Report on
Identification of Vulnerable Marine Ecosystems in the Emperor Seamount and Northern Hawaiian Ridge in the Northwest Pacific Ocean and Assessment of Impacts Caused by Bottom Fishing Activities on such Vulnerable Marine Ecosystems or Marine Species as well as Conservation and Management Measures to Prevent Significant Adverse Impacts (Bottom Gillnet)

Fisheries Agency of Japan
December, 2008

1. Name of the Participating State

Japan

2. Name of the fishery

Bottom gillnet

3. Status of the fishery

Existing fishery

4. Target species

Splendid Alfonsin (*Beryx splendens*) and North Pacific Armorhead (*Pseudopentaceros wheeleri*)

5. Bycatch species

According to the Japanese fishing master, oreo (*Allocyttus verrucosus*), butterfish (*Hyperoglyphe japonica*), mirror dory (*Zenopsis nebulosa*) and rockfish (Sebastidae spp.) are main bycatch species. Since details of bycatch species by the Japanese bottom gillnet are not available, a list of bycatch fish species by a trawl research vessel is attached for reference (Appendix A).

6. Recent level of fishing effort

(1) Number of vessels

(2) Tonnage of each vessel

(3) Number of fishing days

(4) Fishing effort

Please see Appendix B for the above four points.

7. Fishing period

All the year round

8. Analysis of status of fishery resources

(1) Splendid alfonsin

A. Biology

Splendid alfonsin (*Beryx splendens*, Lowe, 1834, hereinafter referred to as “alfonsin”) is widely distributed throughout the world in the tropical and temperate waters at the depths from 25 to more than 1300m, excluding the northeast Pacific Ocean. Although the population structure in the Emperor Seamount and Northern Hawaiian Ridge area (hereinafter referred to as “the ES-NHR area”) was not elucidated, it probably does not consist of separate independent populations at each seamount, because of the no genetic differences among seamounts in the ES-NHR area and buoyant nature of the eggs, which are subject to considerable drifts and subsequent mixtures from multiple spawning grounds. There is no available information on interactions with alfonsin stocks in other areas such as the Japanese Archipelago, where abundant catch of this species has been known, however, the ES-NHR area is separated by a distance of about 30 degrees in longitudes from Japan. Thus, the reasonable hypothesis is that alfonsin in the ES-NHR area forms a single unit in terms of population dynamics.

The life span of alfonsin is about 20 years, and the age at the first maturation is about 3-4 years (28-32 cm FL). The spawning season in the ES-NHR area is considered summer, on the basis of occurrence periods of larvae in the ES-NHR area and the spawning period of the stock near Japan (June-October). The details of biology and fisheries are described in Appendix D.

B. Data and methods used for analysis

The available data for stock assessment was limited to historical records of catches by Japan, Korea and Russia (including the former USSR), and Japanese trawl fishing efforts in the number of operation days and fishing hours. There is no age disaggregated catch data available. Accordingly, as shown in Appendix C and D, two types of surplus production models (ASPIC for 1985-2006 and Excel for 1976-2006 with divided periods) were applied to two-types of the Japanese annual CPUE (catch in metric tons per one hour trawling), which is either non-adjusted or adjusted.

C. Results of analysis

Results of four combinations from the two production models and two CPUE time series suggested that current fishing mortality coefficient (*F*) during the past 10 years (1997-2006) is 20-28% higher than *Fmsy* (Appendix C). Therefore, the current *F* must be reduced by about 20-28%. It should be noted that the stretched mesh size of gillnet is 12 cm and, thus most of fish caught are longer than 25 cm in fork length.

(2) North Pacific armorhead

A. Biology

The North Pacific armorhead (*Pseudopentaceros wheeleri*, Hardy, 1983, hereinafter referred to as “armorhead”) is widely distributed in the temperate and subarctic North Pacific. The life history is unique. While adults are abundant at the depth shallower than 800m of the ES-NHR area, juveniles inhabit the epipelagic layer of the central northern North Pacific and the Gulf of

Alaska (35-55 degrees North, 130-180 degrees West). On the basis of existing knowledge, armorhead in this area is considered to form a meta-population. The life span is estimated to be 7-11 years, and the age at the first maturation is 2-3 years (25-33 cm FL). The spawning season is considered during November-February. The epipelagic life, coinciding with the immature stage, lasts for 2-3 years. Settlement to the ES-NHR area occurs from the late spring to summer, and they become mature in the subsequent winter. The details of biology and fisheries are described in Appendix E.

B. Data and methods used for analysis

As in the case of alfonsin, only historical catch statistics are available for quantitative stock assessment. Episodic occurrences of strong year classes, even after the depletion of the stock in the ES-NHR area, prevent application of standard assessment methods. Therefore, the commercial catch and abundance index derived from research vessel operations (see Section 9) were used as alternative.

C. Results of analysis

Japanese bottom gillnet fisheries for this species mainly take place at the depths of 300-400m in the ES-NHR area. The armorhead catch by commercial fleets of Japan and Russia (including the former USSR) and abundance index by research vessel operations drastically declined from the initial stage of development of this stock (between 1968 and early 1970s) to the mid 1970s, and the stock remained extremely low until 1992 when a strong year class recruited. Also, a good recruitment was observed in 2004. These phenomena suggest that their early survival rates are greatly affected by oceanographic conditions during the pelagic life, and the survival rates after settlement are greatly affected by fishing activities. It should be noted that a great amount of immature individuals were caught by the large-scale driftnet fishing activities, which were conducted until 1992 when a moratorium was put on this fishery, resulting in great reduction of fishing mortality. The effects of bottom fishing are evident, however, as the catch drastically declined within two years after the occurrences of the strong year classes in 1992 and 2004, which also suggest truncation of the age structure of spawners. Given these situations, together with absence of reliable biomass estimations and biological reference points such as *Fmsy*, it is needed to apply adaptive management measures to ensure spawning of this stock, particularly by taking into consideration of target switching between alfonsin and armorhead, and episodic/unpredictable occurrences of strong year classes of armorhead.

(3) Identification of uncertainties in data and methods, and measures to overcome such uncertainties

A. Backgrounds to be considered

(a) Target switching

The change of target from armorhead to alfonsin in the late 1970s, followed by intensive fishing at the times of recruitment of strong year classes of armorhead, is one of bottle-necks of stock assessment. The target of fisheries must be recorded in the coming observer program, in order to estimate fishing effort for each target species.

(b) Absence of reliable estimation of biomass, uncertainty in population dynamics, and poor spawner conditions of armorhead.

As explained in 8. (2) above.

(c) Robustness and uncertainties in the surplus production models for alfonsin

Although the biomass estimation by the surplus production models is less reliable, the ratios of biomass relative to *Bmsy* and *F* relative to *Fmsy* are generally robust.

B. Basic ideas for management

Catch quota or TAC is inadequate, since reliable estimations of biomass are not available for the two species in the ES-NHR area. While it is necessary to reduce the current *F* (average of 1997-2006) by about 20-28% for the alfonsin stock, standard reference points are not applicable to armorhead, for which it is necessary to improve significantly both quantities and quality of spawning, particularly when strong year classes recruited. Given these backgrounds, development of an adaptive management for the two target species is recommended, which will adjust *F* on the basis of quasi real-time monitoring of stock conditions. The monitoring will include, as specified in the Observer Programme Draft Standards（SWG4/WP10）, fishing effort by target species, catch by targets and major bycatch species, size compositions, biological characteristics such as body height of armorhead, which is a key for detection of its new recruitment.

The above management measures to reduce *F* would also mitigate to a certain extent possible negative fishing effects on associated species and potential vulnerable marine ecosystems (VMEs).

(4) Proposal on management procedures

Prohibition of all bottom fishing activities from November 1 to December 31 is recommended in order to protect spawning period of armorhead, and to reduce the current *F* (1997-2006) by about 20%-28%. Hereafter, this reduced *F* is called "*Fref*" for aggregated stocks of armorhead and alfonsin after the prohibition of fishing in the two month corresponding to the spawning period. If a sharp increase in armorhead catch and CPUE accompanied by a high body (fatness) index was observed between late spring and midsummer in a given year, indicating an occurrence of a strong year class, apply the same *Fref* in order to ensure their first-year spawning during the winter, then in the following year, increase fishing effort by 10-30% depending on the magnitude of year class strength based on comparisons of the historical catch or other possible indicators of stock abundance. If such indicator(s) suggested a drastic decline in the second year, then fishing effort shall be decreased in the third year in order to ensure their multiple-year spawning. These specific values for adjustment shall be studied and recommended by SWG to the Governing Counsel. Finally, fishing mortality should be returned to *Fref* within four years after the recruitment of a strong year class. If improvements in capture of immature alfonsin were realized, *Fref* shall be reviewed and revised adaptively, according to the monitoring results.

How to manage *F* is another important issue. While a product of number of nets deployed times duration of fishing operations (hours of soaking) is generally regarded and actually used as a good indicator of fishing effort in case of bottom gillnet fisheries, this type of fishing effort is less useful than fishing mortality coefficient *F* as derived from the surplus production models in this case, because 1) the fishing grounds are generally limited to specific narrow areas due to complicated topography of the ES-NHR area, 2) searching time for the fish schools and/or suitable fishing areas is not considered in the currently used fishing durations, and 3) catchability could change over time. Therefore, *F* values were proposed as an indicator of fishing intensity. When the Government Counsel decided to change *F*, for example in subsequent years of occurrences of a strong year class of armorhead, it is impossible to specify *F* in advance. Therefore, when adjusting *F*, fishing effort that was judged most reliable and representing recent conditions shall be used. Intensification and improvements of monitoring fishing effort are indispensable.

9. Analysis of status of bycatch species resources

(1) Data and methods used for analysis

Appendix A: List of fishes collected by the Meisyo Maru #128 in 1993, expressed in relative abundance in weight by seamount depth zone, with related information

Appendix D: Assessment of associated species

Information describing mirror dory (*Zenopsis nebulosa*) relating to the North Western Pacific Regional Fishery Management Organisation. (yet to be completed)

Information describing broad alfonsino (*Beryx decadactylus*) fisheries relating to the North Western Pacific Regional Fishery Management Organisation. (yet to be completed)

Information describing pencil cardinalfish (*Epigonus denticulatus*) fisheries relating to the North Western Pacific Regional Fishery Management Organisation. (yet to be completed)

(2) Results of analysis

Since no research has been conducted using bottom gillnet, Appendix A was used as an alternative. However, according to the interview with the Japanese fishing master, oreo (*Allocyttus verrucosus*), butterfish (*Hyperoglyphe japonica*), mirror dory (*Zenopsis nebulosa*) and rockfish (Sebastidae spp.) are main bycatch species, and cardinal fish (*Epigonus denticulatus)* are rarely caught probably due to the mesh size.

Out of bycatch species listed in Appendix A, the three dominant species, namely, broad alfonsino (*Beryx decadactylus*), pencil cardinalfish (*Epigonus denticulatus*) and mirror dory (*Zenopsis nebulosa*) were analyzed. Please see Appendix F and the report on bottom trawl for details of analysis.

(3) Identification of uncertainties in data and methods, and measures to overcome such uncertainties

Please see Section 13.

10. Analysis of existence of VMEs in the fishing ground

(1) Data and methods used for analysis

Appendix G: Seamount Bathymetries

Appendix H: Distribution of four orders of corals observed by ROV survey.

Appendix I: Photographs of bottom at the Emperor Seamounts

Appendix J: Analysis on marine ecosystems in the ES-NHR area

Appendix K: Summary of net loss and/or hang-up by trawler

Appendix L: Summary of coral captures

Appendix M: Information on Coral Fisheries in the Emperor Seamount Area

Appendix N: Notification of VMEs in Statistical Area 58.4.1

Appendix R: Structure of a net panel

(2) Results of analysis

A. Identification of fished seamounts in the ES-NHR area

In recent years, fished seamounts by the Japanese bottom gillnetter are: Suiko, Koko, Kinmei, Yuryaku and Kammu, Colahan and C-H. The bathymetries of each seamount are shown in Appendix G. Bottom gillnet operations are confined only to certain areas of summits or slopes of these seamounts shallower than 1,500 m.

B. Potential VMEs found in the ES-NHR area

Japanese research activities in the ES-NHR area found mainly the following marine species:

- Alcyonacea (soft corals)
- Gorgonacea (hard corals including precious corals)
- Antipatharia (hard corals including "sea bamboo")
- Corallimorpharia
- Scleractinia (hard corals)
- Comatulida (feather stars)
- Asteroidea (starfish)
- Ophiuroidea (brittle stars and basket stars)
- Echinoidea (sea urchin)

C. Whether each species forms VMEs?

Attempt was made to assess whether each species has characteristics of forming VMEs in accordance with section 3 of the Science-based Standard and Criteria for Identification of VMEs and Assessment of Significant Adverse Impacts on VMEs and Marine Species (hereinafter referred to as "the Standards"). Due to the difficulties of species identification and limited time available, assessment was limited to the Alcyonacea, Gorgonacea, Antipatharia and Scleractinia, which were included in the working definition of corals in the ES-NHR area, using underwater pictures taken by an ROV camera and drop camera (Appendix H and I). The results of the analysis are shown in Appendix J and were summarized as follows:

(a) Standards 3. (3) a: Uniqueness and rarity of ecosystems or habitats

Uniqueness in seamounts is generally high. Since the ES-NHR area is remote from other seamount areas or continental shelves, and it extends from south to north, there is a possibility that the ES-NHR area forms a unique ecosystem as the entire area or a group of seamounts. So far, any unique species distributed at an individual seamount has not been found yet, and there is no scientific information that an individual seamount forms a unique or rare ecosystem.

(b) Standards 3. (3) b: Functional significance of habitat

The ES-NHR area is serving as spawning grounds for the North Pacific armorhead and splendid alfonsin, which are important fisheries resources.

(c) Standards 3. (3) c: Fragility of ecosystem

Bottom fisheries affect sea floor and benthos (particularly sessile animals). However, it is difficult to assess the impacts on fragility of ecosystems due to lack of knowledge on structure and function of the ecosystem(s) of the ES-NHR area.

(d) Standards 3. (3) d: Life-history traits of component species

(i) Slow growth rate:

The growth rates of the Gorgonacea, Antipatharia and Scleractinia are considered slow, as a general character of deepsea hard corals, while that of the Alcyonacea, which is a soft coral, is considered relatively faster than the hard corals.

(ii) Late age of maturity:

No available information

(iii) Low or unpredictable recruitment:

No available information

(e) Standards 3. (3) e: Structural complexity

No complex structure such as hydrothermal vents has been found in the ES-NHR area.

These analyses indicate that these four orders of corals in the ES-NHR area have characteristics of constituting potential VMEs. However, it is considered that the growth rate and recovery rate of Alcyonacea, which is a soft coral, is relatively faster than the other three orders, the Gorgonacea, Antipatharia and Scleractinia, which are hard corals.

D. Whether the ES-NHR area contains VMEs?

The 2006 ROV survey conducted at 16 points in the ES-NHR area found the four orders of corals as individuals in most cases, and aggregation which may constitute ecosystems were not found except at two points in the Koko Seamount.

Although the two points in the Koko Seamount (St 12 and 15) show a certain level of aggregation of corals, it is not possible to reach any conclusion that they constitute VMEs. This is because the FAO International Guidelines for the Management of Deep-Sea Fisheries in the High Seas as well as the Standards created thereon includes qualitative criteria to decide whether or not aggregation of corals is judged to be VMEs, but they have no quantitative criteria. For example, Figure 1, 2, 3, 6, 7 and 8 in Appendix N show bottoms in the CCAMLR area. It would be possible to judge that such aggregation of corals constitute VMEs, but the degree of aggregation of corals at St 12 and 15 are much less than them. Discussion on the quantitative criteria at the Scientific Working Group Meetings in October and December did not provide any definitive answer to this question. Therefore, it is not possible to conclude based on the results of the surveys that aggregation of corals at St 12 and 15 are VMEs.

It should be noted that these points are covered by the existing main fishing grounds.

The reason why aggregation of corals was found in the main fishing grounds is likely to be that they are in natural refugia (e.g., they are in a concave area or at a steep slope where bottom gillnet operations are impossible) and thereby protected by impacts of bottom gillnet fishing activities. To examine this hypothesis, seafloor bathymetric analysis was conducted using echogram on these two points. Although the results suggest this hypothesis, it was not possible to reach any clear conclusion.

E. Whether there used to be VMEs in the ES-NHR area?

As explained above, it is not possible to conclude based on the results of the surveys that VMEs exist in the ES-NHR area. On the other hand, it cannot be denied that VMEs used to exist before the fishing was started about 40 years ago.

Based on the hypothesis that the possibility of existence of VMEs in the pre-fishing era would be higher if a large aggregation of corals is found in non-fishing area in the ES-NHR area, drop-camera surveys were conducted in 2008. Observation was made at 28 points through a drop camera at places where no fishing is likely to take place in recent years (e.g., places where bottom gillnet cannot be conducted due to their physical characteristics, or fish aggregation is not likely to happen, taking into account their depth, bathymetries and current). As far as the pictures show, there is no difference between existing fishing grounds and non-fishing grounds in terms of distribution of corals.

Therefore, although there is still a possibility that VMEs used to exist in the ES-NHR area in the past, the best scientific information available does not confirm this.

On the other hand, things are different with respect to precious corals (*Corallium* spp.). Out of 44 points surveyed by the ROV and drop-camera, *Corallium* spp. was found at only one point (St 11 of Koko Seamount in the ROV survey). It is known that coral drag fisheries were conducted by Japan and Taiwan in the ES-NHR area from the 1960s to 80s, which may have adversely impacted ecosystems containing cold water corals. It is recorded that about 2,000 metric tons of precious corals were harvested in the ES-NHR area by Japan (Appendix M). This fact indicates that there used to be a large amount of precious coral in the ES-NHR area. To examine whether the coral drag fishing grounds are same as the bottom gillnet fishing grounds, strenuous efforts were made to find documents containing this type of information, which ended with no success. In addition, St 11 of Koko Seamount is covered by the existing main fishing grounds, which suggests that they are in natural refugia.

(3) Identification of uncertainties in data and methods, and measures to overcome such uncertainties

Please see Section 11 and 13.

11. Impact assessment of fishing activities on VMEs or marine species including cumulative impacts, and identification of significant adverse impacts (SAIs) on VMEs or marine species

(1) VME

A. Data and methods used for analysis

Please see Section 10. (1)

B. Results of analysis

The followings are the results of assessment conducted in accordance with the Standards on whether the bottom gillnet fishing activities pose SAIs on VMEs and marine species.

(a) Intensity or severity of the impacts at the specific site being affected

The structure of typical gillnets used in the Japanese commercial bottom gillnet operations is indicated in Appendix R. In a normal operation, 56 net panels (tan in Japanese terminology having 30m in length) are connected to form a unit or net section. In a single fishing day, 10 net sections are soaked at sea floor. In order to avoid direct contact with the sea floor, each net panel is suspended above the sea floor using floats and ropes of 70 cm long. A typical net panel (30 m in length) is equipped with 7 floats and 5 concrete sinkers whose air weight is about 5kg. Effects of normal bottom gillnet operations on bottom ecosystems are considered minimum, because the bottom gillnets are deployed about 70cm above the sea floor, and because the weight of the gear in the sea is relatively light. When long ropes connecting the bottom gillnets and large floats on the sea surface were lost due to mainly interactions with other fishing activities in the ES-NHR area, it is difficult to retrieve the gillnets, thus there is a concern of ghost fishing. According to our interviews with the fishing master, the amount of the lost bottom gillnets during the recent five years was about 100 net panels, i.e., about 3000m in length. There is no estimation on effects of these lost nets on the ecosystems in the ES-NHR area, for example how long the lost gears are effective in fishing.

(b) Spatial extent of the impact relative to the availability of habitat type affected

In order to evaluate this aspect, it is necessary to have knowledge on spatial extent of ecosystem concerned and of individual populations as components of the ecosystem. However, there is no available information on these points in the ES-NHR area.

(c) Sensitivity/vulnerability of the ecosystem to impacts

The four orders of corals (the Gorgonacea, Antipatharia, Scleractinia and Alcyonacea) are considered vulnerable to impacts of bottom gillnet. No aggregation of these corals was detected in the ES-NHR area except for the two points in Koko Seamount.

(d) Ability of an ecosystem to recovery from harm and rates of such recovery

No information is available.

(e) Extent of which ecosystem functions may be altered by the impact

No information is available.

(f) Timing and duration of the impacts relative to the period in which a species needs the habitat during one or more life-history stages

No information is available.

C. Identification of uncertainties in data and methods, and measures to overcome such uncertainties

The data used in this report accompanies the following uncertainties: 1) no available knowledge on the fate of lost gears and evaluation of status and effects of ghost fishing, 2) spatially restricted underwater observations with ROV and drop cameras, 3) difficulties in taxonomic identifications based on camera or video shots, and 4) absence in life history parameters and population structures of species that may constitute potential VMEs.

As measures to overcome such uncertainties, it is recommended to: 1) accumulate information of amount and locations of lost gears and study on their status using ROV etc., 2) continue underwater observations, 3) skill-up of identifications of species using camera and video images, and 4) researches on life history parameters and population structures of species that may constitute potential VMEs.

(2) Marine species (targets species)

A. Data and methods used for analysis

Please see Section 8.

B. Results of analysis

Please see Section 8.

C. Identification of uncertainties in data and methods, and measures to overcome such uncertainties

Please see Section 8.

(3) Marine species (non-target species)

A. Data and methods used for analysis

Please see Section 9.

B. Results of analysis

Please see Section 9.

C. Identification of uncertainties in data and methods, and measures to overcome such uncertainties

The above analysis is subject to uncertainties (observation errors) deriving from relatively short durations and small number of trawl operations. Life history characteristics of associated species are not well known. Therefore, it is necessary to improve knowledge in terms of quality and quantity, through the coming observer monitoring, which includes catch amounts and size compositions by species. Also, effects of reduction of the current *F* shall be evaluated for associated species.

12. Other points to be addressed

(1) It is necessary to assess the aggregated impacts of not only Japanese vessels but also all countries' vessels on VMEs and marine species. As of producing this report, however, Korea and the Russian Federation that also conduct bottom fisheries in the ES-NHR area have not submitted their assessment report, which made it impossible for Japan to conduct the aggregated assessment. It should be stressed that the main fishing country in the ES-NHR area is Japan and the results of the assessment is not likely to change so much even after taking into account the impacts caused by the other countries.

(2) Taiwanese coral drag fishing operations have been frequently sighted by Japanese fishermen and officers of Japanese research vessels in the ES-NHR area. Japan imports precious corals from Taiwan, but the origins of the corals are unknown. There is little information on their fishing operations such as the number of fishing vessels. There is a possibility that their fishing activities are causing serious adverse impacts on ecosystems. Even if Japan implements certain measures to protect VMEs, continuation of their fishing activities would undermine its efforts. Although

Taiwan is not a member to the United Nations and thus not bound by UN Resolution 61/105, it would be necessary to spend more effort including collection of information on the fishing activities and to urge them to implement similar measures as Japan will do.

13. Conclusion

(1) General conclusion

The framework for management of bottom fisheries in the Northwest Pacific Ocean by Japan, Korea, the Russian Federation and the United States is aimed at covering the FAO Statistical Area No. 61 (Appendix O). As this figure shows, there are many seamounts in the Area No. 61, and the ES-NHR area is a part of them. Further, not all seamounts are subject to fishing in the ES-NHR area, and actual fishing grounds are limited to parts of each seamount subject to fishing. Overall, the area which may be affected by bottom gillnet operation is a fraction of the entire Area No. 61.

The research results so far do not support the existence of serious adverse impacts on VMEs and marine species by Japanese bottom gillnet fishing activities. However, taking into account the discussion during the Fifth Scientific Working Group meeting in Tokyo from December 2 to 5 as well as uncertainties deriving from lack of data, Japan will take the following measures in 2009 and thereafter by which Japanese bottom gillnet fishing activities can be continued in the ES-NHR area beyond December 31, 2008.

(2) Common measures

100% scientific observer coverage will be introduced in principle on board bottom gillnet fishing vessels after April 1, 2009, through which collection of data and samples will be made in accordance with the agreed format.

(3) Existence of serious adverse impacts on VMEs and measures to prevent them

As Section 10 has already explained, (i) it is not possible to conclude that there is a VME in the ES-NHR area, and (ii) it is not possible to conclude that there used to be a VME in the ES-NHR area. However, (i) there is a possibility that VMEs may exist in the area not covered by the research (both existing fishing grounds and non-fishing grounds), and (ii) the possibility of VME existence in the past is higher in *Corallium* spp. than other coral species. Therefore, based on the precautionary approach, the following measures will be newly taken or continued in 2009 and thereafter to reduce the possibility that bottom gillnet fishing activities are likely to cause serious impacts on potential VMEs in the ES-NHR area:

A. Introduction of tentative closed area in the southeastern part of Koko Seamount around the point where *Corallium* spp. was found (south of 34 degrees 57 minutes North, east of the 400m isobath, east of 171 degrees 54 minutes East, north of 34 degrees 50 minutes North: please see Appendix P for details) (New measure). Although there is no limit to the east direction, its area will be about 180 – 190 ㎢ if the east boundary is set at the 1,500 m isobath.

B. Visual bottom surveys by drop cameras including at the area in A. above in 2009 to collect scientific information on distribution of potential VMEs

C. Tentative prohibition of bottom gillnet fishing in areas deeper than 1,500m (New measure)

D. Tentative prohibition of bottom gillnet fishing in the area north of 45 degrees North

E. Actions to be taken in accordance with the protocol to be developed by the framework for management of bottom fisheries in the Northwest Pacific Ocean in the case that the four orders of coral was incidentally taken during the fishing operation: as there is no agreement at this moment, Japan will tentatively use a voluntary protocol based on the protocols adopted by NAFO and NEAFC until agreement is reached on this issue (Appendix Q) (New measure)

F. Increased distance between the sea floor and the net from 70 cm to 100 cm (New measure)

(4) Measures to ensure sustainable use of target species

As Section 8 above explains, 20 – 28 % of reduction in average *F* during the last decade is recommended as to alfonsin. Because ordinary management reference points such as *Fmsy* is not applicable to armorhead whose resource level is very low, adaptive management is recommended including protection of spawning stocks and adjustment of *F* based on monitoring results. Taking into account these points, the following measures will be taken newly or continued in 2009 and thereafter for sustainable use of both species.

A. No increase in the number of actual fishing vessels from 1

B. 20 % reduction of average *F* during the period of 1997 to 2006 (New measure)

C. Measures including closure during November and December to achieve B. above: As November and December are included in the spawning season of armorhead (November to February), the closure is expected to be effective specifically for stock recovery of armorhead in addition to that for alfonsin (New measure)

D. Limited increase of *F* even in the case of an occurrence of a strong year class of armorhead: the 20% reduction and two month closure will be maintained in the year when such a strong year class is observed and a 10-30% increase depending on the magnitude of year class strength will be allowed starting from 2nd year (the following year) and may continue up to 4th years after a recruitment of a strong year class (<u>New measure</u>)

It is expected that the above measures will also good for recovery of non-target (bycatch) species as well as protection of potential VMEs.

(5) Non-target species

Regarding non-target species, fork length compositions and CUPE will be monitored by ship-board observers, and necessary measures will be taken if a stock decline becomes evident.

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