

Chapter 48

Management of Non-indigenous Species and Invasive Alien Species

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Abstract When seeking to manage the risks to marine ecosystems and other marine assets arising from the introduction of invasive alien species by human activities, there are two challenges to be surmounted: first, how to avoid the unintentional introduction of non-indigenous species and, second, how to prevent the intentional introduction of such species which, according to both scientific knowledge and practical experience, are “invasive”.

This contribution to the Handbook outlines the legal framework for dealing with the complex challenge to the marine environment posed by non-indigenous species. The chapter focuses on two main vectors—aquaculture and ballast water—and summarizes recent developments at the international level, with a particular focus on the Ballast Water Management Convention. In doing so, it identifies gaps and inconsistencies at the various regulatory levels and illustrates potential development options for the future legal framework. Given the fact that, in almost all cases, the establishment of invasive species is irreversible, the precautionary and the preventive principle must play a key role in managing the impacts of non-indigenous species on the marine environment.

In addition to looking at the specific regulations, strategies and plans designed to protect the marine environment from the risks associated with the introduction of non-indigenous species, the article also deals with the general legal provisions regarding IAS at the level of the Convention on Biological Diversity and, in particular, at the EU level. With the adoption of Regulation (EU) No 1143/2014 of 22 October 2014, a foundational legal instrument now exists at EU level for dealing with IAS. Its most important achievement is to establish a legally binding list of IAS based on risk assessments; this list is to be continuously developed further, its purpose being effectively to prevent the intentional introduction of IAS.

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48.1 Introduction

Non-indigenous, or alien, species are those which, as a result of human action, have succeeded in extending beyond their natural range and establishing themselves on new terrain (Kowarik 2010: 13; Kuhlenkamp and Kind 2016). Marine ecosystems are significantly affected by non-indigenous species that have been introduced either intentionally or unintentionally by humans (Kuhlenkamp and Kind 2016). The main causes of introduction are as follows (Kuhlenkamp and Kind 2016; Kowarik 2010: 355f.; Hewitt et.al. 2009: 117ff.; Leppäskoski et al. 2002: 3):

- the unintentional introduction of species through ballast water from ships and the accumulation of matter on ships' hulls (fouling),
- oceanic regions that are no longer separated due to the creation of water corridors, including shipping channels in particular, which enable marine species to penetrate into new habitats, and
- deliberate releases of species, especially through the importation of marine species for aquacultures and aquariums.

Studies for Europe show that up until 2012 some 1230 marine alien species had been introduced, and that an astonishing 57% of these species have managed to develop stable populations without external influence (Kuhlenkamp and Kind 2016). Successfully established populations in Europe are to be found especially in the Mediterranean region, although climate change has also improved conditions for establishment in the cooler climates of the North Sea area (Galil et.al. 2007: 64ff.; Lonhart 2009: 65; SRU 2012: 276). In its 2010 status report the OSPAR Commission (a body formed out of the OSPAR Convention) speaks of more than 160 non-indigenous species that have been introduced into the OSPAR (North Atlantic) area (OSPAR Commission 2010a: 118).

The introduction of non-indigenous, or alien, species by human activities can have adverse impacts on (marine) ecosystems and on other natural assets, such as ecosystem services, when they display “invasive” characteristics—in other words, when they are capable of spreading aggressively at the expense of native species, triggering changes in the functional processes of ecosystems, or exerting constraints on original communities. It is in this context that experts speak of “invasive alien species” (IAS) (Kuhlenkamp and Kind 2016). This concept has been taken up in international agreements including, especially, the Convention on Biological Diversity (henceforth CBD), and in other major legal regulations, such as Regulation (EU) No 1143/2014 on the prevention and management of the introduction and spread of invasive alien species (henceforth EU-IAS Regulation). Art. 3 (3) of the

EU-IAS Regulation now contains a definition established—for the first time—by EU legislation directly: “‘invasive alien species’ means an alien species whose introduction or spread has been found to threaten or adversely impact upon biodiversity and related ecosystem services.”

IAS are considered to be one of the most significant threats to biodiversity worldwide (Kowarik 2010: 375; Klingenstein et.al. 2005: 14). This gives rise to the need for action on nature conservation in order to preserve biological diversity and its natural dynamic (Klingenstein et.al. 2005: 6) and to protect other important public assets such as ecosystem services.

In the following sections of this chapter we address the requirements for managing IAS and the challenges arising from these (Sect. 48.2), before providing information about the most significant institutional waymarks and pieces of legislation aimed at addressing the IAS problem (Sect. 48.3), along with the key steering instruments and strategies used to do so (Sect. 48.4). The chapter closes with a brief section assessing what has been achieved and giving an indication of future prospects and next steps (Sect. 48.5). Since the task of protecting the oceans from the risks posed by IAS is an international one, the analysis focuses on global actions but also highlights European activities as an example, given that they draw upon global and EU approaches and those found in regional formulations of international law.

48.2 Management Requirements and Challenges

Averting or reducing the risks arising for marine ecosystems and other marine assets from the introduction of non-indigenous species requires two kinds of management measures (Köck 2004: 114f., 121). It is necessary to ensure:

- that, as far as is possible using reasonable means, the unintentional introduction of non-indigenous species does not occur, and
- that the intentional introduction of non-indigenous species identified as “invasive” does not occur (IAS).

These management tasks are already set out in the “Guiding Principles for the Prevention, Introduction and Mitigation of Impacts of alien species that threaten ecosystems, habitats or species” adopted in 2002 by the Conference of the Parties (COP) on the basis of Art. 8 (h) of the CBD (COP 2002: Principles No. 7, 10, 11). (While not legally binding, these Guiding Principles are nonetheless highly significant in practical terms.) Having recognized these tasks as valid, the parties to the CBD have reached agreement on a “three-stage hierarchical approach” (COP 2002: Principle No. 2) and on giving priority to preventive measures: “Priority should be given to preventing the introduction of invasive alien species, between and within States. If an invasive alien species has been introduced, early detection and rapid action are crucial to prevent its establishment. The preferred response is often to eradicate the organisms as soon as possible (principle 13). In the event that eradication is not feasible or resources are not available for its eradication,

containment (principle 14) and long-term control measures (principle 15) should be implemented.”

In order to implement the preventive strategy, the actors require knowledge that is relevant to practical management measures on the following issues at least:

- the entry pathways of non-indigenous species (vectors): along what (non-natural) pathways do non-indigenous species find their way into new habitats?
- appropriate measures for reducing or averting risk: what can be done in practical terms to reduce or completely eradicate the risk of introduction on the entry pathways identified? Taking account of the importance of human activity, which measures are acceptable and appropriate for achieving societal well-being?
- identifying IAS when non-indigenous species are to be introduced deliberately into new habitats for economic reasons.

Accordingly, the first challenge involves guaranteeing that appropriate knowledge is generated, that is, ensuring that entry pathways are identified along with suitable measures for reducing the risks from introduction. This requires not just setting up and securing funding for scientific programmes (COP 2002: Principle No. 5) but also generating knowledge about acceptable options for action that is tailored to each industrial sector. With regard to marine ecosystems and marine ecosystem services, the main issue here is to do with options for shipping (e.g. dealing with ballast water), the management of ocean shipping routes (e.g. environmental impact assessments for new channel projects) and the management of aquacultures along coastlines.

More complex than this, though, is the challenge of identifying IAS, because this is a matter of assessing by anticipation whether or not a non-indigenous species will develop invasive characteristics in its intended new location. This demands the use of corresponding assessment instruments (risk analyses) but also—in view of government agencies’ authority to intervene—the option of applying the precautionary principle if existing knowledge about risks is not yet certain (COP 2002: Principles No. 1 and 10). Further, the socio-economic benefits of introduction should not be ignored when it comes to deciding whether the intentional introduction of IAS can be considered acceptable in isolated cases. In other words, it is also a matter of considering under what circumstances IAS may be introduced as an exception. This issue is addressed explicitly in the EU-IAS Regulation (see below Sect. 48.3.5; Köck 2015: 78).

In addition to generating knowledge, a further challenge consists in giving the actors the necessary knowledge to reduce the risks of introduction (COP 2002: Principle No. 6), ensuring there is a legal framework that places the key actors identified as such under obligation to implement measures for averting or reducing risks and to set up effective monitoring instruments. With particular regard to the intentional introduction of non-indigenous species, it is crucial to establish (border) controls and approval procedures (COP 2002: Principle No. 7) and to provide the relevant agencies with IAS lists based on current scientific and practical knowledge as criteria for control.

Last but not least, a number of requirements exist with regard to the practical, operative level. Marine ecosystems and marine ecosystem services can only be protected if there is an effective international framework for action. Management strat-

egies aimed solely at the national level are doomed to failure because of their much too limited range.

48.3 Existing International Legal and Institutional Framework

“In accordance with customary international law, States have a duty to prevent, reduce and control environmental harm and a duty to cooperate to mitigate trans-boundary environmental risks” (Riley 2009: 200). These general obligations can also be meaningful in the context of averting the risks posed by IAS, but they are ineffective in terms of specificity and enforcement. It is for this reason that treaties have been forged at the global level which specifically address these risks and the obligations arising from them. Of major significance in the early days of these efforts was the CBD, adopted in 1992 (see below, Sect. 48.3.1). Going back further, there is also the UN Convention on the Law of the Sea (UNCLOS) from 1982, which contains a provision for dealing with non-indigenous species (see Sect. 48.3.2). At the level of so-called soft law, regional marine conservation agreements contain specific goals and measures aimed at combating IAS (see Sect. 48.3.3). The International Maritime Organisation’s (IMO) Ballast Water Management Convention is of huge practical significance in the context of protecting marine ecosystems from the risks posed by IAS because it regulates a key entry pathway directly (see below, Sect. 48.3.4). The most important piece of EU legislation for managing the risks posed by IAS is the aforementioned EU-IAS Regulation from 2014 (see below, Sect. 48.3.5.1). It covers the entire sovereign territory of the EU, including coastal waters, thereby affording protection to marine ecosystems in coastal regions. Another EU regulation aimed at protecting Europe’s marine environment is the Marine Strategy Framework Directive, which sets protection and conservation targets and commits EU Member States to setting up programmes and plans to achieve them (see below, Sect. 48.3.5.2).

The following section analyses the international legal response to the challenge of non-indigenous species in the marine environment. While the threat has been a subject of scientific research for more than 50 years and has been recognized in several conventions and treaties, the risk of the spread of invasive alien species has continued to grow worldwide.

48.3.1 *Convention on Biological Diversity (CBD)*

At national level the problem of non-indigenous species has been a part of nature conservation policy and law for several decades, albeit the focus here has been principally on terrestrial ecosystems (e.g in Germany: Köck 2004: 116ff.). At the global level the 1992 CBD is the foundational piece of legislation containing obligations to

combat or reduce the risks posed by IAS and has led to a revision of national and regional strategies. Art. 8 (h) CBD requires of the parties “as far as possible and as appropriate” to “prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species”. It also commits the parties in Art. 6 (a) to “develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes”. What the CBD has not brought forth to date are farther reaching, practical obligations—for example, in the form of an independent IAS protocol. The institutions created by the CBD, especially the Conference of the Parties (COP) (Art. 23 CBD), have, however, adopted a range of non-binding (“soft law”) but, in practical terms, important resolutions regarding how to manage the IAS issue; in particular, they have clarified a number of conceptual issues (COP 2002), developed a set of “Guiding Principles” for dealing with IAS (COP 2002) (Holljesiefken 2007: 67ff.), and formulated targets. In the “Aichi Biodiversity Targets” from 2010, for example, target 9 states: “By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.”

It can be noted, in summary, that the CBD grants the parties to it a wide range of options for dealing with IAS and relies primarily on the states to implement their own strategic plans but to heed the Guiding Principles in doing so. In addition, the COPs provide a forum for communicating and conveying information about practical further steps. While generally applicable to the marine environment (Article 22(2) CBD; see Wolfrum and Matz-Lück 2000), the CBD contains no *specific* stipulations with regard to the protection of marine ecosystems. Due to the lack of legally binding measures at the international level and the lack of common implementation standards, the wide scope given to states to implement the voluntary measures will most likely lead to inconsistencies in terms of how the transboundary problem of marine invasive species is addressed by individual countries (Bostrom 2009: 880). Hence, while in theory having the prevention approach and the precautionary principle at heart, the CBD by itself does little to advance consistent international technological standards and performance benchmarks regarding the prevention, control or eradication of non-indigenous species which threaten marine ecosystems.

48.3.2 *Global Marine Conventions*

Arguably one of the most important international environmental agreements is the 1982 United Nations Convention on the Law of the Sea (UNCLOS) (Birnie et al. 2009: 3), coined the ‘constitution for the oceans’ by Tommy T.B. Koh, President of the Third United Nations Conference on the Law of the Sea. The fact that even states which have not ratified UNCLOS, such as the United States, comply with it for the most part underlines the international legal clout of the Convention.

According to Article 196(1) on the use of technologies and the introduction of alien or new species, states ‘shall take all measures necessary to prevent, reduce and control pollution of the marine environment resulting from the use of technologies under their jurisdiction or control, or the intentional or accidental introduction of species, alien or new, to a particular part of the marine environment, which may cause significant and harmful changes thereto’. While the introduction of an article dedicated to alien species is to be welcomed, the precise interpretation of the provision is still being debated. The main question is whether the introduction of potentially harmful alien species constitutes ‘pollution’ of the marine environment or whether it should be classified as some other form of environmental harm (Firestone and Corbett 2005: 303) Zink 2016: 123ff). Article 1 (4) of UNCLOS defines “pollution of the marine environment” as “the introduction by man, directly or indirectly, of substances or energy into the marine environment, including estuaries, which results or is likely to result in such deleterious effects as harm to living resources and marine life, hazards to human health, hindrance to marine activities, [...] impairment of quality for use of sea water and reduction of amenities;”. If we were to place alien species within the category of pollution, it would certainly impose stricter legal obligations and responsibilities upon states, such as ensuring that species which may cause harm do not spread beyond areas of national jurisdiction (Article 194(2) UNCLOS), or being liable for transboundary invasions of such species (Article 235 UNCLOS).

However, since UNCLOS fails to link the problem of non-indigenous species specifically to the articles regarding pollution, it does not trigger concrete legal obligations for the adoption of uniform and rigorous rules concerning the management of non-indigenous marine species (Bostrom 2009: 881; Holljesiefken 2007: 106).

Furthermore, two other important global marine conventions, the International Convention for the Prevention of Pollution from Ships of 1973, as modified by the Protocol of 1978 (hereinafter MARPOL 73/78), and the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (hereinafter London Convention), do not cover living organisms at all, and thus do not address the challenges posed by non-indigenous species at all (Holljesiefken 2007: 106).

48.3.3 Regional Sea Conventions

While regional conventions are playing an increasingly important role in international environmental law, provisions on marine invasive species are scarce. The Convention on the Protection of the Marine Environment of the Baltic Sea Area (hereinafter Helsinki Convention), for example, is aimed at the “ecological restoration of the Baltic Sea, ensuring the possibility of self-regeneration of the marine environment and preservation of its ecological balance” (Preamble of Helsinki Convention). Of particular relevance here is Article 5 on harmful substances, which obliges the parties to “undertake to prevent and eliminate pollution of the marine environment of the Baltic Sea Area caused by harmful substances from all sources

[...]. In addition, Article 15 on nature conservation and biodiversity requires them to “individually and jointly take all appropriate measures with respect to the Baltic Sea Area and its coastal ecosystems influenced by the Baltic Sea to conserve natural habitats and biological diversity and to protect ecological processes.” However, the text of the Helsinki Convention, when viewed in isolation, fails to introduce concrete measures concerning invasive species.

Similarly, the Convention for the Protection of the Marine Environment of the North-East Atlantic (hereinafter OSPAR) does not contain specific regulations on IAS, but requires member states to “take all possible steps to prevent and eliminate pollution” and “take the necessary measures to protect the maritime area against the adverse effects of human activities so as to safeguard human health and to conserve marine ecosystems and, when practicable, restore marine areas which have been adversely affected” (Article 2(1)(a) OSPAR).

In order to spell out these rather broad provisions, both the governing body of the Helsinki Convention, HELCOM, and the OSPAR Commission have issued several documents and policy papers to address the very particular risks and challenges of managing invasive species. These include, for example, the HELCOM Guide to Alien Species and Ballast Water Management in the Baltic Sea (HELCOM 2014). Furthermore, the two commissions have worked jointly on harmonizing their procedures and have developed an online risk assessment tool for alien species transfers via the ballast water of commercial ships (http://jointbwmexemptions.org/ballast_water_RA/apex/f?p=100:LOGIN:15542751493980:::).

48.3.4 Ballast Water Management Convention

In order to address some of the apparent shortcomings of the international legal framework on the management of marine invasive alien species, the International Maritime Organization (IMO) has developed several mechanisms to tackle the introduction of non-indigenous species through ballast water. An important step in this endeavour was the adoption of the Guidelines for the Control and Management of Ships’ Ballast Water to Minimize the Transfer of Harmful Aquatic Organisms and Pathogens (1997). The measures recommended by the IMO include actions to minimize the uptake of organisms by avoiding areas known to contain harmful organisms, cleaning ballast tanks, and avoiding unnecessary discharges of ballast water (IMO 1997, paras 9.1.1–9.1.3). However, due to the fact that these were voluntary guidelines, compliance was very low (Bostrom 2009: 883). Acknowledging the shortcomings, the IMO’s Marine Environmental Protection Committee (MEPC) drafted the text for the International Convention for the Control and Management of Ships’ Ballast Water and Sediments (the Ballast Water Management Convention), which was adopted in February 2004 and is due to enter into force on 8 September 2017.

The Ballast Water Management Convention is the first international agreement that seeks to “prevent, minimize and ultimately eliminate the transfer of harmful aquatic organisms and pathogens through the control and management of ships’ bal-

last water and sediments”. It is based to a large extent on the precautionary approach and is influenced by the debate on Article 196(1) of UNCLOS. In order to achieve broader implementation, the Convention applies not only to the flag-bearing ships of contracting parties but also to ships “which operate under the authority of a Party” (Article 3(1))—i.e. vessels which operate within the territorial waters of a particular state and are thus subject to its laws.

In order to achieve its goal, the Ballast Water Management Convention sets out specific requirements for discharges of ballast water, including ballast water exchange procedures. For example, the Convention calls upon ships to conduct a ballast water exchange with a rate of effectiveness of at least 95% (Annex D-1, para 1); this should, whenever possible, be conducted at least 200 miles offshore and at a depth of at least 200 m (Annex B-4, para 1.1). In addition, the Convention sets binding performance standards which regulate the number of organisms allowed in ballast water discharges and limits the concentrations of “human health related” microbes, or indicator microbes (Annex D-2, paras 1 and 2).

Annex D-3 further stipulates that all treatment technologies are subject to IMO’s approval. Interesting here is the distinction between technologies that employ an “active substance,” and those that do not (Annex D-3, para 2). An active substance is defined as “a substance or organism, including a virus or a fungus, that has a general or specific action on or against Harmful Aquatic Organisms and Pathogens” (Annex A-1, para 7). If a system uses active substances, it must comply with additional requirements before being approved, in order to ensure “that the use of the [active substance] poses no harm to the environment.” Importantly, the performance standards do not permit the grandfathering of older vessels, and thus entire fleets are required to shift technologies or management practices within the specified time schedule (Bostrom 2009: 886).

In order to ensure a high level of compliance, the Convention creates a legal obligation for ships to retain detailed records of the vessel’s ballast water operations (Annex B-2) and for each vessel to develop a ballast water management plan describing how the provisions will be implemented (Annex B-1). Furthermore, inspections of a ship’s ballast water certificate may be conducted and samples of its ballast water taken (Article 9). In case a vessel violates the Convention’s provisions, the Convention authorizes the state to take several actions—including bringing proceedings in its own court (Article 8(2)) and prohibiting the ship from discharging ballast water (Article 10(3)). Several provisions of the Ballast Water Management Convention refer to guidelines to be developed by the IMO and reviewed by the MEPC, which allows for timely updates as new knowledge becomes available. Several of such guidelines have since been developed and adopted, including guidelines for ballast water sampling (G2) (resolution MEPC.173(58)); guidelines for ballast water management and development of ballast water management plans (G4) (resolution MEPC.127(53)); guidelines for ballast water exchange (G6) (resolution MEPC.124(53)); and guidelines on designation of areas for ballast water exchange (G14) (resolution MEPC.151(55)).

The Ballast Water Management Convention, in conjunction with the various other efforts by the IMO, might be able to drive technology adoption as well as

strengthen enforcement by setting clear goals for the treatment of ballast water. This would certainly constitute an improvement to the current international legal regime, which is far from comprehensive.

48.3.5 *Specific European Regulations and Directives*

48.3.5.1 EU-IAS Regulation

The EU-IAS Regulation from 2014 is the EU's foundational piece of legislation for the management of IAS. It imposes a ban on importing, keeping, breeding, purchasing, using, exchanging and releasing certain (listed) species (Art. 7). It also contains further obligations to do with identifying pathways of introduction (Art. 13), setting up surveillance systems (Art.14 ff.) and eradicating not yet established IAS “of Union concern” (Art. 17 ff.), along with the necessary requirements for applying the programme to combat and monitor IAS in practice (definition of terms and compilation of lists—Art. 3 ff.).

The most important instrument to be implemented by the new regulation is a legally binding “List of invasive alien species of Union concern” (hereinafter EU-IAS list) to which the bans and extended obligations refer (Art. 4). The phrase “of Union concern” does not mean that the species identified need to be “invasive” in the entire EU but merely that its “adverse impact has been deemed such as to require concerted action at Union level” (Art. 3(3)). This criterion is likely to be met regularly in the case of marine IAS.

It is the European Commission that is responsible for compiling the EU-IAS list. It makes its decision in the legal form of implementing regulations (Art. 4(1)) and is supported in this by a “Scientific Forum” consisting of representatives from the scientific community who can be appointed by the EU Member States.

The EU-IAS Regulation defines the material criteria for including species in the list of Union concern. The decision must be backed up by, among other things, scientific research; here, uncertainties can be dealt with by applying the precautionary principle (Köck 2015: 166f). The decision must also be taken on the basis of a risk assessment, involving consideration of not just the risks but also the benefits of introduction (Art. 5 (h)) (Köck 2015: 168). In the summer of 2016 the EU Commission adopted an initial list containing 37 species (Commission Implementing Regulation (EU) 2016/1141 of 13 July 2016), which meet the material criteria and to which the new prohibitions apply (Köck 2016). Thus far, however, this list contains few species of relevance to marine ecosystems.

48.3.5.2 EU Marine Strategy Framework Directive

The EU's Marine Strategy Framework Directive (hereinafter MSFD) commits the Member States to develop strategies and programmes in order to protect and preserve the marine environment, prevent its deterioration or, where practicable,

restore marine ecosystems in areas where they have been adversely affected; andb) prevent and reduce inputs in the marine environment, with a view to phasing out pollution (...), so as to ensure that there are no significant impacts on or risks to marine biodiversity, marine ecosystems, human health or legitimate uses of the sea (Art. 1, (2)).

The strategies to be developed by the Member States are committed to the goal of achieving or maintaining good environmental status in the marine environment by 2020 (Art. 1 MSFD) (Markus et al. 2011: 59–90; Markus 2013)). In doing so, the Member States must also take account of risks that may arise from biological disturbance. In this connection the MSFD mentions, among others, the “introduction of non-indigenous species and translocations” (Annex III, Table 2). The Member States were to devise the strategies and requisite assessments for taking stock and evaluating by 2012 and the programmes of measures by 2015. Germany, which devised its strategy and programme of measures on schedule, can be mentioned as an example in this context. In terms of the objectives, it is guided by the IAS targets of OSPAR and HELCON: endeavour to limit the introduction of non-indigenous species by human activities to levels that do not adversely alter the ecosystems (BMUB 2016: 10; OSPAR-Commission 2010b: 7). In the part of the programme detailing the measures, however, the sole references are to those contained in the IMO Ballast Water Management Convention, the regulation (EC) concerning the use of alien and locally absent species in aquaculture, and the EU-IAS Regulation (BMUB 2016: 29), so that the MSFD currently offers no farther-reaching suggestions for dealing with non-indigenous species (NIS) and IAS.

48.3.5.3 Regulation (EC) Concerning Use of Alien and Locally Absent Species in Aquaculture

The EC had created a special piece of legislation for dealing with NIS in aquacultures in 2007, referring to the CBD in doing so. Regulation (EC) No 708/2007 of 11 June 2007 concerning the use of alien and locally absent species in aquaculture (hereinafter Aquaculture Regulation) stipulates, among other things, that aquaculture operators intending to undertake the introduction of an alien species or the translocation of a locally absent species (...) shall apply for a permit from the competent authority of the receiving Member State. The requirement of a permit does not apply to all species listed in Annex IV (such as the Pacific cupped oyster, Japanese or Manila clam, arctic char and various freshwater fish) (Art. 2 (5)). The permit procedure is conducted on the basis of an Environmental Risk Assessment (Art. 9) whose individual steps are regulated in Annex II. The permit may be granted only in cases where the risk assessment, including any mitigation measures, show a low risk to the environment (Art. 9 (4)). Art. 9 (4) also stipulates explicitly that the precautionary principle is to be applied whenever this judgement cannot be made with the necessary certainty.

At EU level, then, an effective management mechanism for the vector of aquacultures has been available for some 10 years, albeit it does not correspond in every

respect to the regulatory approach taken by the EU-IAS Regulation. The key issue in an Environmental Risk Assessment—unlike in risk assessments within the EU-IAS Regulation—is not benefit. Considerations of benefit play a role only in relation to the species listed in Annex IV. The Aquaculture Regulation provides no special procedure, however, for including species in the Annex IV list.

48.4 Concluding Remarks and Further Perspectives

The study has shown that, beginning with the CBD, a wide range of management approaches have been developed for dealing with NIS and IAS in the context of protecting marine ecosystems and ecosystem services. For the most part, these approaches rest upon strategies and programmes (of measures) which generally have been derived from qualitative targets and key institutional decisions enshrined in international agreements. One example worth mentioning is the important work of the CBD Conference of the Parties aimed at developing an IAS management strategy. Another is the work of the commissions established through regional marine protection treaties, such as the OSPAR Commission and the strategy it oversees, which also addresses NIS and IAS management measures. The development of appropriate strategies and programmes is also a key feature of the IMO's Ballast Water Management Convention, perhaps the most important agreement aimed at protecting marine ecosystems from the risks posed by NIS and IAS.

The international agreements as well as regional legal provisions, such as EU laws on the IAS issue, are not merely limited to proscribing the development of strategies and programmes, however; in many cases they also regulate specific instruments, such as permit requirements (e.g. EC-Aquaculture Regulation), risk assessments (EC-Aquaculture Regulation; EU-IAS Regulation), and technical standards aimed at protecting marine ecosystems (IMO Ballast Water Management Convention).

In all these cases, priority has been given to a management approach that focuses on prevention and thereby includes the precautionary principle, while also taking account of costs and benefits (see especially the EU-IAS Regulation). So far there is little information available about the success of these measures—due in part to the fact that some important regulations have only recently been adopted (such as the EU-IAS Regulation) or else are soon to come into force (IMO-Ballast Water Management Convention).

Of particular interest for the further development of mechanisms to protect marine ecosystems from the risks posed by NIS and IAS is European legislation, because it has established some important and exemplary priority issues, with regard to both the effectiveness of regulations and to the regulatory approach. Worthy of mention in this connection are the Aquaculture Regulation and the EU-IAS Regulation with its binding list of IAS of Union concern and the establishment of procedures for developing this list further.

Whether or not it is possible to protect marine ecosystems effectively from the risks posed by NIS and IAS depends not only on further introductions being prevented, however. It is also dependent on the international community taking effective measures to tackle climate change.

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