfish species has been measured from two sources, research vessel surveys and commercial catch/effort statistics (Appendix I). Comparisons of mean catch per haul from 1963 to date show declines in abundance for most species over the entire Subarea 5 and 6 region, ranging from 20 to over 90% depending upon the area and species involved. Using the survey data and all available assessment calculations, it is estimated that the entire region would support a maximum sustained yield of approximately 1,210,000 metric tons.

23. Using standardized commercial catch/effort statistics and the general Schaefer method of computing maximum sustained yields, an estimate of 1,030,000 metric tons was derived for the entire region. In either case, the data indicates that total effort in 1969, 1970 and 1971 exceeded that level that would result in sustaining a maximum yield. The previous heavy exploitation has reduced the biomass to the extent of lowering the potential harvestable surplus some 320,000 metric tons below the maximum. Current information accordingly would indicate a harvestable surplus of no more than 900,000 metric tons in 1972.

24. Fishing power coefficients show the ratio of catch rate of a particular class of vessel and gear to the catch rate of a standardized type of vessel and gear fishing under similar circumstances. These have been estimated for various gear-tonnage class categories for countries present in ICNAF Subareas 5 and 6 during 1961-1971 (Appendix II). Fishing power coefficients have been determined with the appropriate adjustments for learning, or the increased efficiency resulting from experience. Twenty-four gear-tonnage class combinations and fourteen countries were considered in the analysis. The catch/effort of the US side trawler was used as the standard unit of measurement.

25. Detailed categorization of effort as described above is desirable in scientific analysis. The procedures can be simplified for use in allocating effort. For this purpose the following simplified table is presented which utilizes average values for the most heavily used categories:

Fishing Power Coefficient		
Category	Coefficient	Source (Average of Countries Indicated)
Otter Trawler		
0-150 Side	1.00	USA
151-500 Side	1.10	USA, Canada, USSR
501-900 Side	1.20	Canada, USSR, Poland
0-500 Stern	1.30	USA
501-900 Stern	2.00	Canada, USSR
900+ Stern	3.00	Poland, USSR
900+ Stern	6.65	Germany (FR)
Paired Trawls	2.30	Spain
Purse Seine	10.85	USSR, Canada, USA
Gill Net	0.10	USSR, USA
Long Line	0.25	USSR, Canada, USA
Hand Line	0.10	USA
Other Line	0.35	USA
Dip Net	1.75	USSR

26. The following examples will illustrate how the values given in paragraph 25 can be used to calculate fishing effort. Assuming, for example, that a country is allocated 10,000 standard days fished, the following are some possible alternative combinations of vessel fishing days:

Example	Vessel Classes	Standard Days/ Fishing Power Coefficient	Fishing Days
1/	150 ton Side Trawler	10000/1.0	10000
2/	151-500 ton Side Trawler	10000/1.1	9090
3/	900+ ton Stern Trawler	10000/3.0	3333
4/	151-500 ton Side Trawler	5000/1.1	4545
	Plus		
	900+ ton Stern Trawler	5000/3.0	1667
5/	Purse Seine	2000/10.85	185
	Plus		
	900+ ton Stern Trawler	4000/3.0	1333
	Plus		
	151-500 ton Side Trawler	4000/1.1	3636

27. Fishing effort can be regulated on the basis of days on ground providing there is a close relationship between days fished and days on ground. Our studies have indicated a very high correlation (about 0.99) for the ratio between days fished and days on ground. There were no significant differences in this ratio for all vessel classes. The equation for computing days on grounds from days fished based on data from those countries which submitted both sets of information to ICNAF, i.e. USSR, Poland, and Spain was:

$$\text{days on ground} = 1.30 \text{ days fished}$$

28. Using the relationship: days on ground = 1.3 days fished, the following days on ground are equivalent to the days fished given in paragraph 26:

Example	Vessel Classes	Fishing Days	Equivalent Days on Ground
1/	150 ton Side Trawler	10000	13000
2/	151-500 ton Side Trawler	9090	11817
3/	900+ ton Stern Trawler	3333	4333
4/	151-500 ton Side Trawler	4545	5908
	900 + ton Stern Trawler	1667	2167
	Total Days on Ground		8075
5/	Purse Seine	185	240
	900+ ton Stern Trawler	1333	1733
	151-500 ton Side Trawler	3636	4727
	Total Days on Ground		6700

29. Effective management requires a credible enforcement scheme for the regulations brought into effect. This applies to the ability of administrators to regulate their fleet operations, to monitor the actual performance, and to demonstrate adherence. Direct effort regulation can offer these advantages if properly formulated, and a scheme based on the above discussion would appear to do so. For example, an effort management program with national shares expressed in standard units of vessel time would allow countries to regulate participation by various classes of vessels according to domestic priorities. During the fishing season, the general level of participation by various countries could be observed not only by national

enforcement officers of the Flag State concerned, but also by observations of other national officers under the ICNAF International Inspection Scheme. Such an approach would be facilitated by arranging for participating countries to report their expected participation in the regulated fishery by vessel classes to other participants through the Executive Secretary. Adjustments in the type of an individual members participation could, of course, be reported in a similar manner, as necessary, during the fishing season.

30. In determining how shares would be apportioned amongst participants, some of the same factors need to be taken into account that have been considered in applying quota management programs, and the experience gained in allocating catch quotas should greatly expedite the work of allocating effort levels.

31. Traditional fishing patterns as reflected by average effort levels over a period of selected years expressed in terms of standard fishing units provide a partial basis for considering the allocation of effort levels. As in the case of catch quotas, it would seem appropriate to divide part of the effort quota among participating countries roughly in proportion to their average level of participation. However, it seems only equitable to relate the amount of effort an individual participating country is asked to remove, in part, to the extent by which it has increased its effort level, particularly the period since effort has been clearly excessive.

32. On the other hand, it should also be recognized that countries which have not increased their fishing effort have already made a contribution to effort control and should not be expected to accept further reduction.

33. Furthermore, certain special factors need consideration similar to that given to the allocation of catch quotas. These might include provision for the special needs of recent entrants to the fishery with relatively small fleets. Particular attention also needs to be given to the unique situation of the relatively immobile fleets of small coastal vessels. These vessels have been designed to supply specialized markets with a continuous year-round supply of fresh fish and cannot be shifted to other areas.

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Appendix I

ANNUAL MEETING - JUNE 1973

Status of resource
(as presented to the Special Commission Meeting - January 1973)

1. Research vessel surveys by *Albatross IV* since 1963 have provided a consistent measure of the relative abundance of virtually all finfish species and these surveys have shown a very substantial decline in biomass during the past decade. In Division 5Z, where the greatest increases in fishing effort have occurred, the standing crop of most species in the groundfish community has been reduced by at least 50% since 1963. This decline is documented in ICNAF Research Document 72/119 and the following summary is derived from data presented in that document.

2. Comparisons of mean catch per haul of groundfish and flounders in Div. 5Z, for the first three years (1963-65) and the last three years (1969-71) of *Albatross IV* autumn surveys, show significant drops in abundance for most species including those taken as incidental catches. For example, on Georges Bank, miscellaneous groundfish cateh per haul in 1969-1971 (including white hake, sculpins, ocean pout, angler and other groundfish except flounders) showed a decline of 33% from the period 1963-65, and skates declined by 57%. Flounders as a group show a drop of 29%. In the case of the more heavily fished stocks of cod, haddock, silver hake and red hake, the reduction in abundance ranged from 34% for silver hake to over 90% in the case of haddock, for an average percentage reduction of these four species of 57%.

3. In Southern New England, miscellaneous groundfish (same category as above) abundance dropped 42%, and skates declined by 69%. Flounders as a group declined 20%, but species other than yellowtail dropped more than 50%. Red and silver hake declined by 32 and 48%, respectively, and cod and haddock by 60 and 94% with an average percentage decline of 59% for these four species. Even in the case of certin pelagic species such as sea herring, which are relatively unavailable to the standard survey trawl used on *Albatross IV*, there has been an exponential decline in sea herring abundance indices for spring surveys from Cape Cod to Cape Hatteras. The 1971 index showed a decline of 95% from the 1968 index corresponding to a drastic decline in the Georges Bank herring stock as determined by assessment studies (ICNAF Research Document 72/24). There is no doubt that these declines are significant, and that they reflect the impact of heavy fishing in Subareas 5 and 6.

4. Using data from several sources, an estimate of the potential maximum sustained yield for all finfish was computed for Subareas 5 and 6. Grosslein (ICNAF Res. Doc. 72/119) estimated that the value for the Div. 5Z area for all groundfish (except hakes), flounders, dogfish and skates approximated 200,000 metric tons. Based on historical catches, a catch value of 185,000 metric tons does not seem unreasonable for the same group of species in areas 5Y and 6. Anderson (1972) and Anderson and Au (1972) in assessment working papers presented at the 1972 ICNAF Annual Meeting indicated a MSY for red and silver hake of about 200,000 metric tons in areas 5Z and 6 and 40,000 metric tons for area 5Y. Schumacher and Anthony (ICNAF Res. Doc. 72/24) and Anthony and Brown (ICNAF Res. Doc. 72/13) have estimated MSY values for herring of about 250,000 and 35,000 metric tons for areas 5Z and 6, and 5Y respectively. Mackerel catches over the past 5 years have increased dramatically and, while assessments have not been completed for this species, preliminary calculations indicate an MSY value of about 300,000 metric tons for Subareas 5 and 6 combined. Both mackerel and herring estimates depend on the occurrence of two exceptionally good year-classes within the period of analysis. The mackerel estimate is particularly sensitive to this phenomenon, as only three years of data were available for analysis, and is very likely to be an over-estimate of the long run MSY.

5. Thus, the total estimated yield for all finfish species combined approximates 1,210,000 metric tons for the entire region, Subareas 5 and 6.

6. Commercial catch/effort statistics were also used to estimate a potential maximum sustained yield value for the entire fisfish community. Plots of total finfish landings per unit of standardized effort were fitted with the general Schaefer method. Such a fit results in an estimated MSY value of 1,030,000 metric tons for the entire region, Subareas 5 and 6. While this value is somewhat lower than the estimate based on assessment information, it would be considered a minimum estimate as current commercial landings do not include the non-desired miscellaneous species in the same proportion as considered by the assessment information above.

7. The data also indicates that the total fishing effort over the past three years 1969, 1970 and 1971 has exceeded the level of effort that would result in sustaining a maximum yield. This potential for overfishing is further accentuated by the fact that certain fish stocks have been harvested to the point where current population levels will not allow for achieving their MSY values.

8. Based on assessment studies, the haddock potential is Subarea 5Z has been reduced from 50,000 metric tons to less than 5,000 metric tons. Likewise, the herring population in Subareas 5 and 6 can currently support a catch of less than one-half the MSY just to maintain the stock size, and should be reduced further if the spawning stock is to be increased. Mackerel catches have been supported by the same year-classes since 1967 and it is not likely that the 1971-72 catch levels can be sustained in 1973-74.

9. The actual reduction in potential landings of the above-mentioned stocks together with the reduced abundance of other groundfish observed in survey information totals to some 320,000 metric tons.

10. Thus, in view of the evidence of reduction in biomass by more than 50% for many species, and the fact that some of the most abundant species were already under significant exploitation at the beginning of the survey series, we may reasonably conclude that exploitation is well beyond the level which would provide maximum sustainable yield of the finfish resources as a whole. Current information would indicate a harvestable surplus of only around 900,000 metric tons for present day populations.

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Appendix II

ANNUAL MEETING - JUNE 1973

Techniques for determining fishing power coefficients
(as presented to the Special Commission Meeting - January 1973)

1. The method of determining these fishing power coefficients was suggested by Robson (ICNAF Res. Bull. No. 3, 1966) and was an analysis of variance technique assuming a logarithmic linear model

$$Y_{ijk} = M \cdot A_i \cdot B_j \cdot E_{ijk}$$

where Y = catch per day of all species for country i, gear-tonnage class j, and year k, M = overall mean catch per day, A_i = country effect parameter, B_j = gear-tonnage class effect, and E_{ijk} = the sampling error. The analysis of variance procedure outlined by Snedecor and Cochrane (1967) for a two way design with unequal cell frequencies and missing observations was used. Fishing power coefficients used to estimate standard days fished were then determined for each combination by dividing the non-standard coefficient of that cell by the coefficient of a preselected standard cell. For this analysis, the US side trawler was selected as the standard cell because of its long-term presence in the fisheries. Days fished for all country and gear-tonnage combinations in Subareas 5 and 6 were thus converted to US side trawler units.

2. An examination of catch and effort data reported by countries fishing in the area suggested the phenomena of "learning" for fleets during the initial years of a developing fishery. This learning factor was estimated by comparing the ratio in catch per day of fishing fleets from one year to the next to changes in catch per tow from the research vessel survey cruises for the same period.

3. To date, catch and effort data from ICNAF Division 5Z and Subarea 6 for USSR in the silver hake fishery; for East Germany and Poland in the herring fishery; and for Poland and USSR in the mackerel fishery have been examined to determine the presence and magnitude of such a learning factor. These data represent approximately 50% of the increase in standarized effort in Subareas 5 and 6 during the late sixties and early seventies. By assuming the learning factor to be a exponential function of time, these data provided a fit which indicated that learning took place at a rate such that given a constant population the catch per unit effort would double in the second year in the fishery, and would increase by 50% again in the third year in the fishery. After the third year, changes due to learning were negligable.

4. The standardized days fished for the compenents mentioned above were adjusted to account for this learning factor. This has the effect of increasing the reported days fished in the time period of learning to represent effective standard days fished which are comparable throughout the time period.