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ภาคผนวก

ภาคผนวก ก.

AGREEMENT FOR THE IMPLEMENTATION OF THE PROVISIONS OF THE UNITED NATIONS CONVENTION ON THE LAW OF THE SEA OF 10 DECEMBER 1982 RELATING TO THE CONSERVATION AND MANAGEMENT OF STRADDLING FISH STOCKS AND HIGHLY MIGRATORY FISH STOCKS

The States Parties to this Agreement,

Recalling the relevant provisions of the United Nations Convention on the Law of the Sea of 10 December 1982,

Determined to ensure the long-term conservation and sustainable use of straddling fish stocks and highly migratory fish stocks,

Resolved to improve cooperation between States to that end,

Calling for more effective enforcement by flag States, port States and coastal States of the conservation and management measures adopted for such stocks,

Seeking to address in particular the problems identified in chapter 17, programme area C, of Agenda 21 adopted by the United Nations Conference on Environment and Development, namely, that the management of high seas fisheries is inadequate in many areas and that some resources are overutilized; noting that there are problems of unregulated fishing, over-capitalization, excessive fleet size, vessel reflagging to escape controls, insufficiently selective gear, unreliable databases and lack of sufficient cooperation between States,

Committing themselves to responsible fisheries,

Conscious of the need to avoid adverse impacts on the marine environment, preserve biodiversity, maintain the integrity of marine ecosystems and minimize the risk of long-term or irreversible effects of fishing operations,

Recognizing the need for specific assistance, including financial, scientific and technological assistance, in order that developing States can participate effectively in the conservation, management and sustainable use of straddling fish stocks and highly migratory fish stocks,

Convinced that an agreement for the implementation of the relevant provisions of the Convention would best serve these purposes and contribute to the maintenance of international peace and security,

Affirming that matters not regulated by the Convention or by this Agreement continue to be governed by the rules and principles of general international law,

Have agreed as follows:

PART I

GENERAL PROVISIONS

Article 1

Use of terms and scope

1. For the purposes of this Agreement:

(a) "Convention" means the United Nations Convention on the Law of the Sea of 10 December 1982;

(b) "conservation and management measures" means measures to conserve and manage one or more species of living marine resources that are adopted and applied consistent with the relevant rules of international law as reflected in the Convention and this Agreement;

(c) "fish" includes molluscs and crustaceans except those belonging to sedentary species as defined in article 77 of the Convention; and

(d) "arrangement" means a cooperative mechanism established in accordance with the Convention and this Agreement by two or more States for the purpose, inter alia, of establishing conservation and management measures in a subregion or region for one or more straddling fish stocks or highly migratory fish stocks.

2. (a) "States Parties" means States which have consented to be bound by this Agreement and for which the Agreement is in force.

(b) This Agreement applies mutatis mutandis:

(i) to any entity referred to in article 305, paragraph 1 (c), (d) and (e), of the Convention and

(ii) subject to article 47, to any entity referred to as an "international organization" in Annex IX, article 1, of the Convention which becomes a Party to this Agreement, and to that extent "States Parties" refers to those entities.

3. This Agreement applies mutatis mutandis to other fishing entities whose vessels fish on the high seas.

Article 2

Objective

The objective of this Agreement is to ensure the long-term conservation and sustainable use of straddling fish stocks and highly migratory fish stocks through effective implementation of the relevant provisions of the Convention.

Article 3

Application

1. Unless otherwise provided, this Agreement applies to the conservation and management of straddling fish stocks and highly migratory fish stocks beyond areas under national jurisdiction, except that articles 6 and 7 apply also to the conservation and management of such stocks within areas under national jurisdiction, subject to the different legal regimes that apply within areas under national jurisdiction and in areas beyond national jurisdiction as provided for in the Convention.

2. In the exercise of its sovereign rights for the purpose of exploring and exploiting, conserving and managing straddling fish stocks and highly migratory fish stocks within areas under national jurisdiction, the coastal State shall apply mutatis mutandis the general principles enumerated in article 5.

3. States shall give due consideration to the respective capacities of developing States to apply articles 5, 6 and 7 within areas under national jurisdiction and their need for assistance as provided for in this Agreement. To this end, Part VII applies mutatis mutandis in respect of areas under national jurisdiction.

Article 4

Relationship between this Agreement and the Convention

Nothing in this Agreement shall prejudice the rights, jurisdiction and duties of States under the Convention. This Agreement shall be interpreted and applied in the context of and in a manner consistent with the Convention.

PART II

CONSERVATION AND MANAGEMENT OF STRADDLING FISH STOCKS AND HIGHLY MIGRATORY FISH STOCKS

Article 5

General principles

In order to conserve and manage straddling fish stocks and highly migratory fish stocks, coastal States and States fishing on the high seas shall, in giving effect to their duty to cooperate in accordance with the Convention:

(a) adopt measures to ensure long-term sustainability of straddling fish stocks and highly migratory fish stocks and promote the objective of their optimum utilization;

(b) ensure that such measures are based on the best scientific evidence available and are designed to maintain or restore stocks at levels capable of producing maximum sustainable yield, as qualified by relevant environmental and economic factors, including the special requirements of developing States, and taking into account fishing patterns, the interdependence of stocks and any generally recommended international minimum standards, whether subregional, regional or global;

(c) apply the precautionary approach in accordance with article 6;

(d) assess the impacts of fishing, other human activities and environmental factors on target stocks and species belonging to the same ecosystem or associated with or dependent upon the target stocks;

(e) adopt, where necessary, conservation and management measures for species belonging to the same ecosystem or associated with or dependent upon the target stocks, with a view to maintaining or restoring populations of such species above levels at which their reproduction may become seriously threatened;

(f) minimize pollution, waste, discards, catch by lost or abandoned gear, catch of non-target species, both fish and non-fish species, (hereinafter referred to as non-target species) and impacts on associated or dependent species, in particular endangered species, through measures including, to the extent practicable, the development and use of selective, environmentally safe and cost-effective fishing gear and techniques;

(g) protect biodiversity in the marine environment;

(h) take measures to prevent or eliminate overfishing and excess fishing capacity and to ensure that levels of fishing effort do not exceed those commensurate with the sustainable use of fishery resources;

(i) take into account the interests of artisanal and subsistence fishers;

(j) collect and share, in a timely manner, complete and accurate data concerning fishing activities on, inter alia, vessel position, catch of target and non-target species and fishing effort, as set out in Annex I, as well as information from national and international research programmes;

(k) promote and conduct scientific research and develop appropriate technologies in support of fishery conservation and management; and

(l) implement and enforce conservation and management measures through effective monitoring, control and surveillance.

Article 6

Application of the precautionary approach

1. States shall apply the precautionary approach widely to conservation, management and exploitation of straddling fish stocks and highly migratory fish stocks in order to protect the living marine resources and preserve the marine environment.

2. States shall be more cautious when information is uncertain, unreliable or inadequate. The absence of adequate scientific information shall not be used as a reason for postponing or failing to take conservation and management measures.

3. In implementing the precautionary approach, States shall:

(a) improve decision-making for fishery resource conservation and management by obtaining and sharing the best scientific information available and implementing improved techniques for dealing with risk and uncertainty;

(b) apply the guidelines set out in Annex II and determine, on the basis of the best scientific information available, stock-specific reference points and the action to be taken if they are exceeded;

(c) take into account, inter alia, uncertainties relating to the size and productivity of the stocks, reference points, stock condition in relation to such reference points, levels and distribution of fishing mortality and the impact of fishing activities on non-target and associated or dependent species, as well as existing and predicted oceanic, environmental and socio-economic conditions; and

(d) develop data collection and research programmes to assess the impact of fishing on non-target and associated or dependent species and their environment, and adopt plans which are necessary to ensure the conservation of such species and to protect habitats of special concern.

4. States shall take measures to ensure that, when reference points are approached, they will not be exceeded. In the event that they are exceeded, States shall, without delay, take the action determined under paragraph 3 (b) to restore the stocks.

5. Where the status of target stocks or non-target or associated or dependent species is of concern, States shall subject such stocks and species to enhanced monitoring in order to review their status and the efficacy of conservation and management measures. They shall revise those measures regularly in the light of new information.

6. For new or exploratory fisheries, States shall adopt as soon as possible cautious conservation and management measures, including, inter alia, catch limits and effort limits. Such measures shall remain in force until there are sufficient data to allow assessment of the impact of the fisheries on the long-term sustainability of the stocks, whereupon conservation and management measures based on that assessment shall be implemented. The latter measures shall, if appropriate, allow for the gradual development of the fisheries.

7. If a natural phenomenon has a significant adverse impact on the status of straddling fish stocks or highly migratory fish stocks, States shall adopt conservation and management measures on an emergency basis to ensure that fishing activity does not exacerbate such adverse impact. States shall also adopt such measures on an emergency basis where fishing activity presents a serious threat to the sustainability of such stocks. Measures taken on an emergency basis shall be temporary and shall be based on the best scientific evidence available.

Article 7

Compatibility of conservation and management measures

1. Without prejudice to the sovereign rights of coastal States for the purpose of exploring and exploiting, conserving and managing the living marine resources within areas under national jurisdiction as provided for in the Convention, and the right of all States for their nationals to engage in fishing on the high seas in accordance with the Convention:

(a) with respect to straddling fish stocks, the relevant coastal States and the States whose nationals fish for such stocks in the adjacent high seas area shall seek, either directly or through the appropriate mechanisms for cooperation provided for in Part III, to agree upon the measures necessary for the conservation of these stocks in the adjacent high seas area;

(b) with respect to highly migratory fish stocks, the relevant coastal States and other States whose nationals fish for such stocks in the region shall cooperate, either directly or through the appropriate mechanisms for cooperation provided for in Part III, with a view to ensuring conservation and promoting the objective of optimum utilization of such stocks throughout the region, both within and beyond the areas under national jurisdiction.

2. Conservation and management measures established for the high seas and those adopted for areas under national jurisdiction shall be compatible in order to ensure conservation and management of the straddling fish stocks and highly migratory fish stocks in their entirety. To this end, coastal States and States fishing on the high seas have a duty to cooperate for the purpose of achieving compatible measures in respect of such stocks. In determining compatible conservation and management measures, States shall:

(a) take into account the conservation and management measures adopted and applied in accordance with article 61 of the Convention in respect of the same stocks by coastal States within areas under national jurisdiction and ensure that measures established in respect of such stocks for the high seas do not undermine the effectiveness of such measures;

(b) take into account previously agreed measures established and applied for the high seas in accordance with the Convention in respect of the same stocks by relevant coastal States and States fishing on the high seas;

(c) take into account previously agreed measures established and applied in accordance with the Convention in respect of the same stocks by a subregional or regional fisheries management organization or arrangement;

(d) take into account the biological unity and other biological characteristics of the stocks and the relationships between the distribution of the stocks, the fisheries and the geographical particularities of the region concerned, including the extent to which the stocks occur and are fished in areas under national jurisdiction;

(e) take into account the respective dependence of the coastal States and the States fishing on the high seas on the stocks concerned; and

(f) ensure that such measures do not result in harmful impact on the living marine resources as a whole.

3. In giving effect to their duty to cooperate, States shall make every effort to agree on compatible conservation and management measures within a reasonable period of time.

4. If no agreement can be reached within a reasonable period of time, any of the States concerned may invoke the procedures for the settlement of disputes provided for in Part VIII.

5. Pending agreement on compatible conservation and management measures, the States concerned, in a spirit of understanding and cooperation, shall make every effort to enter into provisional arrangements of a practical nature. In the event that they are unable to agree on such arrangements, any of the States concerned may, for the purpose of obtaining provisional measures, submit the dispute to a court or tribunal in accordance with the procedures for the settlement of disputes provided for in Part VIII.

6. Provisional arrangements or measures entered into or prescribed pursuant to paragraph 5 shall take into account the provisions of this Part, shall have due regard to the rights and obligations of all States concerned, shall not jeopardize or hamper the reaching of final agreement on compatible conservation and management measures and shall be without prejudice to the final outcome of any dispute settlement procedure.

7. Coastal States shall regularly inform States fishing on the high seas in the subregion or region, either directly or through appropriate subregional or regional fisheries management organizations or arrangements, or through other appropriate means, of the measures they have adopted for straddling fish stocks and highly migratory fish stocks within areas under their national jurisdiction.

8. States fishing on the high seas shall regularly inform other interested States, either directly or through appropriate subregional or regional fisheries management organizations or arrangements, or through other appropriate means, of the measures they have adopted for regulating the activities of vessels flying their flag which fish for such stocks on the high seas.

PART III

MECHANISMS FOR INTERNATIONAL COOPERATION CONCERNING STRADDLING FISH STOCKS AND HIGHLY MIGRATORY FISH STOCKS

Article 8

Cooperation for conservation and management

1. Coastal States and States fishing on the high seas shall, in accordance with the Convention, pursue cooperation in relation to straddling fish stocks and highly migratory fish stocks either directly or through appropriate subregional or regional fisheries management organizations or arrangements, taking into account the specific characteristics of the subregion or region, to ensure effective conservation and management of such stocks.

2. States shall enter into consultations in good faith and without delay, particularly where there is evidence that the straddling fish stocks and highly migratory fish stocks concerned may be under threat of over-exploitation or where a new fishery is being developed for such stocks. To this end, consultations may be initiated at the request of any interested State with a view to establishing appropriate arrangements to ensure conservation and management of the stocks. Pending agreement on such arrangements, States shall observe the provisions of this Agreement and shall act in good faith and with due regard to the rights, interests and duties of other States.

3. Where a subregional or regional fisheries management organization or arrangement has the competence to establish conservation and management measures for particular straddling fish stocks or highly migratory fish stocks, States fishing for the stocks on the high seas and relevant coastal States shall give effect to their duty to cooperate by becoming members of such organization or participants in such arrangement, or by agreeing to apply the conservation and management measures established by such organization or arrangement. States having a real interest in the fisheries concerned may become members of such organization or participants in such arrangement. The terms of participation in such organization or arrangement shall not preclude such States from membership or participation; nor shall they be applied in a manner which discriminates against any State or group of States having a real interest in the fisheries concerned.

4. Only those States which are members of such an organization or participants in such an arrangement, or which agree to apply the conservation and management measures established by such organization or arrangement, shall have access to the fishery resources to which those measures apply.

5. Where there is no subregional or regional fisheries management organization or arrangement to establish conservation and management measures for a particular straddling fish stock or highly migratory fish stock, relevant coastal States and States fishing on the high seas for such stock in the subregion or region shall cooperate to establish such an organization or enter into other appropriate arrangements to ensure conservation and management of such stock and shall participate in the work of the organization or arrangement.

6. Any State intending to propose that action be taken by an intergovernmental organization having competence with respect to living resources should, where such action would have a significant effect on conservation and management measures already established by a competent subregional or regional fisheries management organization or arrangement, consult through that organization or arrangement with its members or participants. To the extent practicable, such consultation should take place prior to the submission of the proposal to the intergovernmental organization.

Article 9

Subregional and regional fisheries management organizations and arrangements

1. In establishing subregional or regional fisheries management organizations or in entering into subregional or regional fisheries management arrangements for straddling fish stocks and highly migratory fish stocks, States shall agree, inter alia, on:

(a) the stocks to which conservation and management measures apply, taking into account the biological characteristics of the stocks concerned and the nature of the fisheries involved;

(b) the area of application, taking into account article 7, paragraph 1, and the characteristics of the subregion or region, including socio-economic, geographical and environmental factors;

(c) the relationship between the work of the new organization or arrangement and the role, objectives and operations of any relevant existing fisheries management organizations or arrangements; and

(d) the mechanisms by which the organization or arrangement will obtain scientific advice and review the status of the stocks, including, where appropriate, the establishment of a scientific advisory body.

2. States cooperating in the formation of a subregional or regional fisheries management organization or arrangement shall inform other States which they are aware have a real interest in the work of the proposed organization or arrangement of such cooperation.

Article 10

Functions of subregional and regional fisheries management organizations and arrangements

In fulfilling their obligation to cooperate through subregional or regional fisheries management organizations or arrangements, States shall:

(a) agree on and comply with conservation and management measures to ensure the long-term sustainability of straddling fish stocks and highly migratory fish stocks;

(b) agree, as appropriate, on participatory rights such as allocations of allowable catch or levels of fishing effort;

(c) adopt and apply any generally recommended international minimum standards for the responsible conduct of fishing operations;

(d) obtain and evaluate scientific advice, review the status of the stocks and assess the impact of fishing on non-target and associated or dependent species;

(e) agree on standards for collection, reporting, verification and exchange of data on fisheries for the stocks;

(f) compile and disseminate accurate and complete statistical data, as described in Annex I, to ensure that the best scientific evidence is available, while maintaining confidentiality where appropriate;

(g) promote and conduct scientific assessments of the stocks and relevant research and disseminate the results thereof;

(h) establish appropriate cooperative mechanisms for effective monitoring, control, surveillance and enforcement;

(i) agree on means by which the fishing interests of new members of the organization or new participants in the arrangement will be accommodated;

(j) agree on decision-making procedures which facilitate the adoption of conservation and management measures in a timely and effective manner;

(k) promote the peaceful settlement of disputes in accordance with Part VIII;

(l) ensure the full cooperation of their relevant national agencies and industries in implementing the recommendations and decisions of the organization or arrangement; and

(m) give due publicity to the conservation and management measures established by the organization or arrangement.

Article 11

New members or participants

In determining the nature and extent of participatory rights for new members of a subregional or regional fisheries management organization, or for new participants in a subregional or regional fisheries management arrangement, States shall take into account, inter alia:

(a) the status of the straddling fish stocks and highly migratory fish stocks and the existing level of fishing effort in the fishery;

(b) the respective interests, fishing patterns and fishing practices of new and existing members or participants;

(c) the respective contributions of new and existing members or participants to conservation and management of the stocks, to the collection and provision of accurate data and to the conduct of scientific research on the stocks;

(d) the needs of coastal fishing communities which are dependent mainly on fishing for the stocks;

(e) the needs of coastal States whose economies are overwhelmingly dependent on the exploitation of living marine resources; and

(f) the interests of developing States from the subregion or region in whose areas of national jurisdiction the stocks also occur.

Article 12

Transparency in activities of subregional and regional fisheries management organizations and arrangements

1. States shall provide for transparency in the decision-making process and other activities of subregional and regional fisheries management organizations and arrangements.

2. Representatives from other intergovernmental organizations and representatives from non-governmental organizations concerned with straddling fish stocks and highly migratory fish stocks shall be afforded the opportunity to take part in meetings of subregional and regional fisheries management organizations and arrangements as observers or otherwise, as appropriate, in accordance with the procedures of the organization or arrangement concerned. Such procedures shall not be unduly restrictive in this respect. Such intergovernmental organizations and non-governmental organizations shall have timely access to the records and reports of such organizations and arrangements, subject to the procedural rules on access to them

Article 13

Strengthening of existing organizations and arrangements

States shall cooperate to strengthen existing subregional and regional fisheries management organizations and arrangements in order to improve their effectiveness in establishing and implementing conservation and management measures for straddling fish stocks and highly migratory fish stocks.

Article 14

Collection and provision of information and cooperation in scientific research

1. States shall ensure that fishing vessels flying their flag provide such information as may be necessary in order to fulfil their obligations under this Agreement. To this end, States shall in accordance with Annex I:

(a) collect and exchange scientific, technical and statistical data with respect to fisheries for straddling fish stocks and highly migratory fish stocks;

(b) ensure that data are collected in sufficient detail to facilitate effective stock assessment and are provided in a timely manner to fulfil the requirements of subregional or regional fisheries management organizations or arrangements; and

(c) take appropriate measures to verify the accuracy of such data.

2. States shall cooperate, either directly or through subregional or regional fisheries management organizations or arrangements:

(a) to agree on the specification of data and the format in which they are to be provided to such organizations or arrangements, taking into account the nature of the stocks and the fisheries for those stocks; and

(b) to develop and share analytical techniques and stock assessment methodologies to improve measures for the conservation and management of straddling fish stocks and highly migratory fish stocks.

3. Consistent with Part XIII of the Convention, States shall cooperate, either directly or through competent international organizations, to strengthen scientific research capacity in the field of fisheries and promote scientific research related to the conservation and management of straddling fish stocks and highly migratory fish stocks for the benefit of all. To this end, a State or the competent international organization conducting such research beyond areas under national jurisdiction shall actively promote the publication and dissemination to any interested States of the results of that research and information relating to its objectives and methods and, to the extent practicable, shall facilitate the participation of scientists from those States in such research.

Article 15

Enclosed and semi-enclosed seas

In implementing this Agreement in an enclosed or semi-enclosed sea, States shall take into account the natural characteristics of that sea and shall also act in a manner consistent with Part IX of the Convention and other relevant provisions thereof.

Article 16

Areas of high seas surrounded entirely by an area under the national jurisdiction of a single State

1. States fishing for straddling fish stocks and highly migratory fish stocks in an area of the high seas surrounded entirely by an area under the national jurisdiction of a single State and the latter State shall cooperate to establish conservation and management measures in respect of those stocks in the high seas area. Having regard to the natural characteristics of the area, States shall pay special attention to the establishment of compatible conservation and management measures for such stocks pursuant to article 7. Measures taken in respect of the high seas shall take into account the rights, duties and interests of the coastal State under the Convention, shall be based on the best scientific evidence available and shall also take into account any conservation and management measures adopted and applied in respect of the same stocks in accordance with article 61 of the Convention by the coastal State in the area under national jurisdiction. States shall also agree on measures for monitoring, control, surveillance and enforcement to ensure compliance with the conservation and management measures in respect of the high seas.

2. Pursuant to article 8, States shall act in good faith and make every effort to agree without delay on conservation and management measures to be applied in the carrying out of fishing operations in the area referred to in paragraph 1. If, within a reasonable period of time, the fishing States concerned and the coastal State are unable to agree on such measures, they shall, having regard to paragraph 1, apply article 7, paragraphs 4, 5 and 6, relating to provisional arrangements or measures. Pending the establishment of such provisional arrangements or measures, the States concerned shall take measures in respect of vessels flying their flag in order that they not engage in fisheries which could undermine the stocks concerned.

PART IV

NON-MEMBERS AND NON-PARTICIPANTS

Article 17

Non-members of organizations and non-participants in arrangements

1. A State which is not a member of a subregional or regional fisheries management organization or is not a participant in a subregional or regional fisheries management arrangement, and which does not otherwise agree to apply the conservation and management measures established by such organization or arrangement, is not discharged from the obligation to cooperate, in accordance with the Convention and this Agreement, in the conservation and management of the relevant straddling fish stocks and highly migratory fish stocks.

2. Such State shall not authorize vessels flying its flag to engage in fishing operations for the straddling fish stocks or highly migratory fish stocks which are subject to the conservation and management measures established by such organization or arrangement.

3. States which are members of a subregional or regional fisheries management organization or participants in a subregional or regional fisheries management arrangement shall, individually or jointly, request the fishing entities referred to in article 1, paragraph 3, which have fishing vessels in the relevant area to cooperate fully with such organization or arrangement in implementing the conservation and management measures it has established, with a view to having such measures applied de facto as extensively as possible to fishing activities in the relevant area. Such fishing entities shall enjoy benefits from participation in the fishery commensurate with their commitment to comply with conservation and management measures in respect of the stocks.

4. States which are members of such organization or participants in such arrangement shall exchange information with respect to the activities of fishing vessels flying the flags of States which are neither members of the organization nor participants in the arrangement and which are engaged in fishing operations for the relevant stocks. They shall take measures consistent with this Agreement and international law to deter activities of such vessels which undermine the effectiveness of subregional or regional conservation and management measures.

PART V

DUTIES OF THE FLAG STATE

Article 18

Duties of the flag State

1. A State whose vessels fish on the high seas shall take such measures as may be necessary to ensure that vessels flying its flag comply with subregional and regional conservation and management measures and that such vessels do not engage in any activity which undermines the effectiveness of such measures.

2. A State shall authorize the use of vessels flying its flag for fishing on the high seas only where it is able to exercise effectively its responsibilities in respect of such vessels under the Convention and this Agreement.

3. Measures to be taken by a State in respect of vessels flying its flag shall include:

(a) control of such vessels on the high seas by means of fishing licences, authorizations or permits, in accordance with any applicable procedures agreed at the subregional, regional or global level;

(b) establishment of regulations:

(i) to apply terms and conditions to the licence, authorization or permit sufficient to fulfil any subregional, regional or global obligations of the flag State;

(ii) to prohibit fishing on the high seas by vessels which are not duly licensed or authorized to fish, or fishing on the high seas by vessels otherwise than in accordance with the terms and conditions of a licence, authorization or permit;

(iii) to require vessels fishing on the high seas to carry the licence, authorization or permit on board at all times and to produce it on demand for inspection by a duly authorized person; and

(iv) to ensure that vessels flying its flag do not conduct unauthorized fishing within areas under the national jurisdiction of other States;

(c) establishment of a national record of fishing vessels authorized to fish on the high seas and provision of access to the information contained in that record on request by directly interested States, taking into account any national laws of the flag State regarding the release of such information;

(d) requirements for marking of fishing vessels and fishing gear for identification in accordance with uniform and internationally recognizable vessel and gear marking systems, such as the Food and Agriculture Organization of the United Nations Standard Specifications for the Marking and Identification of Fishing Vessels;

(e) requirements for recording and timely reporting of vessel position, catch of target and non-target species, fishing effort and other relevant fisheries data in accordance with subregional, regional and global standards for collection of such data;

(f) requirements for verifying the catch of target and non-target species through such means as observer programmes, inspection schemes, unloading reports, supervision of transshipment and monitoring of landed catches and market statistics;

(g) monitoring, control and surveillance of such vessels, their fishing operations and related activities by, inter alia:

(i) the implementation of national inspection schemes and subregional and regional schemes for cooperation in enforcement pursuant to articles 21 and 22, including requirements for such vessels to permit access by duly authorized inspectors from other States;

(ii) the implementation of national observer programmes and subregional and regional observer programmes in which the flag State is a participant, including requirements for such vessels to permit access by observers from other States to carry out the functions agreed under the programmes; and

(iii) the development and implementation of vessel monitoring systems, including, as appropriate, satellite transmitter systems, in accordance with any national programmes and those which have been subregionally, regionally or globally agreed among the States concerned;

(h) regulation of transshipment on the high seas to ensure that the effectiveness of conservation and management measures is not undermined; and

(i) regulation of fishing activities to ensure compliance with subregional, regional or global measures, including those aimed at minimizing catches of non-target species.

4. Where there is a subregionally, regionally or globally agreed system of monitoring, control and surveillance in effect, States shall ensure that the measures they impose on vessels flying their flag are compatible with that system.

PART VI

COMPLIANCE AND ENFORCEMENT

Article 19

Compliance and enforcement by the flag State

1. A State shall ensure compliance by vessels flying its flag with subregional and regional conservation and management measures for straddling fish stocks and highly migratory fish stocks. To this end, that State shall:

(a) enforce such measures irrespective of where violations occur;

(b) investigate immediately and fully any alleged violation of subregional or regional conservation and management measures, which may include the physical inspection of the vessels concerned, and report promptly to the State alleging the violation and the relevant subregional or regional organization or arrangement on the progress and outcome of the investigation;

(c) require any vessel flying its flag to give information to the investigating authority regarding vessel position, catches, fishing gear, fishing operations and related activities in the area of an alleged violation;

(d) if satisfied that sufficient evidence is available in respect of an alleged violation, refer the case to its authorities with a view to instituting proceedings without delay in accordance with its laws and, where appropriate, detain the vessel concerned; and

(e) ensure that, where it has been established, in accordance with its laws, a vessel has been involved in the commission of a serious violation of such measures, the vessel does not engage in fishing operations on the high seas until such time as all outstanding sanctions imposed by the flag State in respect of the violation have been complied with.

2. All investigations and judicial proceedings shall be carried out expeditiously. Sanctions applicable in respect of violations shall be adequate in severity to be effective in securing compliance and to discourage violations wherever they occur and shall deprive offenders of the benefits accruing from their illegal activities. Measures applicable in respect of masters and other officers of fishing vessels shall include provisions which may permit, inter alia, refusal, withdrawal or suspension of authorizations to serve as masters or officers on such vessels.

Article 20

International cooperation in enforcement

1. States shall cooperate, either directly or through subregional or regional fisheries management organizations or arrangements, to ensure compliance with and enforcement of subregional and regional conservation and management measures for straddling fish stocks and highly migratory fish stocks.

2. A flag State conducting an investigation of an alleged violation of conservation and management measures for straddling fish stocks or highly migratory fish stocks may request the assistance of any other State whose cooperation may be useful in the conduct of that investigation. All States shall endeavour to meet reasonable requests made by a flag State in connection with such investigations.

3. A flag State may undertake such investigations directly, in cooperation with other interested States or through the relevant subregional or regional fisheries management organization or arrangement. Information on the progress and outcome of the investigations shall be provided to all States having an interest in, or affected by, the alleged violation.

4. States shall assist each other in identifying vessels reported to have engaged in activities undermining the effectiveness of subregional, regional or global conservation and management measures.

5. States shall, to the extent permitted by national laws and regulations, establish arrangements for making available to prosecuting authorities in other States evidence relating to alleged violations of such measures.

6. Where there are reasonable grounds for believing that a vessel on the high seas has been engaged in unauthorized fishing within an area under the jurisdiction of a coastal State, the flag State of that vessel, at the request of the coastal State concerned, shall immediately and fully investigate the matter. The flag State shall cooperate with the coastal State in taking appropriate enforcement action in such cases and may authorize the relevant authorities of the coastal State to board and inspect the vessel on the high seas. This paragraph is without prejudice to article 111 of the Convention.

7. States Parties which are members of a subregional or regional fisheries management organization or participants in a subregional or regional fisheries management arrangement may take action in accordance with international law, including through recourse to subregional or regional procedures established for this purpose, to deter vessels which have engaged in activities which undermine the effectiveness of or otherwise violate the conservation and management measures established by that organization or arrangement from fishing on the high seas in the subregion or region until such time as appropriate action is taken by the flag State.

Article 21

Subregional and regional cooperation in enforcement

1. In any high seas area covered by a subregional or regional fisheries management organization or arrangement, a State Party which is a member of such organization or a participant in such arrangement may, through its duly authorized inspectors, board and inspect, in accordance with paragraph 2, fishing vessels flying the flag of another State Party to this Agreement, whether or not such State Party is also a member of the organization or a participant in the arrangement, for the purpose of ensuring compliance with conservation and management measures for straddling fish stocks and highly migratory fish stocks established by that organization or arrangement.

2. States shall establish, through subregional or regional fisheries management organizations or arrangements, procedures for boarding and inspection pursuant to paragraph 1, as well as procedures to implement other provisions of this article. Such procedures shall be consistent with this article and the basic procedures set out in article 22 and shall not discriminate against non-members of the organization or non-participants in the arrangement. Boarding and inspection as well as any subsequent enforcement action shall be conducted in accordance with such procedures. States shall give due publicity to procedures established pursuant to this paragraph.

3. If, within two years of the adoption of this Agreement, any organization or arrangement has not established such procedures, boarding and inspection pursuant to paragraph 1, as well as any subsequent enforcement action, shall, pending the establishment of such procedures, be conducted in accordance with this article and the basic procedures set out in article 22.

4. Prior to taking action under this article, inspecting States shall, either directly or through the relevant subregional or regional fisheries management organization or arrangement, inform all States whose vessels fish on the high seas in the subregion or region of the form of identification issued to their duly authorized inspectors. The vessels used for boarding and inspection shall be clearly marked and identifiable as being on government service. At the time of becoming a Party to this Agreement, a State shall designate an appropriate authority to receive notifications pursuant to this article and shall give due publicity of such designation through the relevant subregional or regional fisheries management organization or arrangement.

5. Where, following a boarding and inspection, there are clear grounds for believing that a vessel has engaged in any activity contrary to the conservation and management measures referred to in paragraph 1, the inspecting State shall, where appropriate, secure evidence and shall promptly notify the flag State of the alleged violation.

6. The flag State shall respond to the notification referred to in paragraph 5 within three working days of its receipt, or such other period as may be prescribed in procedures established in accordance with paragraph 2, and shall either:

(a) fulfil, without delay, its obligations under article 19 to investigate and, if evidence so warrants, take enforcement action with respect to the vessel, in which case it shall promptly inform the inspecting State of the results of the investigation and of any enforcement action taken; or

(b) authorize the inspecting State to investigate.

7. Where the flag State authorizes the inspecting State to investigate an alleged violation, the inspecting State shall, without delay, communicate the results of that investigation to the flag State. The flag State shall, if evidence so warrants, fulfil its obligations to take enforcement action with respect to the vessel. Alternatively, the flag State may

authorize the inspecting State to take such enforcement action as the flag State may specify with respect to the vessel, consistent with the rights and obligations of the flag State under this Agreement.

8. Where, following boarding and inspection, there are clear grounds for believing that a vessel has committed a serious violation, and the flag State has either failed to respond or failed to take action as required under paragraphs 6 or 7, the inspectors may remain on board and secure evidence and may require the master to assist in further investigation including, where appropriate, by bringing the vessel without delay to the nearest appropriate port, or to such other port as may be specified in procedures established in accordance with paragraph 2. The inspecting State shall immediately inform the flag State of the name of the port to which the vessel is to proceed. The inspecting State and the flag State and, as appropriate, the port State shall take all necessary steps to ensure the well-being of the crew regardless of their nationality.

9. The inspecting State shall inform the flag State and the relevant organization or the participants in the relevant arrangement of the results of any further investigation.

10. The inspecting State shall require its inspectors to observe generally accepted international regulations, procedures and practices relating to the safety of the vessel and the crew, minimize interference with fishing operations and, to the extent practicable, avoid action which would adversely affect the quality of the catch on board. The inspecting State shall ensure that boarding and inspection is not conducted in a manner that would constitute harassment of any fishing vessel.

11. For the purposes of this article, a serious violation means:

(a) fishing without a valid licence, authorization or permit issued by the flag State in accordance with article 18, paragraph 3 (a);

(b) failing to maintain accurate records of catch and catch-related data, as required by the relevant subregional or regional fisheries management organization or arrangement, or serious misreporting of catch, contrary to the catch reporting requirements of such organization or arrangement;

(c) fishing in a closed area, fishing during a closed season or fishing without, or after attainment of, a quota established by the relevant subregional or regional fisheries management organization or arrangement;

(d) directed fishing for a stock which is subject to a moratorium or for which fishing is prohibited;

(e) using prohibited fishing gear;

(f) falsifying or concealing the markings, identity or registration of a fishing vessel;

(g) concealing, tampering with or disposing of evidence relating to an investigation;

(h) multiple violations which together constitute a serious disregard of conservation and management measures; or

(i) such other violations as may be specified in procedures established by the relevant subregional or regional fisheries management organization or arrangement.

12. Notwithstanding the other provisions of this article, the flag State may, at any time, take action to fulfil its obligations under article 19 with respect to an alleged violation. Where the vessel is under the direction of the inspecting State, the inspecting State shall, at the request of the flag State, release the vessel to the flag State along with full information on the progress and outcome of its investigation.

13. This article is without prejudice to the right of the flag State to take any measures, including proceedings to impose penalties, according to its laws.

14. This article applies mutatis mutandis to boarding and inspection by a State Party which is a member of a subregional or regional fisheries management organization or a participant in a subregional or regional fisheries management arrangement and which has clear grounds for believing that a fishing vessel flying the flag of another State Party has engaged in any activity contrary to relevant conservation and management measures referred to in paragraph 1 in the high seas area covered by such organization or arrangement, and such vessel has subsequently, during the same fishing trip, entered into an area under the national jurisdiction of the inspecting State.

15. Where a subregional or regional fisheries management organization or arrangement has established an alternative mechanism which effectively discharges the obligation under this Agreement of its members or participants to ensure compliance with the conservation and management measures established by the organization or arrangement, members of such organization or participants in such arrangement may agree to limit the application of paragraph 1 as between themselves in respect of the conservation and management measures which have been established in the relevant high seas area.

16. Action taken by States other than the flag State in respect of vessels having engaged in activities contrary to subregional or regional conservation and management measures shall be proportionate to the seriousness of the violation.

17. Where there are reasonable grounds for suspecting that a fishing vessel on the high seas is without nationality, a State may board and inspect the vessel. Where evidence so warrants, the State may take such action as may be appropriate in accordance with international law.

18. States shall be liable for damage or loss attributable to them arising from action taken pursuant to this article when such action is unlawful or exceeds that reasonably required in the light of available information to implement the provisions of this article.

Article 22

Basic procedures for boarding and inspection pursuant to article 21

1. The inspecting State shall ensure that its duly authorized inspectors:

(a) present credentials to the master of the vessel and produce a copy of the text of the relevant conservation and management measures or rules and regulations in force in the high seas area in question pursuant to those measures;

(b) initiate notice to the flag State at the time of the boarding and inspection;

(c) do not interfere with the master's ability to communicate with the authorities of the flag State during the boarding and inspection;

(d) provide a copy of a report on the boarding and inspection to the master and to the authorities of the flag State, noting therein any objection or statement which the master wishes to have included in the report;

(e) promptly leave the vessel following completion of the inspection if they find no evidence of a serious violation; and

(f) avoid the use of force except when and to the degree necessary to ensure the safety of the inspectors and where the inspectors are obstructed in the execution of their duties. The degree of force used shall not exceed that reasonably required in the circumstances.

2. The duly authorized inspectors of an inspecting State shall have the authority to inspect the vessel, its licence, gear, equipment, records, facilities, fish and fish products and any relevant documents necessary to verify compliance with the relevant conservation and management measures.

3. The flag State shall ensure that vessel masters:

(a) accept and facilitate prompt and safe boarding by the inspectors;

(b) cooperate with and assist in the inspection of the vessel conducted pursuant to these procedures;

(c) do not obstruct, intimidate or interfere with the inspectors in the performance of their duties;

(d) allow the inspectors to communicate with the authorities of the flag State and the inspecting State during the boarding and inspection;

(e) provide reasonable facilities, including, where appropriate, food and accommodation, to the inspectors; and

(f) facilitate safe disembarkation by the inspectors.

4. In the event that the master of a vessel refuses to accept boarding and inspection in accordance with this article and article 21, the flag State shall, except in circumstances where, in accordance with generally accepted international regulations, procedures and practices relating to safety at sea, it is necessary to delay the boarding and inspection, direct the master of the vessel to submit immediately to boarding and inspection and, if the master does not comply with such direction, shall suspend the vessel's authorization to fish and order the vessel to return immediately to port. The flag State shall advise the inspecting State of the action it has taken when the circumstances referred to in this paragraph arise.

Article 23

Measures taken by a port State

1. A port State has the right and the duty to take measures, in accordance with international law, to promote the effectiveness of subregional, regional and global conservation and management measures. When taking such measures a port State shall not discriminate in form or in fact against the vessels of any State.

2. A port State may, inter alia, inspect documents, fishing gear and catch on board fishing vessels, when such vessels are voluntarily in its ports or at its offshore terminals.

3. States may adopt regulations empowering the relevant national authorities to prohibit landings and transshipments where it has been established that the catch has been taken in a manner which undermines the effectiveness of subregional, regional or global conservation and management measures on the high seas.

4. Nothing in this article affects the exercise by States of their sovereignty over ports in their territory in accordance with international law.

PART VII

REQUIREMENTS OF DEVELOPING STATES

Article 24

Recognition of the special requirements of developing States

1. States shall give full recognition to the special requirements of developing States in relation to conservation and management of straddling fish stocks and highly migratory fish stocks and development of fisheries for such stocks. To this end, States shall, either directly or through the United Nations Development Programme, the Food and Agriculture Organization of the United Nations and other specialized agencies, the Global Environment Facility, the Commission on Sustainable Development and other appropriate international and regional organizations and bodies, provide assistance to developing States.

2. In giving effect to the duty to cooperate in the establishment of conservation and management measures for straddling fish stocks and highly migratory fish stocks, States shall take into account the special requirements of developing States, in particular:

(a) the vulnerability of developing States which are dependent on the exploitation of living marine resources, including for meeting the nutritional requirements of their populations or parts thereof;

(b) the need to avoid adverse impacts on, and ensure access to fisheries by, subsistence, small-scale and artisanal fishers and women fishworkers, as well as indigenous people in developing States, particularly small island developing States; and

(c) the need to ensure that such measures do not result in transferring, directly or indirectly, a disproportionate burden of conservation action onto developing States.

Article 25

Forms of cooperation with developing States

1. States shall cooperate, either directly or through subregional, regional or global organizations:

(a) to enhance the ability of developing States, in particular the least-developed among them and small island developing States, to conserve and manage straddling fish stocks and highly migratory fish stocks and to develop their own fisheries for such stocks;

(b) to assist developing States, in particular the least-developed among them and small island developing States, to enable them to participate in high seas fisheries for such stocks, including facilitating access to such fisheries subject to articles 5 and 11; and

(c) to facilitate the participation of developing States in subregional and regional fisheries management organizations and arrangements.

2. Cooperation with developing States for the purposes set out in this article shall include the provision of financial assistance, assistance relating to human resources development, technical assistance, transfer of technology, including through joint venture arrangements, and advisory and consultative services.

3. Such assistance shall, inter alia, be directed specifically towards:

(a) improved conservation and management of straddling fish stocks and highly migratory fish stocks through collection, reporting, verification, exchange and analysis of fisheries data and related information;

(b) stock assessment and scientific research; and

(c) monitoring, control, surveillance, compliance and enforcement, including training and capacity-building at the local level, development and funding of national and regional observer programmes and access to technology and equipment.

Article 26

Special assistance in the implementation of this Agreement

1. States shall cooperate to establish special funds to assist developing States in the implementation of this Agreement, including assisting developing States to meet the costs involved in any proceedings for the settlement of disputes to which they may be parties.

2. States and international organizations should assist developing States in establishing new subregional or regional fisheries management organizations or arrangements, or in strengthening existing organizations or arrangements, for the conservation and management of straddling fish stocks and highly migratory fish stocks.

PART VIII

PEACEFUL SETTLEMENT OF DISPUTES

Article 27

Obligation to settle disputes by peaceful means

States have the obligation to settle their disputes by negotiation, inquiry, mediation, conciliation, arbitration, judicial settlement, resort to regional agencies or arrangements, or other peaceful means of their own choice.

Article 28

Prevention of disputes

States shall cooperate in order to prevent disputes. To this end, States shall agree on efficient and expeditious decision-making procedures within subregional and regional fisheries management organizations and arrangements and shall strengthen existing decision-making procedures as necessary.

Article 29

Disputes of a technical nature

Where a dispute concerns a matter of a technical nature, the States concerned may refer the dispute to an ad hoc expert panel established by them. The panel shall confer with the States concerned and shall endeavor to resolve the dispute expeditiously without recourse to binding procedures for the settlement of disputes.

Article 30

Procedures for the settlement of disputes

1. The provisions relating to the settlement of disputes set out in Part XV of the Convention apply mutatis mutandis to any dispute between States Parties to this Agreement concerning the interpretation or application of this Agreement, whether or not they are also Parties to the Convention.

2. The provisions relating to the settlement of disputes set out in Part XV of the Convention apply mutatis mutandis to any dispute between States Parties to this Agreement concerning the interpretation or application of a subregional, regional or global fisheries agreement relating to straddling fish stocks or highly migratory fish stocks to which they are parties, including any dispute concerning the conservation and management of such stocks, whether or not they are also Parties to the Convention.

3. Any procedure accepted by a State Party to this Agreement and the Convention pursuant to article 287 of the Convention shall apply to the settlement of disputes under this Part, unless that State Party, when signing, ratifying or acceding to this Agreement, or at any time thereafter, has accepted another procedure pursuant to article 287 for the settlement of disputes under this Part.

4. A State Party to this Agreement which is not a Party to the Convention, when signing, ratifying or acceding to this Agreement, or at any time thereafter, shall be free to choose, by means of a written declaration, one or more of the means set out in article 287, paragraph 1, of the Convention for the settlement of disputes under this Part. Article 287 shall apply to such a declaration, as well as to any dispute to which such State is a party which is not covered by a declaration in force. For the purposes of conciliation and arbitration in accordance with Annexes V, VII and VIII to the Convention, such State shall be entitled to nominate conciliators, arbitrators and experts to be included in the lists referred to in Annex V, article 2, Annex VII, article 2, and Annex VIII, article 2, for the settlement of disputes under this Part.

5. Any court or tribunal to which a dispute has been submitted under this Part shall apply the relevant provisions of the Convention, of this Agreement and of any relevant subregional, regional or global fisheries agreement, as well as generally accepted standards for the conservation and management of living marine resources and other rules of international law not incompatible with the Convention, with a view to ensuring the conservation of the straddling fish stocks and highly migratory fish stocks concerned.

Article 31

Provisional measures

1. Pending the settlement of a dispute in accordance with this Part, the parties to the dispute shall make every effort to enter into provisional arrangements of a practical nature.

2. Without prejudice to article 290 of the Convention, the court or tribunal to which the dispute has been submitted under this Part may prescribe any provisional measures which it considers appropriate under the circumstances to preserve the respective rights of the parties to the dispute or to prevent damage to the stocks in question, as well as in the circumstances referred to in article 7, paragraph 5, and article 16, paragraph 2.

3. A State Party to this Agreement which is not a Party to the Convention may declare that, notwithstanding article 290, paragraph 5, of the Convention, the International Tribunal for the Law of the Sea shall not be entitled to prescribe, modify or revoke provisional measures without the agreement of such State.

Article 32

Limitations on applicability of procedures for the settlement of disputes

Article 297, paragraph 3, of the Convention applies also to this Agreement.

PART IX

NON-PARTIES TO THIS AGREEMENT

Article 33

Non-parties to this Agreement

1. States Parties shall encourage non-parties to this Agreement to become parties thereto and to adopt laws and regulations consistent with its provisions.

2. States Parties shall take measures consistent with this Agreement and international law to deter the activities of vessels flying the flag of non-parties which undermine the effective implementation of this Agreement.

PART X

GOOD FAITH AND ABUSE OF RIGHTS

Article 34

Good faith and abuse of rights

States Parties shall fulfil in good faith the obligations assumed under this Agreement and shall exercise the rights recognized in this Agreement in a manner which would not constitute an abuse of right.

Part XI

RESPONSIBILITY AND LIABILITY

Article 35

Responsibility and liability

States Parties are liable in accordance with international law for damage or loss attributable to them in regard to this Agreement.

PART XII

REVIEW CONFERENCE

Article 36

Review conference

1. Four years after the date of entry into force of this Agreement, the Secretary-General of the United Nations shall convene a conference with a view to assessing the effectiveness of this Agreement in securing the conservation and management of straddling fish stocks and highly migratory fish stocks. The Secretary-General shall invite to the conference all States Parties and those States and entities which are entitled to become parties to this Agreement as well as those intergovernmental and non-governmental organizations entitled to participate as observers.

2. The conference shall review and assess the adequacy of the provisions of this Agreement and, if necessary, propose means of strengthening the substance and methods of implementation of those provisions in order better to address any continuing problems in the conservation and management of straddling fish stocks and highly migratory fish stocks.

PART XIII

FINAL PROVISIONS

Article 37

Signature

This Agreement shall be open for signature by all States and the other entities referred to in article 1, paragraph 2(b), and shall remain open for signature at United Nations Headquarters for twelve months from the fourth of December 1995.

Article 38

Ratification

This Agreement is subject to ratification by States and the other entities referred to in article 1, paragraph 2(b). The instruments of ratification shall be deposited with the Secretary-General of the United Nations.

Article 39

Accession

This Agreement shall remain open for accession by States and the other entities referred to in article 1, paragraph 2(b). The instruments of accession shall be deposited with the Secretary-General of the United Nations.

Article 40

Entry into force

1. This Agreement shall enter into force 30 days after the date of deposit of the thirtieth instrument of ratification or accession.

2. For each State or entity which ratifies the Agreement or accedes thereto after the deposit of the thirtieth instrument of ratification or accession, this Agreement shall enter into force on the thirtieth day following the deposit of its instrument of ratification or accession.

Article 41

Provisional application

1. This Agreement shall be applied provisionally by a State or entity which consents to its provisional application by so notifying the depositary in writing. Such provisional application shall become effective from the date of receipt of the notification.

2. Provisional application by a State or entity shall terminate upon the entry into force of this Agreement for that State or entity or upon notification by that State or entity to the depositary in writing of its intention to terminate provisional application.

Article 42

Reservations and exceptions

No reservations or exceptions may be made to this Agreement.

Article 43

Declarations and statements

Article 42 does not preclude a State or entity, when signing, ratifying or acceding to this Agreement, from making declarations or statements, however phrased or named, with a view, inter alia, to the harmonization of its laws and regulations with the provisions of this Agreement, provided that such declarations or statements do not purport to exclude or to modify the legal effect of the provisions of this Agreement in their application to that State or entity.

Article 44

Relation to other agreements

1. This Agreement shall not alter the rights and obligations of States Parties which arise from other agreements compatible with this Agreement and which do not affect the enjoyment by other States Parties of their rights or the performance of their obligations under this Agreement.

2. Two or more States Parties may conclude agreements modifying or suspending the operation of provisions of this Agreement, applicable solely to the relations between them, provided that such agreements do not relate to a provision derogation from which is incompatible with the effective execution of the object and purpose of this Agreement, and provided further that such agreements shall not affect the application of the basic principles embodied herein, and that the provisions of such agreements do not affect the enjoyment by other States Parties of their rights or the performance of their obligations under this Agreement.

3. States Parties intending to conclude an agreement referred to in paragraph 2 shall notify the other States Parties through the depositary of this Agreement of their intention to conclude the agreement and of the modification or suspension for which it provides.

Article 45

Amendment

1. A State Party may, by written communication addressed to the Secretary-General of the United Nations, propose amendments to this Agreement and request the convening of a conference to consider such proposed amendments. The Secretary-General shall circulate such communication to all States Parties. If, within six months from the date of the circulation of the communication, not less than one half of the States Parties reply favorably to the request, the Secretary-General shall convene the conference.

2. The decision-making procedure applicable at the amendment conference convened pursuant to paragraph 1 shall be the same as that applicable at the United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks, unless otherwise decided by the conference. The conference should make every effort to reach agreement on any amendments by way of consensus and there should be no voting on them until all efforts at consensus have been exhausted.

3. Once adopted, amendments to this Agreement shall be open for signature at United Nations Headquarters by States Parties for twelve months from the date of adoption, unless otherwise provided in the amendment itself.

4. Articles 38, 39, 47 and 50 apply to all amendments to this Agreement.

5. Amendments to this Agreement shall enter into force for the States Parties ratifying or acceding to them on the thirtieth day following the deposit of instruments of ratification or accession by two thirds of the States Parties. Thereafter, for each State Party ratifying or acceding to an amendment after the deposit of the required number of such instruments, the amendment shall enter into force on the thirtieth day following the deposit of its instrument of ratification or accession.

6. An amendment may provide that a smaller or a larger number of ratifications or accessions shall be required for its entry into force than are required by this article.

of amendments in accordance with paragraph 5 shall, failing an expression of a different intention by that State:

(a) be considered as a Party to this Agreement as so amended; and

(b) be considered as a Party to the unamended Agreement in relation to any State Party not bound by the amendment.

Article 46

Denunciation

1. A State Party may, by written notification addressed to the Secretary-General of the United Nations, denounce this Agreement and may indicate its reasons. Failure to indicate reasons shall not affect the validity of the denunciation.

The denunciation shall take effect one year after the date of receipt of the notification, unless the notification specifies a later date.

2. The denunciation shall not in any way affect the duty of any State Party to fulfill any obligation embodied in this Agreement to which it would be subject under international law independently of this Agreement.

Article 47

Participation by international organizations

1. In cases where an international organization referred to in Annex IX, article 1, of the Convention does not have competence over all the matters governed by this Agreement, Annex IX to the Convention shall apply mutatis mutandis to participation by such international organization in this Agreement, except that the following provisions of that Annex shall not apply:

(a) article 2, first sentence; and

(b) article 3, paragraph 1.

2. In cases where an international organization referred to in Annex IX, article 1, of the Convention has competence over all the matters governed by this Agreement, the following provisions shall apply to participation by such international organization in this Agreement:

(a) at the time of signature or accession, such international organization shall make a declaration stating:

(i) that it has competence over all the matters governed by this Agreement;

(ii) that, for this reason, its member States shall not become States Parties, except in respect of their territories for which the international organization has no responsibility; and

(iii) that it accepts the rights and obligations of States under this Agreement;

(b) participation of such an international organization shall in no case confer any rights under this Agreement on member States of the international organization;

(c) in the event of a conflict between the obligations of an international organization under this Agreement and its obligations under the agreement establishing the international organization or any acts relating to it, the obligations under this Agreement shall prevail.

Article 48

Annexes

1. The Annexes form an integral part of this Agreement and, unless expressly provided otherwise, a reference to this Agreement or to one of its Parts includes a reference to the Annexes relating thereto.

2. The Annexes may be revised from time to time by States Parties. Such revisions shall be based on scientific and technical considerations. Notwithstanding the provisions of article 45, if a revision to an Annex is adopted by consensus at a meeting of States Parties, it shall be incorporated in this Agreement and shall take effect from the date of its adoption or from such other date as may be specified in the revision. If a revision to an Annex is not adopted by consensus at such a meeting, the amendment procedures set out in article 45 shall apply.

Article 49

Depositary

The Secretary-General of the United Nations shall be the depositary of this Agreement and any amendments or revisions thereto.

Article 50

Authentic texts

The Arabic, Chinese, English, French, Russian and Spanish texts of this Agreement are equally authentic.

IN WITNESS WHEREOF, the undersigned Plenipotentiaries, being duly authorized thereto, have signed this Agreement.

OPENED FOR SIGNATURE at New York, this fourth day of December, one thousand nine hundred and ninety-five, in a single original, in the Arabic, Chinese, English, French, Russian and Spanish languages.

ANNEX I

STANDARD REQUIREMENTS FOR THE COLLECTION AND SHARING OF DATA

Article 1

General principles

1. The timely collection, compilation and analysis of data are fundamental to the effective conservation and management of straddling fish stocks and highly migratory fish stocks. To this end, data from fisheries for these stocks on the high seas and those in areas under national jurisdiction are required and should be collected and compiled in such a way as to enable statistically meaningful analysis for the purposes of fishery resource conservation and management. These data include catch and fishing effort statistics and other fishery-related information, such as vessel-related and other data for standardizing fishing effort. Data collected should also include information on non-target and associated or dependent species. All data should be verified to ensure accuracy. Confidentiality of non-aggregated data shall be maintained. The dissemination of such data shall be subject to the terms on which they have been provided.

2. Assistance, including training as well as financial and technical assistance, shall be provided to developing States in order to build capacity in the field of conservation and management of living marine resources. Assistance should focus on enhancing capacity to implement data collection and verification, observer programmes, data analysis and research projects supporting stock assessments. The fullest possible involvement of developing State scientists and managers in conservation and management of straddling fish stocks and highly migratory fish stocks should be promoted.

Article 2

Principles of data collection, compilation and exchange

The following general principles should be considered in defining the parameters for collection, compilation and exchange of data from fishing operations for straddling fish stocks and highly migratory fish stocks:

(a) States should ensure that data are collected from vessels flying their flag on fishing activities according to the operational characteristics of each fishing method (e.g., each individual tow for trawl, each set for long-line and purse-seine, each school fished for pole-and-line and each day fished for troll) and in sufficient detail to facilitate effective stock assessment;

(b) States should ensure that fishery data are verified through an appropriate system;

(c) States should compile fishery-related and other supporting scientific data and provide them in an agreed format and in a timely manner to the relevant subregional or regional fisheries management organization or arrangement where one exists. Otherwise, States should cooperate to exchange data either directly or through such other cooperative mechanisms as may be agreed among them;

(d) States should agree, within the framework of subregional or regional fisheries management organizations or arrangements, or otherwise, on the specification of data and the format in which they are to be provided, in accordance with this Annex and taking into account the nature of the stocks and the fisheries for those stocks in the region. Such organizations or arrangements should request non-members or non-participants to provide data concerning relevant fishing activities by vessels flying their flag;

(e) such organizations or arrangements shall compile data and make them available in a timely manner and in an agreed format to all interested States under the terms and conditions established by the organization or arrangement; and

(f) scientists of the flag State and from the relevant subregional or regional fisheries management organization or arrangement should analyze the data separately or jointly, as appropriate.

Article 3

Basic fishery data

1. States shall collect and make available to the relevant subregional or regional fisheries management organization or arrangement the following types of data in sufficient detail to facilitate effective stock assessment in accordance with agreed procedures:

(a) time series of catch and effort statistics by fishery and fleet;

(b) total catch in number, nominal weight, or both, by species (both target and non-target) as is appropriate to each fishery. [Nominal weight is defined by the Food and Agriculture Organization of the United Nations as the live-weight equivalent of the landings];

(c) discard statistics, including estimates where necessary, reported as number or nominal weight by species, as is appropriate to each fishery;

(d) effort statistics appropriate to each fishing method; and

(e) fishing location, date and time fished and other statistics on fishing operations as appropriate.

2. States shall also collect where appropriate and provide to the relevant subregional or regional fisheries management organization or arrangement information to support stock assessment, including:

(a) composition of the catch according to length, weight and sex;

(b) other biological information supporting stock assessments, such as information on age, growth, recruitment, distribution and stock identity; and

(c) other relevant research, including surveys of abundance, biomass surveys, hydro-acoustic surveys, research on environmental factors affecting stock abundance, and oceanographic and ecological studies.

Article 4

Vessel data and information

1. States should collect the following types of vessel-related data for standardizing fleet composition and vessel fishing power and for converting between different measures of effort in the analysis of catch and effort data:

(a) vessel identification, flag and port of registry;

(b) vessel type;

(c) vessel specifications (e.g., material of construction, date built, registered length, gross registered tonnage, power of main engines, hold capacity and catch storage methods); and

(d) fishing gear description (e.g., types, gear specifications and quantity).

2. The flag State will collect the following information:

(a) navigation and position fixing aids;

(b) communication equipment and international radio call sign; and

(c) crew size.

Article 5

Reporting

A State shall ensure that vessels flying its flag send to its national fisheries administration and, where agreed, to the relevant subregional or regional fisheries management organization or arrangement, logbook data on catch and effort, including data on fishing operations on the high seas, at sufficiently frequent intervals to meet national requirements and regional and international obligations. Such data shall be transmitted, where necessary, by radio, telex, facsimile or satellite transmission or by other means.

Article 6

Data verification

States or, as appropriate, subregional or regional fisheries management organizations or arrangements should establish mechanisms for verifying fishery data, such as:

(a) position verification through vessel monitoring systems;

(b) scientific observer programmes to monitor catch, effort, catch composition (target and non-target) and other details of fishing operations;

(c) vessel trip, landing and transshipment reports; and

(d) port sampling.

Article 7

Data exchange

1. Data collected by flag States must be shared with other flag States and relevant coastal States through appropriate subregional or regional fisheries management organizations or arrangements. Such organizations or arrangements shall compile data and make them available in a timely manner and in an agreed format to all interested States under the terms and conditions established by the organization or arrangement, while maintaining confidentiality of non-aggregated data, and should, to the extent feasible, develop database systems which provide efficient access to data.

2. At the global level, collection and dissemination of data should be effected through the Food and Agriculture Organization of the United Nations. Where a subregional or regional fisheries management organization or arrangement does not exist, that organization may also do the same at the subregional or regional level by arrangement with the States concerned.

ANNEX II

GUIDELINES FOR THE APPLICATION OF PRECAUTIONARY REFERENCE POINTS IN CONSERVATION AND MANAGEMENT OF STRADDLING FISH STOCKS AND HIGHLY MIGRATORY FISH STOCKS

1. A precautionary reference point is an estimated value derived through an agreed scientific procedure, which corresponds to the state of the resource and of the fishery, and which can be used as a guide for fisheries management.

2. Two types of precautionary reference points should be used: conservation, or limit, reference points and management, or target, reference points. Limit reference points set boundaries which are intended to constrain harvesting within safe biological limits within which the stocks can produce maximum sustainable yield. Target reference points are intended to meet management objectives.

3. Precautionary reference points should be stock-specific to account, inter alia, for the reproductive capacity, the resilience of each stock and the characteristics of fisheries exploiting the stock, as well as other sources of mortality and major sources of uncertainty.

4. Management strategies shall seek to maintain or restore populations of harvested stocks, and where necessary associated or dependent species, at levels consistent with previously agreed precautionary reference points. Such reference points shall be used to trigger pre-agreed conservation and management action. Management strategies shall include measures which can be implemented when precautionary reference points are approached.

5. Fishery management strategies shall ensure that the risk of exceeding limit reference points is very low. If a stock falls below a limit reference point or is at risk of falling below such a reference point, conservation and management action should be initiated to facilitate stock recovery. Fishery management strategies shall ensure that target reference points are not exceeded on average.

6. When information for determining reference points for a fishery is poor or absent, provisional reference points shall be set. Provisional reference points may be established by analogy to similar and better-known stocks. In such situations, the fishery shall be subject to enhanced monitoring so as to enable revision of provisional reference points as improved information becomes available.

7. The fishing mortality rate which generates maximum sustainable yield should be regarded as a minimum standard for limit reference points. For stocks which are not overfished, fishery management strategies shall ensure that fishing mortality does not exceed that which corresponds to maximum sustainable yield, and that the biomass does not fall below a predefined threshold. For overfished stocks, the biomass which would produce maximum sustainable yield can serve as a rebuilding target.

ภาคผนวก ข.

Precautionary approach to capture fisheries and species introductions.

INTRODUCTION

1. In line with its commitment towards environmental conservation and sustainable use of natural resources, the Government of Sweden (through its Ministry of Agriculture) decided to organize, in close cooperation with FAO, a Technical Consultation on the Precautionary Approach to Capture Fisheries (including Species Introductions). The meeting was hosted by the Institute of Marine Research, Lysekil, Sweden at the invitation of the Swedish National Board of Fisheries and was formally opened by her Excellency the Swedish Minister of Agriculture, Mrs Margareta Winberg.

2. The meeting was chaired by Per Wramner (Swedish National Board of Fisheries), assisted by Armin Lindquist (Swedish National Board of Fisheries) and Serge Garcia (FAO, Vice-Chairman). The participants attended in their personal capacity and were selected on the basis of their technical competence and level of expertise. Their deliberations were based on 7 background documents prepared specifically for the purpose, as well as on a number of other documents considered of relevance. Four
Working Groups were established to discuss and prepare the sections of the draft guidelines related to: Research, Management, Technology and Species Introductions.

3. The Administrative Report of the meeting, including Agenda, List of Participants, background documentation, opening address by the Swedish Minister of Agriculture, and composition of Working Groups, has been published as *FAO Fisheries Report*, (527), 1995.

4. The following document first characterizes the concept of precaution, then defines some of the important terms used in the Guidelines, and provides specific guidelines for management, research, technology development and transfer, and species introduction. Under each of these topics, a discussion is provided on its specific aspects, followed by specific guidance for implementation.

1. PRECAUTIONARY APPROACH AND BURDEN OF PROOF

5. Within the framework outlined in Article 15 of the UNCED Rio Declaration, the precautionary approach to fisheries recognises that changes in fisheries systems are only slowly reversible, difficult to control, not well understood, and subject to changing environment and human values.

6. The precautionary approach involves the application of prudent foresight. Taking account of the uncertainties in fisheries systems and the need to take action with incomplete knowledge, it requires, *inter alia:*
a. consideration of the needs of future generations and avoidance of changes that are not potentially reversible;
b. prior identification of undesirable outcomes and of measures that will avoid them or correct them promptly;
c. that any necessary corrective measures are initiated without delay, and that they should achieve their purpose promptly, on a timescale not exceeding two or three decades;
d. that where the likely impact of resource use is uncertain, priority should be given to conserving the productive capacity of the resource;
e. that harvesting and processing capacity should be commensurate with estimated sustainable levels of resource, and that increases in capacity should be further contained when resource productivity is highly uncertain;
f. all fishing activities must have prior management authorization and be subject to periodic review;
g. an established legal and institutional framework for fishery management, within which management plans that implement the above points are instituted for each fishery, and
h. appropriate placement of the burden of proof by adhering to the requirements above.

7. Key concepts in past discussions of the precautionary approach have been the burden of proof and the standard of proof (i.e., the responsibility for providing the relevant evidence and the criteria to be used to judge that evidence). Often, the precautionary approach has been taken as requiring that human actions are assumed to be harmful unless proven otherwise (reversal of the burden of proof). In regard to these concepts, it is recognised
a. all fishing activities have environmental impacts, and it is not appropriate to assume that these are negligible until proved otherwise;
b. although the precautionary approach to fisheries may require cessation of fishing activities that have potentially serious adverse impacts, it does not imply that no fishing can take place until all potential impacts have been assessed and found to be negligible;
c. the precautionary approach to fisheries requires that all fishing activities be subject to prior review and authorization; that a management plan be in place that clearly specifies management objectives and how impacts of fishing are to be assessed, monitored and addressed; and that specified interim management
measures should apply to all fishing activities until such time as a management plan is in place, and
d. the standard of proof to be used in decisions regarding authorization of fishing activities should be commensurate with the potential risk to the resource, while also taking into account the expected benefits of the activities.

2. DEFINITIONS

8. **Decision Rule**: Specification of how pre-agreed management actions will respond to estimated or perceived states of nature.

9. **Fishery Technology**: The equipment and practices used for finding, harvesting, handling, processing and distributing aquatic resources and their products.

10. **Genetically Modified Organism**: An organism in which the genetic material has been altered anthropogenically by means of gene or cell technologies.

11. **Genetically selected organism**: An organism produced by selective breeding.

12. **Introduced Species**: Any species intentionally or accidentally transported and released by humans into an environment beyond its present range.

13. **Management procedure**: A description of the data to collect, how to analyze it, and how the analysis translates into actions.

14. **Risk**: The probability of something undesirable happening (note that when a technical definition in a decision theoretic framework is needed, it would be appropriate to use the terms "expected loss" or "average forecasted loss", not risk)

15. **States of Nature**: A description of a condition and dynamics of the resource and the fishery including parameters such as stock abundance, age structure, fishing mortality, the economic condition of the industry and the state of the environment.

16. **Statistical uncertainty**: Stochasticity or error from various sources as described using statistical methodology.

17. **Transferred species**: Any species intentionally or accidentally transported and released by humans into an environment inside its present range.

18. **Uncertainty**: The incompleteness of knowledge about the state or processes of nature.

3. PRECAUTIONARY APPROACH TO FISHERY MANAGEMENT

3.1 Introduction

19. Management according to the precautionary approach exercises prudent foresight to avoid unacceptable or undesirable situations, taking into account that changes in fisheries systems are only slowly reversible, difficult to control, not well understood, and subject to change in the environment and human values.

20. An important element of the precautionary approach is to establish legal or social management frameworks for all fisheries, which is not the current situation. At a minimum, such frameworks should establish rules controlling access to fisheries (e.g., all boats must be licensed), data reporting requirements, and processes for planning and implementing more comprehensive fishery management. Plans for management institutionalize prudent foresight that takes into account potential consequences of fishery development and events affecting it. Comprehensive plans for fisheries can take a long time to develop. For this reason the legal or social management framework should include interim measures that safeguard the resources until such plans are adopted.

21. The precautionary approach gives due concern to long-term effects in the specification of management objectives and in the development of management frameworks, procedures, and measures. The consequences of management and fishery development are evaluated to reduce the possibilities of changes that are not potentially reversible on a 2 to 3 decade time scale. Processes for determining acceptable changes and impacts are used to support the precautionary approach. Thus, a precautionary approach links fisheries management intimately with general environmental management.

22. Precautionary management involves explicit consideration of undesirable and potentially unacceptable outcomes and provides contingency and other plans to avoid or mitigate such outcomes. Undesirable or unacceptable outcomes include overexploitation of resources, overdevelopment of harvesting capacity, loss of biodiversity, major physical disturbances of sensitive biotopes, or social or economic dislocations. Undesirable conditions can also arise when a fishery is negatively influenced by other fisheries or other activities and when management fails to take action in the face of shifts in the external conditions affecting, for example, the productivity of the fish stocks.

23. The operational interpretations of precautionary management will depend on the context. Different interpretation may be appropriate depending on the scale of the fishing operations (artisanal or small-scale fisheries vs. highly capitalized and technologically advanced fisheries) and on the state of the exploited system (early stages of exploitation versus systems in a state of obvious overexploitation).

24. The precautionary approach is included in all stages of the management process. Thus, precaution should be identifiable in the different stages of management, from planning through implementation, enforcement and monitoring to re-evaluation. These issues are covered in the following paragraphs organized according to the different stages in a management process.

3.2 Management Planning

25. A precautionary approach to managing a fishery involves developing, within management strategies and plans, explicit consideration of precautionary actions that will be taken to avoid specific undesirable outcomes. As over-development of harvesting capacity is a common cause of undesirable outcomes, a management plan should include mechanisms to monitor and control that capacity. Consideration needs to be given to how uncertainty and ignorance are to be taken into account in developing and varying management measures. For all fisheries, plans should be developed or revised to incorporate precautionary elements. The plans, even where no additional precautionary elements are considered necessary, should be re-evaluated in accordance with the process outlined below. Where there are multiple fisheries, plans will also be required to implement precautionary approaches to their aggregate impact on the marine environment. The plans should consider time scales of at least two to three decades, or longer in the case of long-lived species.

26. To ensure broad acceptance, all stages of planning should involve consultation with the fishing industry, conservation groups, and other interested parties. Fisheries plans should also be coordinated with integrated coastal-area management plans. In order to identify a management plan that has broad acceptance, it is best to consider a range of alternatives, each of which has been developed and evaluated through the components set out below. The range of alternatives may differ in their basic approach or in detail. For example, a basic approach using total allowable catches (TACs) could be contrasted with one using effort controls. Variations in detail might involve different decision rules for the TACs.

Specifying management objectives

27. The first step is to identify the broad management objectives to be achieved. The management objectives need to consider both the manner in which the benefits from the fishery are to be realized, as well as the possible undesirable outcomes which are to be avoided. Broad objectives include considerations of long-term interests and the avoidance of irreversible or slowly reversible changes. Typically, the catches are to be as large as possible, so long as the probability of substantial stock depletion is below an acceptably low level and catches can be kept reasonably steady.

28. The general objectives could be taken as the starting point for setting the more specific objectives for a particular fishery. To be precautionary, priority should be accorded to restoration of already overfished stocks, to avoidance of overfishing, and to avoidance of excessive harvesting capacity. Objectives should also include restricting the environmental impacts of fishing to acceptable levels. Some examples are limiting or eliminating bycatch and incidental mortality of non-target species and containing the possible effects of some types of fishing gear on bottom communities.

Specifying operational targets and constraints

29. Targets identify the desired outcomes for the fishery. For example, these may take the form of a target fishing mortality, or a specified level of average abundance relative to the unfished state. In some cases, these targets are likely to be identical with those that would be specified for fisheries management, regardless of whether a precautionary approach was to be adopted. In other cases, targets may need to be adjusted to be precautionary, for example, by setting the target fishing mortality lower than FMSY.

30. The operational constraints explicitly define the undesirable outcomes that are to be avoided. For example, to avoid the risk of declining recruitment, a minimum spawning stock biomass, range of ages, or geographic range could be set to define safe limits within which the stock should be maintained with a specified high probability. Specific limits may also be required to deal with ecosystem effects, with bycatches and with other sideeffects of the fishery.

31. Operational targets and constraints should be expressed in measurable terms such as target reference points and limit reference points (refer to FAO documents). The details of what can be measured will often vary with different species and fisheries, and so the operational targets and constraints will need to be expressed in ways that take this into account. The specification of operational targets and constraints cannot be separated from consideration of the types of data and methods that can be used to assess the status of the stocks. In all cases attention should be given to the rate at which targets are approached so as to avoid overshooting them and hence violating the constraints.

Specifying the procedure to apply and adjust management measures

32. A management plan must indicate which management measures are to be applied, and the circumstances under which the measures are to be varied. This should involve the formulation of decision rules, which specify in advance what action should be taken when specified deviations from the operational targets and constraints are observed. The specification should include minimum data requirements for the types of assessment methods to be used for decision-making.

33. Precautionary management measures listed below under "Examples of Precautionary Measures" could be included in the plan. To be precautionary, decision rules are required for responding to unexpected or unpredictable events with minimum delay. All foreseeable contingencies should be considered when developing the plan. For example, plans should include explicit effort-reduction measures that apply in response to unpredicted, marked decline in recruitment.

34. It is highly desirable that the procedure makes regular small adjustments to the management measures so as to maintain acceptably low levels of probability that the constraints are violated. It is not always possible to simultaneously attain a target (desired outcome) for a fishery and respect constraints designed to prevent undesirable outcomes. For example, a specified target fishing mortality such as FMSY may reduce the spawning stock biomass to a level near the levels where there should be a precautionary constraint designed to avoid the probability of declining recruitment. If, for example, the constraint is to maintain spawning stock biomass above 30% of the average unfished level with high probability, then a FMSY target that would reduce the spawning stock biomass to 35% of the unfished level could have a too high probability of violating the constraint. Precautionary management must adjust targets to be consistent with the constraints.

Prospective evaluation

35. A precautionary approach requires that the feasibility and reliability of the management options be evaluated. A management plan should not be accepted until it has been shown to perform effectively in terms of its ability to avoid undesirable outcomes. The evaluation can be used to determine whether the data and assessment methods available for management are sufficient to meet the management objectives. The evaluation should attempt to determine if the management plan is robust to both statistical uncertainty and to incomplete knowledge on factors such as uncertain stock identity and abundance, stock dynamics, and the effects of environmental variability and trends. As well, evaluations should consider the dynamic behaviour of the harvesting sector and managers ability to change harvest levels.

36. For economically valuable fisheries, and where substantial scientific expertise is available, there will usually be substantial benefits from employing powerful evaluation techniques such as simulation modelling. Such analyses will often reveal which sources of uncertainty are critical to achieving satisfactory results for the various objectives. The evaluation will also need to take into account the practicality of implementing, and securing compliance with, the range of management measures included in the plan.

37. For small fisheries and artisanal fisheries, computationally intensive management analyses are often not possible or cost-effective. In such cases, management measures will probably not depend on quantitative analyses, but rather on assessing the practicality of ensuring that the precautionary measures are accepted and observed by the fishing community. An example would be closing certain areas to fishing to protect a sufficient proportion of the stock. Another example would be to establish a community-based fisheries management system. This would decentralize fisheries management authority to resource users and could reduce the cost of fisheries management and enforcement. Other examples of simple precautionary measures applicable to such fisheries are given in the section "Examples of Precautionary Measures" below.

38. If management options are found to be inadequate with respect to precaution, then one or more of the following aspects can be modified and then re-evaluated until the management system is judged to be adequate. These aspects may include:

a. modification of the operational targets and constraints;
b. re-specification of the procedure to apply management measures;
c. further research to reduce critical uncertainties, or
d. consideration of more powerful assessment and monitoring methods.

3.3 Implementation, Monitoring, and Enforcement

39. Management plan implementation puts in place all planned decision rules. This involves the practical interpretation of objectives and procedures, and the implementation of detailed instructions for compliance, monitoring of the fishery, and enforcement tactics. Elements of the implementation phase include: stock assessments, rule setting, economic assessments, and communication of decisions and rationale to the public and fishing industry. Because the public and industry are more inclined to understand and support measures on which they are consulted, public participation in the implementation phase is important. Peer review of stock assessments and a transparent process help to guard against error, which is essential to effective implementation of the planned measures. Independent auditing of the monitoring procedures should also be a regular feature of the management system. The effect of the measures on compliance should be studied specifically.

40. Monitoring of a fishery involves collection of all information relevant to ensuring that the plan is being executed and that it is achieving the desired results. In particular, data are needed to determine whether that precautionary decision rules are being violated. A precautionary approach to monitoring will use many and various sources of information, including environmental and socio-economic data.

41. Precautionary monitoring of fishing should seek to detect and observe a variety of ancillary impacts, e.g., environmental changes, fish habitat degradation, and effects on birds, mammals and other biota. This monitoring function could use information from fishing participants, indigenous people, and other public groups, and have appropriate procedures to process and analyze this information.

42. In a precautionary management system, contingency rules should be implemented to ensure compliance with operational targets and constraints in the face of major adverse events with low probability. There should also be mechanisms for revising targets and constraints in the light of unexpected events.

43. A precautionary system of enforcement and the penalties for non-compliance should have the flexibility for prompt action by redeployment of monitoring and enforcement resources. For example, the first signs of bycatch problems should be followed by more extensive sampling in problem areas according to an agreed procedure or enhanced surveillance of the fishery. In the case of emergency, it should be possible to rapidly modify regulations.

3.4 Re-evaluation of Management Systems

44. The level of precaution in the management system needs to be re-assessed periodically. This includes: (1) the degree of precaution in the objectives, operational targets and constraints in relation to observed changes in the fishery and the environment, (2) the use of scientific information and other information in the management process, (3) the applicability of the contingency plans for unexpected conditions, and (4) auditing of all procedures in the fisheries management system. Special re-evaluations should be initiated as soon as it becomes apparent that the fishery inadvertently violates the limit reference points established in the plan.

3.5 Implementation guidelines

45. There are several precautionary measures that fisheries management agencies should take in order to avoid undesirable or unacceptable outcomes in the development of fisheries. Some of these will apply to all types of fisheries, whereas others will be useful only in specific situations such as overexploited fisheries. For illustrative purposes, we list precautionary measures for four typical situations: (1) new or developing fisheries; (2) overutilized fisheries; (3) fully utilized fisheries; and (4) traditional or artisanal fisheries.

46. The listed measures could be included in comprehensive fisheries plans, but could also be used in the interim for immediate precautionary action. An example interim measure in the case of new fisheries would be a conservative cap on fishing effort. In overutilized fisheries an interim measure would be a rapid reduction of fishing mortality. Once various proposed management plans have been evaluated by the methods discussed above, the approved plan can replace the interim action.

New or developing fisheries

47. Some of the precautionary measures listed below for new or still-developing fisheries will also apply to fully utilized, overutilized, or artisanal fisheries, as described later. Most of these recommendations also apply to existing fisheries that are not yet managed:

a. always control access to the fishery early, before problems appear. An open access fishery is not precautionary;

b. immediately put a conservative cap (or default level) on both fishing capacity and the total fishing mortality rate. This could be achieved by limiting effort or total allowable catch. As well, attention should be paid to preventing excessive investment in the processing sector. The conservative caps should remain in place until analyses of data justify an increase in fishing effort or fishing mortality. The objective is to prevent that the development of the fleet's fishing power and capacity outpaces the ability of management to understand the effect of existing fishing effort;

c. build in flexibility so that it is feasible to phase vessels out of the fleet, if this becomes necessary. To avoid new investments in fishing capacity, temporarily license vessels from another fishery;

d. to limit risks to the resource and the environment, use area closures, which are relatively quick to implement and are easily enforceable. Closures provide refuges for fish stocks, protect habitat, and provide areas for comparison with fished areas;

e. establish precautionary, preliminary biological limit reference points (e.g., spawning stock biomass less than 50% of the initial biomass) in the planning stage as described above;

f. encourage fishing in a responsible manner to ensure long-term persistence of a productive stock or other parts of the ecosystem. For instance, encourage voluntary agreements on conduct in the fishery through co-management, community management, or some form of tenure of fishing rights;

g. encourage development of fisheries that are economically viable without long term subsidies;

h. establish a data collection and reporting system for new fisheries early in their development;

i. immediately start a research programme on the stock and fisheries, including the response of individual vessels to regulations. When issuing a fishing license, require a vessel to report detailed information, including standard biological data and economic information, and

j. take advantage of any opportunities for setting up experimental situations to generate information on the resources. This could be done by contrasting different harvesting strategies on subpopulations, for instance.

Overutilized fisheries

48. Most of the above recommendations also apply to fish stocks that are already overutilized, but in addition, special precautionary measures need to be taken for such stocks. These are:
a. immediately limit access to the fishery and put a cap on a further increase in fishing capacity and fishing mortality rate;
b. establish a recovery plan that will rebuild the stock over a specific time period with reasonable certainty. This will include several of the components below;
c. reduce fishing mortality rates long enough to allow rebuilding of the spawning stock. If possible, take immediate short-term action even on the basis of circumstantial evidence about the effectiveness of a particular measure. In some cases this can be accomplished by entirely closing some areas to fishing;
d. when there is a good year class, give priority to using the recruits to rebuild the stock rather than increasing the allowable harvest;
e. reduce fishing capacity to avoid recurrence of over-utilization. Remove excessive fishing capacity from the fishery; do not provide subsidies or tax incentives to maintain fishing capacity. If necessary, develop mechanisms to eliminate some fishing effort;
f. alternatively, allow vessels to move from an overutilized fishery into another fishery, as long as the pressure from this redeployment does not jeopardize the fishery that the vessels are moving into;
g. do not use artificial propagation as a substitute for the precautionary measures listed above;
h. in the management plan, establish biological reference points to define recovery, using measures of stock status, such as spawning stock biomass, spatial distribution, age structure, or recruitment, and
i. for species where it is possible, closely monitor the productivity and total area of required habitat to provide another indicator of when management action is needed.

Fully utilized fisheries
49. These are fisheries that are heavily harvested but not yet overexploited. Regulatory agencies must particularly watch for signs that the population is becoming overexploited. While some precautionary measures from the above lists apply here, additional measures to take in this situation are:
a. ensure that there are means to effectively keep fishing mortality rate and fishing capacity at the existing level;
b. there are many "early-warning signs" that a stock is becoming overutilized (e.g., age structure of the spawners shifting to an unusually high proportion of young fish, shrinking spatial distribution of the stock or species composition in the catch). These warning signs should trigger investigative action according to prespecified procedures while interim management actions are taken, as noted below;
c. when precautionary or limit reference points are approached closely, prespecified measures should be taken immediately to ensure that they will not be exceeded (i.e., do not wait until violation of a limit point is imminent to start deciding what to do about it);
d. if limit reference points are exceeded, recovery plans should be implemented immediately to restore the stock. The recommendations for overutilized stocks described above should then be implemented;
e. to prevent excessively reducing the reproductive capacity of a population, avoid harvesting immature fish, unless there is strong protection of the spawning stock. For example, if immature fish exceed a specified percentage of the catch, close the local area to all harvesting.

Traditional or artisanal fisheries
50. These are low-technology fisheries carried out by large numbers of small vessels, often where there is no central management agency. Again, many of the recommendations above apply to these fisheries. The following precautionary steps can also apply to some recreational fisheries:
a. keep some areas closed to fishing in order to obtain the benefits noted above as item (d) under "New or Developing Fisheries". Also ensure that excessive fishing effort does not develop in the open areas;
b. delegate some of the decision-making, especially area closures and entry limitations, to local communities or cooperatives;
c. ensure that fishing pressure from other (e.g., industrial) segments of the fishery does not deplete the resources to the point where severe corrective action is needed, and
d. investigate the factors that influence the behaviour of harvesters to develop approaches that can control fishing intensity. For example, improving incomes of individual harvesters may reduce pressure on resources.

4. PRECAUTIONARY APPROACH TO FISHERY RESEARCH

51. Application of the precautionary approach to fishery management depends on the amount, type and reliability of information about the fishery and how this information is used to achieve management objectives. The precautionary approach to fishery management is applicable even with very limited information. Research to increase information about a fishery usually increases potential benefits while reducing the risk to the resource. The scientific and research input that is required for the precautionary approach to fisheries is considered under the following headings; management objectives, observations and information base, stock assessment and analysis and decision processes.

4.1 The Role of Research in Establishing Management Objectives

52. There is a valid scientific role in helping managers develop objectives, so that scientific input to the overall management process is as effective as possible in achieving management intent. The precautionary approach requires continuing and anticipatory evaluation of the consequences of management actions with respect to management

objectives. Scientific evaluation of consequences with respect to management objectives requires explicit definition of quantifiable criteria for judgement. An important scientific contribution is in the development of operational targets, constraints and criteria that are both scientifically usable and have management relevance.

53. Research is required to help formulate biological objectives, targets and constraints regarding the protection of habitat, the avoidance of fishing that significantly reduces population reproductive capacity, and reduces the effects of fishing on other (e.g., nontarget) species. Combined with biological research, research on socio-economics and the structure of fishing communities is needed to formulate management objectives.

54. Until stock specific research leads to the establishment of alternative operational target based on research and practical experiences, a precautionary approach would seek to: (a) maintain the spawning biomass at a prudent level (i.e., above 50% of its unexploited level), (b) keep the fishing mortality rate relatively low (i.e., below the natural mortality rate), (c) avoid intensive fishing on immature fish, (d) protect the habitat.

4.2 Observation Processes and Information Base

55. A precautionary approach to fisheries requires explicit specification of the information needed to achieve the management objectives, taking account of the management structure, as well as of the processes required to ensure that these needs are met. Periodic evaluation and revision of the data collection system is necessary.

56. A precautionary approach would include mechanisms to ensure that, at a minimum, discarded catch, retained catch and fishing effort data are accurate and complete. These mechanisms could include use of observers and identification of incentives for industry co-operation.

57. Recognizing that resource users have substantial knowledge of fisheries, a precautionary approach makes use of their experience in developing an understanding of the fishery and its impacts.

58. The precautionary approach is made more effective by development of an understanding of the sources of uncertainty in the data sampling processes, and collection of sufficient information to quantify this uncertainty. If such information is available it can be explicitly used in the management procedure to estimate the uncertainty affecting decisions and the resulting risk. If such information is not available, a precautionary approach to fishery management would implicitly account for the unknown uncertainty by being more conservative.

59. Precautionary fishery monitoring is part of precautionary research. It includes collection of information to address issues and questions that are not only of immediate concern but which may reasonably be expected to be important for future generations on in case objectives are changed. Information should be collected on target species, bycatch, harvesting capacity, behaviour of the fishery sector, social and economic aspects of the fishery, and ecosystem structure and function. Measures of resource status independent of fishery data are also highly desirable.

60. The precautionary approach relies on the use of a history of experience with the effects of fishing, in the fishery under consideration and/or similar fisheries, from which possible consequences of fishing can be identified and used to guide future precautionary management. This requires that both data and data collection methods are well documented and available.

61. There are many management processes and decision structures used throughout the world, such as regional management bodies, co-management, community-based management, and traditional management practices. Research is needed to determine the extent to which different management processes and decision structures promote precaution.

4.3 Assessment Methods and Analysis

62. Biological reference points for overfishing should be included as part of a precautionary approach.

63. A precautionary approach specifically requires a more comprehensive treatment of uncertainty than is the current norm in fishery assessment. This requires recognition of gaps in knowledge, and the explicit identification of the range of interpretations that is reasonable given the present information.

64. The use of complementary sources of fishery information should be facilitated by active compilation and scientific analysis of the relevant traditional knowledge. This should be accompanied by the development of methods by which this information can be used to develop management advice.

65. Specifically the assessment process should include:

a. scientific standards of evidence (objective, verifiable and potentially replicable), should be applied in the evaluation of information used in analysis;

b. a process for assessment and analysis that is transparent, and

c. periodic, independent, objective and in-depth peer review as a quality assurance.

66. A precautionary approach to assessment and analysis requires a realistic appraisal of the range of outcomes possible under fishing and the probabilities of these outcomes under different management actions. The precautionary approach to assessment would follow a process of identifying alternative possible hypotheses or states of nature, based on the information available, and examining the consequences of proposed management actions under each of these alternative hypotheses. This process would be the same in data-rich and data-poor analyses. A precautionary assessment would, at the very least, aim to consider: (a) uncertainties in data; (b) specific alternative hypotheses about underlying biological, economic and social processes, and (c) calculation of the theoretical response of the system to a range of alternative management actions. A checklist of issues for consideration under these headings is found in the following paragraphs.

67. Sources of uncertainty in data include: (a) estimates of abundance; (b) model structure; (c) parameter values used in models; (d) future environmental conditions; (e) effectiveness of implementation of management measures; (f) future economic and social conditions; (g) future management objectives, and (h) fleet capacity and behaviour.

68. Specific alternative hypotheses about underlying biological, economic and social processes to be considered include: (a) depensatory recruitment or other dynamics giving rapid collapse; (b) changes in behaviour of the fishing industry under regulation, including changes in coastal community structure; (c) medium-term changes in environmental conditions; (d) systematic underreporting of catch data; (e) fisherydependent estimates of abundance not being proportional to abundance; (f) changes in price or cost to the fishing industry; and (g) changes in ecosystems caused by fishing.

69. In calculating (simulating) the response of the system to a range of alternative management actions, the following should be taken into account:
a. short-term (1-2y) projections alone are not sufficient for precautionary assessment; time frames and discount rates appropriate to inter-generational issues should be used, and
b. scientific evaluation of management options requires specification of operational targets, constraints and decision rules. If these are not adequately specified by managers, then precautionary analysis requires that assumptions be made about these specifications, and that the additional uncertainty resulting from these assumptions be calculated. Managers should be advised that additional specification of targets, constraints and decision rules are needed to reduce this uncertainty.

70. Methods of analysis and presentation will differ with circumstances, but effective treatment of uncertainty and communication of the results are necessary in a precautionary assessment. Some approaches (see also the Appendix to this section) that could prove useful are:
a. where there are no sufficient observations to assign probabilities to different states of nature that have occurred, decision tables could be used to represent different degrees of management caution through the Maximin and Minimax criteria;
b. where the number of different states of nature and the number of potential management actions considered are small, but probabilities can be assigned, decision tables can be used to show the consequences and probabilities of all combinations of these, and
c. where the range of states of nature is large, the evaluation of management procedures is more complex, requiring integration across the various sources of uncertainty.

71. A precautionary approach to analysis would examine the ability of the data collection system to detect undesirable trends. When the ability to detect trends is low, management should be cautious.

72. Since concern regarding the reversibility of the adverse impacts of fishing is a major reason for a precautionary approach, research on reversibility in ecosystems should be an important part of developing precautionary approaches.

4.4 Implementation Guidelines

73. The following measures could be applied in order to implement a precautionary approach to fishery research:
a. take into account the best scientific evidence available when designing and adopting management and conservation measures, in accordance with the provisions of the 1982 UNCLOS Convention. In the context of precautionary management, the best scientific evidence is described in section 4.3;
b. require a minimum level of information to be made available for any fishery to start or continue;
c. ensure that the *"lack of full scientific certainty shall be not used as a reason for postponing cost-effective measures to prevent environmental degradation"* (principle 15 of the Rio Declaration);
d. reduce critical uncertainties in the management plan;
e. take measures aimed at eliminating or reducing non-reporting and misreporting, *inter alia,* by ensuring that the fisheries sector cooperates in data collection and the public is fully informed of the results and uncertainty in the assessment;
f. systematically analyze various possible management options using the whole range of available models (bioeconomic, multispecies and behavioural), showing: (a) the likely direction and magnitude of the biological, social and economic consequences; (b) the related levels of uncertainty and the potential costs of the proposed action (risk assessment), and of no action (*status quo* scenarios);

g. promote multidisciplinary research. including: (a) social, economic and environmental sciences, and (b) research on management institutions and decision-making processes;
h. develop scientific information on multispecies and ecosystem processes as a foundation for identifying acceptable degrees of disturbance;
i. identify biological limit and target reference points for affected species and stocks, habitats and the ecosystem at large;
j. identify bioeconomic reference points to address the objectives of the fishery management plan;
k. improve methods for quantification of direct and indirect impacts of fishing;
l. improve understanding of the performance of different management structures in relation to precaution;
m. develop methods for optimizing the monitoring system, and
n. develop research and development programmes aiming at improving the performance of fishery technology in relation to environmental impacts and precautionary management.

Appendix

74. **The Minimax/Maximin approach** is a way of examining uncertainty and guiding decisions without the need for explicit statements of probabilities on the alternative hypotheses (Schmid, A. 1989, Cost-benefit analysis, West View Press). In the table below, S1 and S2 represent the alternative hypotheses about the resource (sometimes called "the different states of nature"). In this example, S1 is a hypothesis that implies a higher level of resource productivity and sustainable yield than S2. In the table rows, D1 to D3 represent alternative decisions. In this example D1, D2 and D3 broadly represent respectively a high, medium, and low level of fishing effort. The Ps represent the probabilities being placed on hypotheses being true. Values in the table represent the relative value of the outcome of a decision as applied to a given state of nature. In the example, these values could be regarded as representing sustainable catch.

Decision	S1	S2
	p=?	p=?
D1	100	5
D2	50	40
D3	70	20

75. **The Maximin Values Criterion** is a cautious approach that leads to selects the maximum (highest) of the minimum outcome. The following table gives the relative value of outcomes for decisions given the hypothesis being true. Decision 2 would be chosen by this approach.

Decision	S1	S2	Minimum
	p=?	p=?	Value
D1	100	5	5
D2	50	40	40
D3	70	20	20

76. **The Minimax Regret Criterion** is a less cautious approach that selects the minimum of the maximum regret. The following table give a measure of regret for each decision when the hypothesis is true. Decision 3 would be chosen by this approach.

Decision	S1	S2	Minimum
	p=?	p=?	Regret
D1	100-100=0	40-5=35	35
D2	100-50=50	40-40=0	50
D3	100-70=30	40-20=20	30

77. **The decision table approach** uses the probabilities of alternative hypotheses of the state of nature, along with the values of the outcomes of decisions to give an expected value and variance of each action across all alternative hypotheses.

Decision	S1	S2	Expected	Variance
	p=?	p=?	Value	
D1	100	5	71.5	1895.25
D2	50	40	47.0	21
D3	70	20	55.0	525

78. The decision is to select the desired trade-off between the variance and the expected value of the outcome. The variance is a measure of uncertainty and the expected value gives the expected result of choosing a given policy. Policy D1 has a high expected outcome with the highest uncertainty, and a 0.3 probability of a very poor outcome. On the other hand, policy D2 has a much lower expected outcome with lower uncertainty, and no probability of a poor outcome. Methods that integrate across uncertainty: Where the number of possible states of nature is large, as is almost always the case, a mathematical equivalent operation to that described above for a simple decision table can be carried out. This results in the calculation of outcome probabilities for each possible decision, integrating across uncertainties.

5. PRECAUTIONARY APPROACH TO FISHERY TECHNOLOGY

5.1 Objective

80. Recognizing that many aquatic resources are overfished and that the fishing capacity presently available jeopardize their conservation and rational use, technological changes aimed solely at further increasing fishing capacity would not generally be seen as desirable. Instead a precautionary approach to technological changes would aim at:
a. improving the conservation and long-term sustainability of living aquatic resources;
b. preventing irreversible or unacceptable damage to the environment;
c. improving the social and economic benefits derived from fishing, and
d. improving the safety and working conditions of fishery workers.

5.2 Introduction

81. Fishery technology consists of the equipment and practices used for finding, harvesting, handling, processing and distributing of aquatic resources and their products.

82. Different fishery technologies will have different effects on the ecosystem, the social structure of fishing communities, the safety of fishery workers and the ease, effectiveness and efficiency of management of the fishery. It is the amount and context in which fishery technology is used (e.g. when, where and by whom) that influence whether the objectives of fisheries management are reached, and not the technology. For instance, the current overfishing of many aquatic resources is the product of both the efficiency of the finding and catching technologies and of the amount used. Similarly, building a fishmeal plant might involuntarily result in severe changes in the way the fishery is conducted, and in the community's social structure.

83. Fishery technology is constantly evolving and its efficiency in catching fish will increase over time. For example, a 4% increase in efficiency per year would cause a doubling of the fishing mortality rate in 18 years if the fishing effort remained constant. A precautionary approach to management should take such increases into account.

84. A precautionary approach should be adopted for the development of new technologies or the transfer of existing technologies to other fisheries to avoid unplanned abrupt changes in fishing pressure or social structures. Certain technologies will be considered undesirable, if they create unacceptable effects (e.g., poison or explosives) or if their adoption leads to wasteful use (e.g., at sea, sorting machines have been banned where they might increase discarding).

85. Fishery technologies produce side effects on the environment and on non-target species. These effects have often been ignored but, in the context of a precautionary approach, some technologies may warrant a review. Similarly, a precautionary approach would encourage careful consideration of the side effects of new fishery technologies before they are introduced.

86. Each fishery technology has advantages and disadvantages that should be balanced in a precautionary approach, and it may be better to have a mixture of technologies. When new fishery technology is introduced, it should be carefully evaluated to assess its potential direct and indirect effects. If a mix of fishery technology representing "best current practice" in an area can be identified, precautionary management would encourage its adoption while it would discourage damaging ones. Responsible fishery technology achieves the specific fishery management objectives with the minimum damaging side effects. These concepts (of responsible fishing and best current practices) were addressed by the UN General Assembly[1] and in the Cancun Declaration[2].

87. A precautionary approach would provide for a process of initial and on-going review of the effects of fishery technology as it is introduced or evolves in local practice. However, the extent to which a precautionary approach can be applied to the management of technological changes depends on the existing level of management. In some cases, education of fishermen and consumers towards responsible practices may be the only possible approach. Where elaborate research, management and enforcement systems are in place, a wider variety of options are available for application of the precautionary approach. However, although some gears and practices are prohibited they may continue to be used. The adoption of a precautionary approach to the management of new fishery technology depends on the ability to achieve compliance through education and/or enforcement. The following sections assume that institutional arrangements exist to achieve compliance.

5.3 Evaluating the Impacts of Technologies

88. A precautionary approach to developing and selecting responsible technologies for fishing requires an appropriate understanding of the consequences of their adoption and use. These consequences, particularly the impacts on non-target species and ecosystems, may be highly uncertain. Nevertheless, some information exists and more can be

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[1] General Assembly resolution 44/228 of 22 December 1989 on UNCED referred instead to *"environmentally sound technology"*, stressing the need for socio -economic constraints to be taken into account. The wording does not pretend to limit the choice to a single "best" or soundest technology, implying that many "sound" technologies may be used together, depending on the socio-economic context of their introduction

[2] The Cancun Declaration (Mexico, 1992) provides that " *States should promote the development and use of selective fishing gear and practices that minimise waste of catch of target species and minimise by-catch of non-target species*", focusing on only one aspect of responsible fishing technology

obtained. The problem of evaluating impacts is relevant both to the use of existing technologies and to the development of new ones, as well as to the introduction of existing technologies to new areas. The description of a given technology would state its relative impacts and advantages for a given species in a specific environment. Target fishery, environmental and ecosystem, socio-economic and legal factors should be considered when evaluating the impacts of fishery technologies.

89. The factors to consider when evaluating the impacts of fishery technology include:
a. target-fishery factors such as selectivity by size and species (e.g., target, nontarget, and protected species; discards; survival of escapees; "Ghost fishing"; and
b. environmental and ecosystem factors such as bio-diversity; habitat degradation; contamination and pollution; generation of debris and rubbish disposal; direct mortality; predator-prey relationships;
c. socio-economic factors such as safety and occupational hazards; training requirements; user conflicts; economic performance; employment; monitoring and enforcement requirements and costs; and techno-economic factors (i.e., infrastructure and service requirements; cost and technological accessibility;
product quality; and energy efficiency), and
d. legal factors such as existing legislation; need for new legislation; international agreements; and civil liberties.

90. These factors could be used to identify beneficial new technologies or damaging ones, to assess the ability of a fishery to accommodate increased use of an established technology and to help direct monitoring and special reporting procedures towards important questions. Technologies for aids to navigation, fish-locating devices, processing and distribution could also be described and evaluated using the above criteria. This will require a suitable description of technologies, cross-referenced against a range of possible impacts. Other elements relevant to the specific technology/area evaluated would also be included.

91. The approaches used to evaluate impacts will vary according to the human and financial resources available to collect information. If resources are limited, it may be possible to make decisions based on existing information on the impacts of similar technologies in similar environments. Monitoring of existing fishing practices (for example recording of bycatch) will provide additional information.

92. Where financial and human resources are limited, existing information on impacts could be used to do desk studies following the approach to evaluation suggested above. Although some general guidelines can be given, based on known characteristics of types of resources and technology, the most appropriate mix of technologies to be used in a particular fishery should be established on a case-by-case basis, following evaluations made at appropriate regional and national levels. Such evaluations could be refined with practical experience and weighed in accordance with local social and economic values.

93. In the case of new technologies, or technologies new to an area, pilot studies may be cost-effective in evaluating the impacts and can be useful in demonstrating the benefits of new technology. For example, the introduction of escape ports in lobster traps for undersized individuals demonstrated to fishermen that catch rates of large lobsters increased. On the other hand, pilot studies cannot demonstrate long-term gains such as increased yield per recruit, but they will show the short-term losses.

94. Considerable resources are required for major experiments to measure effects of fishery technology on the marine environment, but well-designed experiments of this type (either as research projects or via experimental management) will provide the most useful information on which to judge the impacts of technologies in particular areas or habitats. This information may be relevant in other areas than the study sites or fisheries from which the data were derived.
95. Procedures developed in other contexts for protecting the environment[3] could also be suitable when evaluating new technologies in fisheries or major alterations to existing ones. This would be particularly necessary when there are vulnerable resources or fragile ecosystems, that must be protected. In a precautionary approach, proponents of new fishery technology would be required by the State to provide for a proper evaluation of the potential impacts of new techniques before authorization is given.

96. The maximum cost that could be justified for evaluating new fishery technology or practices should be in proportion to the expected benefits and impacts.

5.4 Implementation

97. In a precautionary approach to managing fishery technology, a designated lead authority should have the mandate to evaluate and decide on the acceptability of a proposed new technology, or changes to existing technology, and

[3] Before introducing a possibly dangerous technology or discharging pollutants, industries have to provide information on the potential impact in order to obtain a permit from authorities. Usually a number of special measures are prescribed for monitoring the effect and limiting the possible impacts on the environment. A softer approach is the Prior Informed Consent (PIC), a more stringent one the Prior Consultation Procedures (PCP); the former mainly requires a consent from those who could possibly become affected, while the latter is a more formal procedure. Those mechanisms however are efficient only when there is a powerful and competent environmental authority

oversee the impact evaluation procedure. Proponents and other stakeholders should be able to appeal if the proper procedure has not been followed or if the decision by authorities does not appear to agree with the conclusions of the review.

98. As authorization procedures in the majority of cases would be for minor technical improvements, the procedures could be kept simple and administration costs held at a relatively low level. However, minimal progressive improvements will accumulate over time and periodic reviews of the impacts of existing technology will be necessary. Increases in catching efficiency result from the rapid growth in the use of modern information technologies in most fisheries around the world (acoustic fish detection and identification, gear and vessel monitoring, satellite-based environmental sensing and navigation, and easy inter-vessel communication). However, information, formally treated as "a measure of the reduction of uncertainty", can also potentially improve selectivity, safety and profitability of fishing operations and thus create beneficial effects.

99. Restricting the use of improved information technologies will rarely be justified or successful and there should be a positive attitude towards technical progress in fisheries in general especially with regards to safety at sea and fishermen's health.

100. The benefits of technological improvements need adequate extension work and education to encourage their adoption. The promotion of the best technology would benefit from improvement in international cooperation regarding technology transfer, as underscored in UNCED's Agenda 21. The successful international efforts in the Eastern Central Pacific in training crews in effectively avoiding bycatches of dolphins through the use of specifically designed technology is a good example of what can be achieved in this respect.

5.5 Technology Research and Development

101. Fishery technology research in support of a precautionary approach would encourage the improvement of existing technologies and promote the development of appropriate new technologies. Such research would not just concentrate on gears used for capture; for example, research into the cost-effective purification of water supplies to ice plants might considerably reduce post-harvest losses and improve product quality and safety.

102. Technological developments such as satellite tracking may also help precautionary management by improving monitoring of commercial operations and by enabling research to reduce uncertainty about relevant aspects of fisheries science.

5.6 Implementation Guidelines

103. The following measures could be applied in order to implement a precautionary approach to fishery technology development and transfer.

Authority

a. Effective mechanisms to ensure that the introduction of technology is subject to review and regulation should be established.

Evaluation procedures

b. A first step in the evaluation procedure is the documentation of the characteristics and amount of the fishery technology currently used.

c. Procedures for the evaluation of new technologies with a view to identify their characteristics in order to promote the use of beneficial technologies and prevent usage of those leading to difficult-to-reverse changes should be established.

d. These procedures should evaluate with appropriate accuracy the possible impacts of the proposed technology in order to avoid wasteful capital and social investments.

e. Authorities should ensure that proponents and other stakeholders understand their obligations and their rights regarding such procedures.

f. The extent of the evaluation procedures should match the potential effects of the proposed technology, e.g., from desk study through full scale impact studies, possibly including or leading to pilot projects.

Implementation

g. Authorities should implement technology gradually to minimize the risk of irreversible damage or overinvestment.

h. Existing technologies and their effect on the environment should be reviewed periodically.

i. Technological developments may modify the practices of fishery workers. To achieve the full benefits of the technology and to ensure the safety of fishery workers, training in the proper use of the new technology should be provided.

j. In fisheries that are being rehabilitated, the opportunity should be taken to review the mix of technologies used.

k. Research into responsible fishery technology should be encouraged.

l. Technology research for the reduction of uncertainty in stock assessment and monitoring should be encouraged.

6. PRECAUTIONARY APPROACH TO SPECIES INTRODUCTION

6.1 Introduction

104. Because of the high probability that impacts of species introduction be of irreversible and unpredictable impacts, many species introductions are not precautionary. Therefore, a strictly precautionary approach would not permit

deliberate introductions and would take strong measures to prevent unintentional introductions. Recognizing the difficulties with introductions, the objectives of a precautionary approach to species introductions in relation to capture fisheries should be to reduce the risk of adverse impacts of introductions on capture fisheries, to establish corrective or mitigating procedures (as in a contingency plan) in advance of actual adverse effects, and to minimize unintended introductions to wild ecosystems and associated capture fisheries.

105. In relation to aquaculture, experience has shown that animals will usually escape the confines of a facility. As a consequence, the introduction of aquatic organisms for aquaculture should be considered as a purposeful introduction into the wild, even though the quarantine/hatchery facility may be a closed system.

106. Introductions and transfers (hereafter referred to as introductions) are an effective means to increase protein, generate income and provide employment. However, some intended and many unintended introductions may result in significant and serious impacts on capture fisheries. The numbers of unintended introductions, for example by means of ballast water, greatly outnumber those purposefully introduced for capture fisheries. In the case of introduced species for fishery purposes, the risk to capture fisheries can be reduced by the use of internationally accepted codes, such as the 1994 ICES Code of Practice (see Annex A)[4]. This code forms a basis for a more precautionary introduction and should be widely circulated and explained.

107. For a precautionary approach to fishery management, irreversible changes in the time scale of human generations and other undesirable impacts should be avoided, taking into account uncertainty. Species introductions, either purposeful or unintended, may have such undesirable effects. Once a species has been introduced, it cannot usually be eradicated, although it may be possible to mitigate its undesirable effects.

108. The difficulty in reversing an introduction and its adverse effects should figure prominently in the decision process on whether to allow an introduction. Assessment of the risks of intentional introductions on fisheries is necessary for the precautionary approach; the ICES Code of Practice provides a procedure for such an assessment.

109. To encourage more compliance with the precautionary approach to introductions, the existing Code of Practice formulated for the ICES region can be modified and adapted to suit more national implementation of the codes by streamlining its procedures without weakening the rigour of the codes.

110. Unintended introductions are inherently unprecautionary because they can rarely be evaluated in advance. A precautionary approach would aim at reducing the risk of such unintended introductions and minimize their impact.

6.2 Main Issues and Objectives

111. Introductions are considered here from the perspective of the fishery sector. The main reasons for deliberate introductions include production of protein, employment, generation of foreign exchange, biological control and recreation. Species have been introduced through activities associated with transport (i.e., ballast water, ship and oil-rig fouling), trade in living organisms including aquarium species, aquaculture and fisheries (commercial, recreational, stock enhancement, organisms carried on fishing equipment, live bait fish). Many of these activities have increased over the last century and are expected to increase further in the future.

112. Potential impacts of some introductions on the fishery sector included changes in the distribution and abundance of fishery resources through disease, changes in predatorprey relationships, changes in competition, mixing of bad (maladapted) genes, and habitat modification. There may also be second and third order changes that affect the ecosystem. Changes in fishing strategy and the fishing community may also require changes in fishing gear and season to allow for a newly introduced species to establish itself or to avoid potential side issues associated with the new fishery. Climate changes may also have significant consequences that may modify the environment, making it more suitable for introductions of either useful or harmful species.

113. The use of introduced species, including genetically modified and genetically selected organisms, may allow for continued or increased production from habitats that have been so altered or degraded that native fisheries are no longer viable. Care should be taken not to use this potential productivity from introduced species as justification for further abuse of habitat or for delaying their restoration.

6.3 Research and Technology

Deliberate introductions

114. The ICES Code of Practice (Annex A) describes the research activities that should be conducted in advance of an introduction as follows: (1) desk assessment of the biology and ecology of the intended introduction; (2) preparation of a hazard assessment (detailed analysis of potential environmental impacts); (3) examination of the species within its

[4] **Editor's note**: The ICES Code of Practice originally drafted by ICES was subsequently finalized jointly by ICES and EIFAC for use by the FAO Regional Fishery Bodies. The Code is still being evolved and supplementary material is being produced by FAO to assist in its implementation mainly in developing countries

home range. The results of the above research should be contained in a prospectus or proposal to be submitted to the competent authority for evaluation and decision.

115. Technological intervention can be used during and following the introduction; such technologies may include:
a. use of hatcheries and quarantine stations to reduce the chance of spread of disease to fishery resources, and to impart some control on numbers of exotic organisms released;
b. use of sterile organisms to reduce the chance of interbreeding with natural fish stocks;
c. genetic stock identification to reduce or prevent genetic changes in the fishery resource;
d. disease diagnostics to monitor the health of the introduced species, and
e. development of the use of limited (pilot) scale introductions to assess impacts and performance.
116. Continued research and technological intervention on introduced species as part of a monitoring and evaluation scheme should be conducted to assess their impact, health and performance within their new habitat. In this regard, databases or registries of introductions of aquatic species, including their ecological and socio-economic impact, have been established and should be maintained by competent organizations with input from the fishery sector.

Unintended introductions
117. Although unintended introductions may arise from several sources, such as fouling organisms, removal of natural barriers and aquarium fish trade, ballast water is probably the most significant and troublesome for the fishery sector and, therefore, emphasized here. In the case of ballast water and sediment, desk studies may be undertaken to determine (1) main ballast water sources, (2) volumes of ballast introduced, and (3) likely "hot spots" as sources of introductions.

118. Active research should take place and continue on:
a. practical methods for treating organisms in ballast water and sediment;
b. study of dynamics of target species in voyage;
c. study of algal cysts in ships ballast sediment and in port areas;
d. effectiveness of reballasting activities;
e. design changes to ballast water tanks to kill or control harmful species in ballast water, and
f. vessel design that will facilitate the treatment and handling of ballast sediments and water.

119. Research into new effective non-biocidal antifouling materials should continue to reduce the risks of introductions on ships hulls and to replace those biocidal applications detrimental for capture fisheries. Antifouling agents are designed to reduce drag and increase the fuel efficiency of a vessel and its long-term efficacy, but they should also be environmentally friendly. Consideration should also be given to those antifouling agents designed to control organisms that would be especially harmful to capture fisheries, even though they may not affect the performance of the vessel.

6.4 Management
120. The first step to managing introductions is to establish a management authority with responsibility for evaluation of proposed introductions, approval in accordance with these guidelines and assuring monitoring of the effects of the introduction. The management of species introductions will involve comparative risk assessment and choices between various options to increase productivity. Management options are limited here to those in the aquatic sector, although countries may be aware of broader issues, such as the development of other sectors (e.g., agriculture). International codes of practice, such as the ICES code, provide a good framework for the management of purposeful species introductions. These codes should not be seen as a hindrance to development, but rather as a tool to help importers make good choices with regard to introductions. Implementation of the code should increase the probability of success of an appropriate introduction.

Deliberate introductions
121. Intended introductions should be controlled. As a consequence, those making an introduction should follow the ICES or similar code of practice as appropriate and would be expected to demonstrate caution by preparing a proposal covering: (1) the purpose and objectives of the introduction in advance of the introduction, (2) all relevant biological, ecological, and genetic data of the species in the target area likely to be affected, (3) analysis of potential impacts at the introduction site, including potential ecological, genetic and disease impacts and consequences of its spread, and (4) a qualitative and, where possible, a quantitative risk assessment.

122. If this proposal is approved: (1) a brood stock should be established at a suitable quarantine site; (2) all effluents from facility should be appropriately sterilized; (3) isolated first generation individuals, free of disease, should be released to the wild in small numbers; and (4) studies of the introduction in the new environment should be continued.

123. A contingency plan should take account of negative effects should they become apparent and warrant intervention.

124. The code should also cover introductions that are part of current commercial practice (live trade in fish and shellfish) and recommend: (a) periodic inspection prior to exportation; (b) regular inspection; and (c) quarantine and control if appropriate.

125. The concern expressed in relation to the introduction of species for fisheries, using the ICES Code, should apply to those species under consideration for biological control, which may have implications for capture fisheries. Bio-control programmes should be weighed carefully against other control methodologies, such as physical and chemical techniques or through intensive fishing. It is likely biological control techniques will take some years to evaluate, through field trials. Much may be learned from the studies on biological control in other disciplines, such as entomology.

126. The proposal submitted by the potential importer of an exotic species and its review by the competent authority serve as precautionary measures to reduce the chance of a harmful introduction. Governments may wish to consider for national legislation that, if these elements of the code are not followed, the importer of an exotic species may be financially responsible and subject to liability, should significant negative effects arise.

127. Care should be taken to ensure that the introduced population has an adequate genetic resource base, i.e., genetic diversity, low inbreeding, etc. This may reduce the need for additional introductions, which might otherwise be necessary to increase the genetic resource base. In addition, consideration should be given to the use of gametes, e.g., eggs, cryopreserved sperm, as import material instead of whole organisms to reduce the risk of introducing disease or unintended organisms.

Unintended introductions

128. Introduction of undesirable species via ballast water poses problems for fisheries worldwide. In addition to unintentional introductions by ballast water, there are many other mechanisms, including fishing and trade in live fish. Fishing can introduce species by transporting live or fresh bait, or biologically contaminated fishing gear between ecosystems. With trade in live organisms (for aquarium or human consumption), there is the risk of escape.

129. Authorities responsible for regulating fishing and trade in fish products should establish regulations to reduce these risks, commensurate with the severity of potential adverse impacts. However, the national and international competent authorities that deal with ballast issues are seldom also responsible for fishery management matters. Cooperation between these authorities would greatly aid the management of this problem.

130. In order to reduce the risk of introductions of organisms in ballast water on capture fisheries in or near deballasting areas, the following methods of prevention include, as recommended by the IMO (1994, Annex B): (a) non-release of ballast; (b) ballast water exchange(s) in or near approved areas; (c) preventing or minimizing uptake of contaminated water or sediment (in shallow water, near dredging operations, during algal blooms); (d) special ballasting facilities on shore; (e) education of crews about ballast-water management procedures, and (f) treatments of ballast water, including changes in temperature and salinity and use of biocides (chemicals).

131. Although the issues of ballast-water transport, fouling organisms and other unintentional introductions may fall outside the mandate of fishery ministries, the fishery sector could contribute to the management of such introductions, which impact upon the industry. This could be accomplished by promoting the establishment and maintenance in the appropriate institution, of an accessible database on ballast or fouling organisms that have a demonstrated impact on fisheries, by promoting a network of experts who wouldidentify problems, assist with species identification, and delimit areas of impact. The fishery sector may be well placed to detect the spread of harmful ballast/fouling organisms and should, therefore, contribute to such databases and networks once established, and may take a lead in instigating action on environmental management.

132. Introduced organisms may cause major changes in ecosystems, especially in port and associated, partly enclosed or enclosed areas, such as lagoons. Such introductions may result in changes in the productivity of local harvested species. Monitoring of introduced organisms and fisheries in these areas may provide useful information as a basis for modifying management techniques and policy for harvested resources.

6.5 Implementation Guidelines

133. Those making introductions should consider the ICES code as a means to reduce introductions of harmful or nuisance species, including parasites and diseases, which may impact on capture fisheries:

134. To encourage a more precautionary approach, governments outside the ICES region should follow the principles or recommendations of the code according to their particular circumstances. Critical elements to be considered are a proposal, independent review by a scientific body, and subsequent protocols if an introduction is approved.

135. In addition to codes of practice issued by ICES and IMO, the following may be useful as a precautionary approach to introduced species:

a. establish clear and straightforward procedures and protocols on the mechanisms for the management of introduced species under the relevant competent government agencies with authority to address issues of compliance, responsibility, and liability;
b. promote cooperation between the fishery sector and other sectors dealing with the aquatic environment in order to coordinate policy and regulation of introduced species, especially the national shipping sector, and port authorities and international organizations, e.g., ICES, FAO, IMO and ICLARM, which have relevant expertise;
c. encourage relevant groups (e.g., importer and regulatory agencies) to consider the development of a contingency plan in the event that the introduced species does not fulfil expectations or causes adverse impacts;
d. promote education, training and awareness of harmful species introductions, disseminate as widely as possible the ICES and IMO codes of practice and advise responsible authorities within the fishery and other sectors on the procedures of these codes;
e. develop an international information system in appropriate institutions on ballast or fouling organisms, which have demonstrated impacts on fisheries, by promoting a network of experts who would identify problems, species identification, and areas of impact, arrange standardization of sampling methods (inter-calibration), and develop a monitoring system so that changes can be evaluated in high-risk areas. Should unwanted species be detected, an eradication programme should be considered;
f. encourage compliance with the code by the fishing industry and other users of aquatic resources; national governments could encourage self-policing and selfenforcing by fishing industry and other users of the resource in minimising the impacts of introducing species by unauthorised means, and
g. conduct research on the applicability of information gained from introductions of limited numbers of animals (e.g. pilot/experimental introductions).
136. Promotion and maintenance of databases on species deliberately introduced for capture fisheries is suggested. This would include the impact of these introductions. Importers or fishery managers may wish to consult such databases to assist in the proposal formulation and its evaluation.
137. The development of effective non-biocidal antifouling applications to reduce the risk of introduction from ship fouling is encouraged.

ANNEX A
CODE OF PRACTICE ON THE INTRODUCTION AND TRANSFER OF MARINE ORGANISMS, 1994[5] (ICES, 1995)

The introduction and transfer of marine organisms, including genetically modified organisms, carry the risk of introducing not only pests and disease agents but also many other species. Both intentional and unintentional introductions may have undesirable ecological and genetic effects in the receiving ecosystem, as well as potential economic impacts. This Code of Practice provides recommendations for dealing with new intentional introductions, and also recommends procedures for species which are part of existing commercial practice, in order to reduce the risks of adverse effects that could arise from such movements.

I Recommended procedure for all species prior to reaching a decision regarding new introductions. (A recommended procedure for introduced or transferred species which are part of current commercial practice is given in Section IV; a recommended procedure for the consideration of the release of genetically modified organisms is given in Section V.)
(a) Member Countries contemplating any new introduction should be requested to present to the Council at an early stage a detailed prospectus on the proposed new introduction(s) for evaluation and comment.
(b) The prospectus should include the purpose and objectives of the introduction, the stage(s) in the life cycle proposed for introduction, the area of origin and the target area(s) of release, and a review of the biology and ecology of the species as these pertain to the introduction (such as the physical, chemical, and biological requirements for reproduction and growth, and natural and human-mediated dispersal mechanisms).
(c) The prospectus should also include a detailed analysis of the potential impacts on the aquatic ecosystem of the proposed introduction. This analysis should include a thorough review of:
i) the ecological, genetic, and disease impacts and relationships of the proposed introduction in its natural range and environment;
ii) the potential ecological, genetic, and disease impacts and relationships
of the proposed introduction in the proposed release site and environment. These aspects should include but not necessarily be limited to:
- potential habitat breadth,
. prey (including the potential for altered diets and feeding strategies),
. predators,
. competitors,
. hybridization potential and changes in any other genetic attributes, and
. the role played by disease agents and associated organisms and epibiota.
Potential predation upon, competition with, disturbance of, and genetic impacts upon, native and previously introduced species should receive the utmost attention. The potential for the proposed introduction and associated disease agents and other organisms to spread beyond the release site and interact with species in other regions should be addressed.

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[5] Reproduced for easy reference by courtesy of the International Council for the Exploration of the Sea (ICES)

The effects of any previous intentional or accidental introductions of the same or similar species in other regions should be carefully evaluated.
(d) The prospectus should conclude with an overall assessment of the issues, problems, and benefits associated with the proposed introduction. Quantitative risk assessments, as far as reasonably practicable, could be included.
(e) The Council should then consider the possible outcome of the proposed introduction, and offer advice on the acceptability of the choice.

II If the decision is taken to proceed with the introduction, the following action is recommended:
(a) A brood stock should be established in a quarantine situation approved by the country of receipt, in sufficient time to allow adequate evaluation of the stock's health status. The first generation progeny of the introduced species can be transplanted to the natural environment if no disease agents or parasites become evident in the first generation progeny, but not the original import. In the case of fish, brood stock should be developed from stocks imported as eggs or juveniles, to allow sufficient time for observation in quarantine.
(b) The first generation progeny should be placed on a limited scale into open waters to assess ecological interactions with native species.
(c) All effluents from hatcheries or establishments used for quarantine purposes in recipient countries should be sterilized in an approved manner (which should include the killing of all living organisms present in the effluents).
(d) A continuing study should be made of the introduced species in its new environment, and progress reports submitted to the International Council for the Exploration of the Sea.

III Regulatory agencies of all Member Countries are encouraged to use the strongest possible measures to prevent unauthorized or unapproved introductions.
IV Recommended procedure for introduced or transferred species which are part of current commercial practice.
(a) Periodic inspection (including microscopic examination) of material prior to exportation to confirm freedom from introducible pests and disease agents. If inspection reveals any undesirable development, importation must be immediately discontinued. Findings and remedial actions should be reported to
the International Council for the Exploration of the Sea. and/or
(b) Quarantining, inspection, and control, whenever possible and where appropriate.
(c) Consider and/or monitor the genetic impact that introductions or transfers have on indigenous species, in order to reduce or prevent detrimental changes to genetic diversity. It is appreciated that countries will have different requirements toward the selection of the place of inspection and control of the consignment, either in the country of origin or in the country of receipt.

V Recommended procedure for the consideration of the release of genetically modified organisms (GMOs).
(a) Recognizing that little information exists on the genetic, ecological, and other effects of the release of genetically modified organisms into the natural environment (where such releases may result in the mixing of altered and wild populations of the same species, and in changes to the environment), the Council urges Member Countries to establish strong legal measures[6] to regulate such releases, including the mandatory licensing of physical or juridical persons engaged in genetically modifying, or in importing, using, or releasing any genetically modified organism.
(b) Member Countries contemplating any release of genetically modified organisms into open marine and fresh water environments are requested at an early stage to notify the Council before such releases are made. This notification should include a risk assessment of the effects of this release on the environment and on natural populations.
(c) It is recommended that, whenever feasible, initial releases of GMOs be reproductively sterile in order to minimize impacts on the genetic structure of natural populations.
(d) Research should be undertaken to evaluate the ecological effects of the release of GMOs.

DEFINITIONS
For the application of this Code, the following definitions should be used:
Brood stock Specimens of a species, either as eggs, juveniles, or adults, from which a first or subsequent generation may be produced for possible introduction to the environment.
Country of origin The country where the species is native.
Current commercial practice Established and ongoing cultivation, rearing, or placement of an introduced or transferred species in the environment for economic or recreational purposes, which has been ongoing for a number of Years.
Disease agent For the purpose of the Code, 'disease agent' is understood to mean all organisms, including parasites, that cause disease. (A list of prescribed disease agents, parasites, and other harmful agents is made for each introduced or transferred species in order that adequate methods for inspection are available. The discovery of other agents, etc., during such inspection should always be recorded and reported.)
Genetic diversity All of the genetic variation in an individual, population, or species. (ICES, 1988)

[6] Such as the European Community Council Directive of 23 April 1990 on the deliberate release into the environment of Genetically Modified Organisms (90/220/EEC) Official Journal of the European Communities, L117: 15-17 (1990)

Genetically modified organism (GMO) An organism in which the genetic material has been altered anthropogenically by means of gene or cell technologies[7].
Introduced species (= non-indigenous species, = exotic species) Any species intentionally or accidentally transported and released by humans into an environment outside its present range.
Marine species Any aquatic species that does not spend its entire life cycle in fresh water.
Quarantined species Any species held in a confined or enclosed system that is designed to prevent any possibility of the release of the species, or any of its disease agents or any other associated organisms into the environment
Transferred species (= transplanted species)
Any species intentionally or accidentally transported and released within its present range.
NOTES
(a) It is understood that an introduced species is what is also referred to as an introduction, and a transferred species as a transfer.
(b) Introduced species are understood to include exotic species, while transferred species include exotic individuals or populations of a species.
(c) It is understood for the purpose of the Code that introduced and transferred species may have the same potential to carry and transmit disease or any other associated organisms into a new locality where the disease or associated organism does not at present occur.

REFERENCES
ICES. 1984. Guidelines for Implementing the ICES Code of Practice Concerning Introductions and Transfers of Marine Species. Cooperative Research Report No. 130. 20 pp.
ICES. 1988. Codes of Practice and Manual of Procedures for Consideration of Introductions and Transfers of Marine and Freshwater Organisms. Cooperative Research Report No. 159. 44 pp.
ICES. 1994. Report of the ICES Advisory Committee on the Marine Environment, 1994, Annex 3. ICES Cooperative Research Report No. 204. 122 pp.

ANNEX B
GUIDELINES FOR PREVENTING THE INTRODUCTION OF UNWANTED AQUATIC ORGANISMS AND PATHOGENS FROM SHIPS BALLAST WATER AND SEDIMENT DISCHARGES (IMO, 1994)[8]

1. INTRODUCTION

1.1 Studies carried out in several countries have shown that many species of bacteria, plants, and animals can survive in a viable form in the ballast water and sediment carried in ships, even after journeys of several weeks' duration. Subsequent discharge of contaminated ballast water or sediment into the waters of port States may result in the establishment of unwanted species which can seriously upset the existing ecological balance. Although other media have been identified for transferring organisms between geographically separated water bodies, ballast water discharge from ships appears to have been among the most prominent. The introduction of diseases may also arise as a result of port State waters being inoculated with large quantities of ballast water containing viruses or bacteria, thereby posing health threats to indigenous human, animal and plant life.

1.2 The potential for ballast water discharges to cause harm, was recognized by resolution 18 of the International Conference on Marine Pollution, 1973, from which Conference emerged the MARPOL Convention. Resolution 18 called upon the World Health Organization, in collaboration with the International Maritime Organization, to carry out research into the role of ballast water as a medium for the spreading of epidemic disease bacteria.

1.3 It is the aim of these Guidelines to provide Administrations and port State Authorities with guidance on procedures that will minimize the risk from the introduction of unwanted aquatic organisms and pathogens from ships' ballast water and sediment. The selection of an appropriate procedure will depend upon several factors, including the type or types of organisms being targeted, the level of risks involved, its environmental acceptability, and the economic and ecological costs involved.

1.4 The choice of procedures will also depend upon whether the measure is a short-term response to an identified problem or a long-term strategy aimed at completely eliminating the possibility of the introduction of species by ballast water. In the short term, operational measures such as ballast water exchange at sea may be appropriate where they have been shown to be effective and are accepted by port State Authorities and Administrations. For the longer term, more effective strategies, possibly involving structural or equipment modifications to ships, may need to be considered.

2. DEFINITIONS

For the purposes or these Guidelines, the following definitions apply:

[7] Such technologies include the isolation, characterization, and modification of genes and their introduction into living cells or viruses of DNA as well as techniques for the production of living cells with new combinations of genetic material by the fusion of two or more cells

8 Resolution A.774(18) Adopted on 4 November 1993. Reproduced by courtesy of the International Maritime Organization (IMO)

Administration means the Government of the State under whose authority the ship is operating.
Member States means States that are Members of the International Maritime Organization.
Organization means the International Maritime Organization (IMO).
Port State authority means any official or organization authorized by the Government of a port State to administer guidelines or enforce standards and regulations relevant to the implementation of national and international shipping control measures.

3. APPLICATION

The Guidelines can apply to all ships; however, a port State Authority shall determine the extent to which these Guidelines do apply.

4. GENERAL PRINCIPLES

4.1 Member States may adopt ballast water and sediment discharge procedures to protect the health of their citizens from foreign infectious agents, to safeguard fisheries and aquaculture production against similar exotic risks and to protect the environment generally.
4.2 Application of ballast water and sediment discharge procedures to minimize the risk of importing unwanted aquatic organisms and pathogens may range from regulations based upon quarantine laws to guidelines providing suggested measures for controlling or reducing the problem.
4.3 In all cases, a port State Authority must consider the overall effect of ballast water and sediment discharge procedures on the safety of ships and those on board. Regulations or guidelines will be ineffective if compliance is dependent upon the acceptance of operational measures that put a ship or its crew at risk.

4.4 Ballast water and sediment discharge procedures should be practicable, effective, designed to minimize cost and delays to ships, and based upon these Guidelines whenever practicable.

4.5 The ability of aquatic organisms and pathogens to survive after transportation in ballast water may be reduced if significant differences in ambient conditions prevail - e.g. salinity, temperature, nutrients and light intensity.

4.6 If fresh water (FW), brackish water (BW) and fully saline water (SW) are considered, the following matrix provides, in most cases, an indication of the probability that aquatic organisms and pathogens will survive after being transferred.

Probability of organism's survival and reproduction

Receiving Waters	**Discharged Ballast**		
	FW	**BW**	**SW**
FW	HIGH	MEDIUM	LOW
BW	MEDIUM	HIGH	HIGH
SW	LOW	HIGH	HIGH

4.7 The duration of ballast water within an enclosed ballast tank will also be a factor in determining the number of surviving organisms. For example, even after 60 days, some organisms may remain in ballast water in a viable condition.

4.8 Because some aquatic organisms and pathogens that may exist in sediments carried by ships can survive to several months or longer, disposal of such sediment should be carefully managed and reported to port State Authorities.

4.9 In implementing ballast water and sediment discharge procedures, Port State Authorities should take account of all relevant factors.

5. IMPLEMENTATION

5.1 Member States applying ballast water and sediment discharge procedures should notify the Organization of specific requirements and provide to the Organization, for the information of other Member States and non-governmental organizations, copies of any regulations, standards or guidelines being applied.

5.2 Administrations and non-governmental shipping organizations should provide the widest possible distribution of information on ballast water and sediment discharge procedures being applied to shipping by port State Authorities. Failure to do so may lead to unnecessary delays for ships seeking entry to port States where ballast water and sediment discharge procedures are being applied.

5.3 In accordance with paragraph 5.2 above, ship operators and ships' crews should be familiar with the requirements of port State Authorities with respect to ballast water and sediment discharge procedures, including information that will be needed to obtain entry clearance. In this respect, masters should be made aware that penalties may be applied by port State Authorities for failure to comply with national requirements.

5.4 Member States and non-governmental organizations should provide to the Organization, for circulation, details of any research and development studies that they carry out with respect to the control of aquatic organisms and pathogens in ballast water and sediment found in ships.

5.5 Administrations are encouraged to report to the Organization incidences where compliance with ballast water and sediment discharge procedures required by port State Authorities has resulted in ship safety problems, unacceptably high costs, or delays to ships.

5.6 Member States should provide to the Organization details of annual compliance records for ballast water and sediment discharge procedures that they are applying. These records should report all incidences of non-compliance with regulations or guidelines and cite, by ship's name, official number and flag, all non-complying vessels.

5.7 Member States should notify the Organization of any local outbreaks or infectious diseases or water borne organisms that have been identified as a cause of concern to health and environmental authorities in other countries and for which ballast water or sediment discharges may be vectors of transmission. This information should be relayed by the Organization, without delay, to all Member States and non governmental organizations. Member States should ensure that problem species, endemic to their waters, are not being transferred from locally loaded ballast water. Masters of ships should be notified of the existence of problem species, including local outbreaks of phytoplankton blooms, and advised to exchange or treat their ballast water and sediment accordingly.
5.8 Member States should determine the environmental sensitivity of their waters to the extent deemed necessary. Ballast water and sediment discharge procedures should take into account the environmental sensitivity of these waters.

6. SHIP OPERATIONAL PROCEDURES

6.1 When loading ballast, every effort should be made to ensure that only clean ballast water is being taken on and that the uptake of sediment with the ballast water is minimized. Where practicable, ships should endeavour to avoid taking on ballast water in shallow water areas, or in the vicinity of dredging operations, to reduce the likelihood that the water will contain silt, which may harbour the cysts of unwanted aquatic organisms and pathogens, and to otherwise reduce the probability that unwanted aquatic organisms and pathogens are present in the water. Areas where there is a known outbreak or diseases communicable through ballast water, or in which phytoplankton blooms are occurring, should be avoided wherever practicable as a source or ballast.

6.2 When taking on ballast water, records of the dates, geographical locations, salinity and amount of ballast water taken on should be recorded in the ship's log-book. To enable monitoring by the Organization and port State Authorities, a report in the format shown in the appendix to these Guidelines should be completed by the ship's master and made available to theport State Authority. Procedures to be followed by the ship should be described in detail in the ship's operational manual. The sample used to determine the salinity of loaded ballast water should be obtained, wherever possible, from the ballast tanks themselves or from a supply piping tap. Surface sea water samples should not be taken as indicative of the water in the ballast tanks since sea water salinity may vary significantly with depth.

6.3 Subject to accessibility, all sources of sediment retention such as anchors, cables, chain lockers and suction wells should be cleaned routinely to reduce the possibility of spreading contamination.

7. STRATEGIES FOR PREVENTING THE INTRODUCTION OF UNWANTED AQUATIC ORGANISMS AND PATHOGENS FROM SHIP'S BALLAST WATER AND SEDIMENT DISCHARGES

7.1 General

7.1.1 In determining appropriate strategies for ballast water and sediment discharge procedures, the following criteria, *inter alia*, should be taken into account:
- operational practicability;
- effectiveness;
- seafarer and ship safety;
- environmental acceptability;
- water and sediment control;
- monitoring; and
- cost effectiveness.

7.1.2 Approaches that may be effective in controlling the incidence and introduction of aquatic organisms and pathogens include:
- the non-release or ballast water;
- ballast water exchange and sediment removal at sea or in areas designated as acceptable for the purpose by the port State Authority;
- ballast water management practices aimed at preventing or minimizing the uptake of contaminated water or sediment in ballasting and deballasting operations; and
- discharge of ballast water into shore-based facilities for treatment or controlled disposai.

7.1.3 In considering which particular approach, or combination of approaches, to use, port State Authorities should have regard to the factors listed in paragraph 7.1.1.

7.2 Non-release of Ballast Water

The most effective means of preventing the introduction or unwanted aquatic organisms and pathogens from ships' ballast waters and sediments is to avoid, wherever possible, the discharge of ballast water.

7.3 Ballast Water Exchange and Sediment Removal

7.3.1 In the absence of more scientifically based means of control, exchange of ballast water in deep ocean areas or open seas currently offers a means of limiting the probability that fresh-water or coastal species will be transferred in ballast water. Responsibility for deciding on such action must rest with the master, taking into account prevailing safety, stability and structural factors and influences at the time.

7.3.2 Unlike coastal and estuarine waters that are rich in nutrients and life forms, deep ocean water or open seas contain few organisms. Those that do exist are unlikely to adapt readily to a new coastal or freshwater environment, hence the probability of transferring unwanted organisms through ballast water discharges can be greatly reduced by ocean or open sea ballast exchanges, preferably in water depths of 2,000 m or more. In those cases where ships do not encounter water depths of at least 2,000 m, exchange of ballast water should occur well clear of coastal and estuarine influences. There is evidence to suggest that, despite contact with water of high salinity, the cysts of some organisms can survive for protracted periods in the sediment within ballast tanks and elsewhere on a ship. Hence, where ballast water exchange is being used as a control measure, care should be taken to flush out ballast tanks, chain lockers and other locations where silt may accumulate, to dislodge and remove such accumulations, wherever practicable.

7.3.3 Care should also be taken when removing sediment deposits while a ship is in port or in coastal waters to ensure that the sediment is not disposed of directly into adjacent waters. Sediment should be removed to land-fill locations designated by the port State Authority or, alternatively, sterilized to kill all living organisms that it may contain prior to being discharged into local water bodies or otherwise disposed of.

7.3.4 Ships likely to be required to exchange ballast during a voyage should take into account the following requirements:

1 stability to be maintained at all times to values not less than those recommended by the Organization (or required by the Administration);

2 longitudinal stress values not to exceed those permitted by the ship's classification society with regard to prevailing sea conditions; and

3 exchange of ballast in tanks or holds where significant structural loads may be generated by sloshing action in the partially filled tank or hold to be carried out in favourable sea and swell conditions such that the risk of structural damage is minimized.

7.3.5 Where the requirements of paragraph 7.3.4 cannot be met during an "at sea" exchange of ballast water, a "flow through" exchange of ballast water may be an acceptable alternative for those tanks. Procedures for exchange of this type should be approved by the Administration.

7.3.6 Where the requirements of paragraph 7.3.4 can be met during an "at sea" exchange of ballast water, before taking on exchange ballast water, tanks should be drained until pump suction is lost. This will minimize the likelihood of residual organism survival.

7.3.7 Where a port State Authority requires that an "at sea" exchange of ballast water be made, and, due to weather, sea conditions or operational impracticability, such action cannot be taken, the ship should report this fact to the port State Authority prior to entering its national waters, so that appropriate alternative action can be arranged.

7.3.8 Alternative action will also be necessary in those instances where ships may not leave a continental shelf during their voyage. Unless specific alternative instructions have been issued by a port State Authority applying ballast water and sediment controls, ships should report non-compliance prior to entering the port State's waters.

7.3.9 Port State Authorities applying ballast water exchange and sediment removal procedures may require ships to complete a ballast water control form or some other acceptable system of reporting. A model form for this purpose is in the appendix. Port State Authorities shouldarrange for such reporting forms to be distributed to ships, together with instructions for completion of the form and procedures for its return to the appropriate authorities.

7.3.10 In those cases where a ship arrives at a port without having carried out an "at sea" ballast water exchange, or has otherwise failed to carry out any alternative procedures acceptable to port State Authorities, the ship may be required to proceed to an approved location to carry out the necessary exchange, treat the ballast water *in situ*, seal the ballast tanks against discharge in the port State's waters, pump the ballast water to a shore reception facility, or prove. by laboratory analysis, that the ballast water is acceptable.

7.3.11 To facilitate administration of ballast water exchange and sediment removal procedures on board ships, a responsible officer familiar with those procedures should be appointed to maintain appropriate records and to ensure that all ballast water exchange and sediment removal procedures are followed and recorded. Written ballast water and sediment removal procedures should be included in the ship's operational manual.

7.3.12 Port State Authorities applying ballast water exchange and sediment discharge procedures may wish to monitor compliance with, and effectiveness of, their controls.

7.3.13 Effectiveness monitoring may also be undertaken by port State Authorities, by taking and analyzing ballast water and sediment samples from ships complying with prescribed exchange procedures, to test for the continued survival of unwanted aquatic organisms and pathogens.

7.3.14 Where ballast water or sediment sampling for compliance or effectiveness monitoring is being undertaken, port State Authorities should minimize delays to ships when taking such samples. Use of plankton nets, either by a vertical tow through ballasted deep tanks or cargo holds or by attachment to an open fire-main hydrant, suitably cross-connected to the ballast main, is one suggested means of ballast water sampling. Sediment samples may be taken from areas where sediment is most likely to accumulate, such as around outlet pipes, bulkhead and hold corners, etc., to the extent that these are accessible. Appropriate safety precautions must be employed wherever the taking of water or sediment samples requires tank entry.

7.3.15 Port State Authorities may also wish, subject to relevant safety considerations, to sample sediment in suction wells, chain lockers or other areas where sediment may accumulate.

7.3.16 In some cases, ships bound for ports which apply strategies for preventing the introduction of unwanted aquatic organisms and pathogens from ships' ballast water and sediments may avoid "at sea" exchange of ballast water, or other control procedures, by having their ballast water or harbour source samples analysed by a laboratory that is acceptable to the port State Authority. Where sampled and analysed ballast or harbour source water is found to be free from unwanted aquatic organisms or pathogens, an analyst's certificate, attesting to that fact, should be made available to port State Authorities. When analysis of ballast or harbour source water or sediment is being used as a control procedure, port State Authorities should provide Administrations with a target listing of unwanted aquatic organisms or pathogens.

7.3.17 Port State Authorities may sample or require samples to analyse ballast water and sediment before permitting a vessel to proceed to discharge its ballast water in environmentally sensitive locations. In the event that unwanted aquatic organisms or pathogens are found to be present in the samples, ships may be prohibited from discharging ballast or sediment, except to shore reception facilities or in designated marine areas.

7.4 Ballast Water Management Practices

7.4.1 Port State Authorities may allow the use of appropriate ballast water management practices, aimed at preventing or minimizing the uptake and discharge of contaminated water or sediment in ballasting and deballasting operations. Such practices may be used when adjudged as reducing the risks of introducing unwanted aquatic organisms and pathogens to a level acceptable to port State Authorities, who, for this purpose, may set conditions with which such practices need to comply.

7.4.2 Such conditions should include appropriate ballast water management plans, training of ships' officers and crew, and the nomination of key control personnel.

7.5 Shore Reception Facilities

7.5.1 Where adequate shore reception facilities exist, discharge of ship's ballast water in port into such facilities may provide an acceptable means of control. Port State Authorities utilizing this strategy should ensure that the discharged ballast water has been effectively treated before release. Any treatment used should itself be environmentally acceptable.

7.5.2 Reception facilities should be made available for the safe disposal of tank sediment when ships are undergoing repair or refit. Sediment, removed from ballast tanks and other areas of accumulation, should be disposed of in accordance with paragraph 7.3.3 above.

7.5.3 Member States should provide the Organization and ships with information on the locations, capacities and availability of, and any applicable fees relevant to, reception facilities being provided for the safe disposal of ballast water and removed sediment.

8. TRAINING, EDUCATION AND SHIPS' MANAGEMENT PLANS

8.1 Administrations and non-governmental shipping organizations should ensure that ships' crews are made aware of the ecological and health hazards posed by the indiscriminate loading and discharging of ballast water and of the need to maintain tanks and equipment, such as anchors, cables and hawse pipes, free from sediment.

8.2 Training curricula for ships' crews should include instruction on the application of ballast water and sediment discharge procedures, based upon the information contained in these Guidelines. Instruction should also be provided on the maintenance of log-book records, indicating the dates and times of ballast water loading, exchange or discharge, salinity and the geographical location where such operations are carried out.

8.3 Ships' crews should receive adequate instruction on the methods of ballast water and sediment discharge procedures being applied on their ship, including appropriate safety training in the relevant procedures.

8.4 Ballast water management plans should be incorporated into ships' operational manuals for the guidance of the ships' crews. Such plans should include, but not necessarily be limited to, information on the following:
- ballast water loading and discharging procedures and precautions;
- ballast water and sediment sampling and testing;
- controls applied by port State Authorities;
- reporting and information requirements;
- exchange and treatment options or requirements;
- crew safety guidelines;
- sediment disposal arrangements; and
- crew education and training.

8.5 Ships' operational manuals should include reference to these Guidelines and to the need to comply with any ballast water and sediment discharge procedures imposed by port State Authorities.

9. FUTURE CONSIDERATIONS

9.1 There is a clear need to research and develop revised and additional measures, particularly as new information on organisms and pathogens of concern becomes available. Areas for further research include, *inter alia*:
- treatment by chemicals and biocides;
- heat treatment;
- oxygen deprivation control;
- tank coatings;
- filters; and
- ultraviolet light disinfection.

It must be made clear, however, that there is a lack of research knowledge and practical experience on the cost, safety, effectiveness and environmental acceptability of these possible approaches. Any proposed chemical or biocidal treatments should be environmentally safe and in compliance with international conventions. Authorities carrying out or commissioning research studies into these or other relevant areas are encouraged to work co-operatively and provide information on the results to the Organization.

9.2 In the longer term and to the extent possible, changes in ship design may be warranted to prevent the introduction of unwanted aquatic organisms and pathogens from ships. For example, subdivision of tanks, piping arrangements and pumping procedures should be designed and constructed to minimize uptake and accumulation of sediment in ballast tanks.

9.3 Classification societies are urged to include provisions for ballast water and sediment discharge procedures in their rule requirements.

ประวัติผู้เขียนวิทยานิพนธ์

นางสาวนิชุดา เศรษฐะทัตต์ เกิดเมื่อวันที่ 13 กันยายน พ.ศ. 2524 สำเร็จการศึกษาระดับมัธยมศึกษาจากโรงเรียนสามเสนวิทยาลัย และเข้ารับการศึกษาระดับปริญญาตรีที่คณะนิติศาสตร์ สาขากฎหมายระหว่างประเทศ จุฬาลงกรณ์มหาวิทยาลัย จบการศึกษาในปีการศึกษา 2545 และเข้าศึกษาต่อในหลักสูตรนิติศาสตร์มหาบัณฑิต สาขากฎหมายระหว่างประเทศ จุฬาลงกรณ์มหาวิทยาลัย เมื่อ พ.ศ. 2548