

8 DISEASE ZONING

8.1 Purpose

This section supports Section 8 of the *Technical Guidelines* and provides guidance in how to develop zoning plans. Because there is little experience in aquatic animal disease zoning in the Asia Region, the information in this section is based on experience from other regions.

Zoning for disease purposes allows the identification of specific geographical areas within a country or neighboring countries, as having a defined status with respect to a particular disease. This can facilitate the continuation of trade activities, despite a disease incursion into a particular area, through the establishment and identification of specified zones free of the disease so that only the infected zone is placed under movement restrictions.

8.2 Background

Traditionally, when evaluating the animal (terrestrial and aquatic) disease situation within a country, the country has been judged as a whole. Thus, if an infectious disease existed somewhere within a country's borders, or if its presence was strongly suspected, the whole country was considered to be infected.

However, ecological, geographical and hydrographical barriers, rather than a country's frontiers, can be effective in containing diseases (or keeping them out). Such barriers can be used to delineate "zones," whether "infected" with, or "free" of, a specific disease, or where they are of uncertain status and under surveillance. When a country suffers a disease incursion into a particular farm or water system, an effective zoning scheme can allow the rest of the country or other ("free") zones within the country to continue trade. Only the infected zone is placed under movement restrictions. The OIE code provides technical guidance to member countries planning to adopt the zoning concept i.e., zonation based on the distribution or absence of certain diseases/agents within a country or adjacent countries. This has two objectives:

- it shows that there is a surveillance program in place, with clear documentation (see 8.4) of the health status of exported aquatic animals, and
- it provides importing countries and zones free of specified disease(s) with justification for import conditions/restriction based on the clear definition of the health status of aquatic animals in the receiving waters.

This chapter describes the different types of zones currently recognized by the OIE for aquatic animal diseases, details movement principles under a zoning policy, explains general requirements for zoning, lists the OIE zoning requirements for freedom from specific diseases notifiable to the OIE (the list of OIE-notifiable diseases is given in Box 8.1), and highlights issues that countries need to consider for following a zoning approach for aquatic animal diseases. The chapter draws on information in the OIE *International Animal Health Code* (2000a) and the OIE *International Aquatic Animal Health Code* (2000b). It also describes how the European Union (EU) is achieving zonation for two major salmonid diseases (viral haemorrhagic septicaemia (VHS) and infectious haematopoietic necrosis (IHN)) under EU Directive 91/67/EEC. It is important to note, however, that this requires significant financial and specialized expertise support through well-established industry and/or government agencies or

Box 8.1. Diseases of aquatic animals notifiable to the OIE (see OIE 2000b).

Fish

Epizootic haematopoietic necrosis
Infectious haematopoietic necrosis
Oncorhynchus masou virus disease
Spring viraemia of carp
Viral haemorrhagic septicaemia

Crustaceans

White spot syndrome virus
Yellow-head Disease Virus
Taura Syndrome Virus

Molluscs

Bonamiosis
Haplosporidiosis
Martelliosis
Mikrocytosis
Perkinsosis

programs. Since such support structures are still relatively rare, on a national and international scale within the Asia Region, this chapter outlines both the OIE standards, as well as other methodology which will help develop zonation until the OIE standards can be met.

8.3 Definition and Description of Zones

What are "zones"?

Zones are usually clearly delineated geographical areas within a country, but they can cross borders of adjacent countries sharing one or more water catchments. Coastal zones can also be defined, but this is more difficult and requires oceanographic information (tidal exchange, current dynamics, etc.). Different diseases have different means of spread, thus, delineation of zones may vary depending on the particular disease or host(s) concerned. Zones usually refer to a particular disease, rather than several, or all, significant diseases.

How are zones delineated?

For terrestrial animals, an infected zone on land may simply be defined as an area of a specified radius around an infected property. For aquatic animals, delineation of zones is more difficult. Most inland farms or sites are connected, at some point, to river systems or other waterways. This means any infectious agents present can be released to surrounding wild populations or to farm sites downstream and could result in disease spread and/or establishment of persistent reservoirs of infection. Thus, for culture production in freshwater systems, a zone is usually an entire river system or water catchment area. In certain cases e.g., upstream of a permanent physical or ecological barrier that prevents upstream migration of fish, the river system may be subdivided. If a disease emerged upstream of such a barrier, this could not be isolated from downstream waters, so all become one infected zone for that disease. Another freshwater example of possible sub-zonation within a catchment area are farm sites supplied only with well-water or spring sources and without effluent discharge or drainage into surrounding river-water resources in the vicinity. These can be treated as isolated sites that are not affected by the disease status of the river system and can be treated as individual "mini-zones." Generally, however, the presence of disease in a pond farm may influence zonation for the entire river system and other farms connected to the same drainage system.

Types of zones defined by OIE

The OIE recognizes three types of zones for diseases of aquatic animals: i) free zones; ii) surveillance zones; and iii) infected zones. The criteria for each are:

Free zone

"A free zone can be established within a country or countries where the disease is present (see Box 8.2). In the free zone, there must be knowledge of the location of all aquaculture establishments and populations of wild aquatic animals containing susceptible species. Suspected outbreaks of the disease must be investigated immediately by the Competent Authority (CA). Outbreaks must be reported to the OIE. If necessary, the free zone is separated from the rest of the country and from the infected neighbouring countries by a surveillance zone. Importation of aquatic animals from other parts of the country or from countries where the disease still exists

Box 8.2. Example - CE infected but SVC free zone.

Country 'X' has widely dispersed inland carp farms. Carp erythrodermatitis (CE) is enzootic in a particular river system of X, and is carried by wild fish populations in the river system. There have been no attempts at eradication or detailed monitoring, thus the entire river system, and its tributaries, are considered to constitute a single "CE-infected zone." All farms in Country X, however, are believed to be free of spring viraemia of carp (SVC), and the country is concerned about SVC introduction. Therefore, the Competent Authority of Country X runs a surveillance and monitoring program throughout the entire country aimed at detection of this virus. The program uses OIE guidelines, and, after two years of no detection of SVC, the entire country is recognized by OIE as "SVC-free". Thus, Country X is "CE infected, SVC free".

into the free zone must take place under strict controls established by the Competent Authority."

"The free zone should not be dependent on importation of aquatic animals or aquatic animal products from infected zones or countries which could introduce the disease agent" (OIE 2000b).

Free "aquaculture establishments" can be located within an infected zone, if they use a protected independent water supply, and meet other strict conditions, to demonstrate freedom of a the disease of concern (record-keeping, surveillance and monitoring logs, etc.).

Surveillance zone

"A surveillance zone must have certain minimum dimensions, with a precise geographical limitation based on hydrological data and the nature of the disease (see Box 8.3). Aquatic animal movements must be controlled. The surveillance zone must have an advanced degree of disease control and surveillance. Suspected outbreaks of the disease must be investigated immediately and, if confirmed, eliminated. A mechanism for immediate reporting to the Competent Authority must be in place. Adequate surveillance activities must follow in order to ascertain the potential spread of such outbreaks. Accordingly, it may be necessary to modify the boundaries of the zone."

Box 8.3. Example - SVC virus detection in a previously SVC-free country

Country 'X' is officially (internationally) recognized as SVC free. There have never been any recorded outbreaks of the disease and the country runs a surveillance program to specifically detect the virus, even in the absence of clinical signs. The program uses OIE guidelines, thus Country X is recognized as being 'SVC-free'. During routine monitoring, carp on a small farm are found to be infected with SVC virus. This farm, the river system to which it connects, plus all farms connected to the river thus become a single "SVC-infected zone" and should be separated from the rest of the country by a "surveillance zone". If the disease is "stamped out" on the affected site(s), the infected zone may be re-categorized as a "surveillance zone". All farms unconnected to the affected river system, maintain "SVC free zone" status, but the national "SVC-free country" status is lost.

"Importation of susceptible aquatic animals into the surveillance zone from parts of the country or from other countries where the disease exists can only take place under controls established by the Competent Authority. Freedom from infection should be confirmed by appropriate tests" (OIE 2000b).

Surveillance zones are sometimes established as "buffers" between an infected zone and a free zone. They serve to protect, and often to expand the free zone. They are also used to define zones for the pre-approval period (2 year minimum). when surveillance data are being gathered to demonstrate freedom from one or more specified disease(s).

Infected zone

"An infected zone is a zone where the disease is present, in an otherwise disease free country [or adjacent countries]. A surveillance zone will separate the infected zone from the remainder of the country [or countries]. Movement of susceptible aquatic animals out of the infected zone into the disease free parts of the country must be strictly controlled. Four alternatives can be considered:

- no live aquatic animals may leave the infected zone, or
- aquatic animals can be moved by mechanical transport to special aquatic animal slaughtering premises/mollusc and shrimp production facilities located in the surveillance zone for immediate slaughter, or
- exceptionally, live aquatic animals can enter the surveillance zone from an infected zone under suitable controls established by the Competent Authority. For diseases in which the disease agent constitutes a surface pathogen, appropriately disinfected eggs can enter a surveillance zone. Freedom from infection of these aquatic animals must be confirmed by appropriate tests before entering the zone, or
- live aquatic animals can leave the infected zone if the epidemiological conditions are such that disease transmission cannot occur." (OIE 2000b).

8.4 Movement of Aquatic Animals between Zones

The principal aims of zoning are to facilitate trade for free zones within an otherwise infected country, and to protect those free zones against the introduction of pathogens. It may be possible to geographically expand zones, in situations where pathogens can be eradicated (although possible in isolated pond or land-based facilities, this is rarely achieved in open-water aquatic systems). To achieve these aims, control of movements of aquatic animals between infected zones, surveillance zones, free zones and zones of unknown status, is necessary (see Box 8.4). In order to accurately assess the health risks associated with moving aquatic animals from one zone to another, it is necessary to know if the animals to be moved are susceptible to the disease(s) of concern. This may not always be known. "Susceptibility" can range from manifest disease, to non-clinical "carriage" of the infectious agent. For notifiable diseases, OIE advises that export stocks are certified as coming from sources free of these diseases, regardless of species susceptibility. Such certification requires OIE-based surveillance to establish "free-zone" status³. The European Union regard all live fish species not known to be susceptible to their listed diseases of concern (currently IHN and VHS for finfish) as being potentially capable of transferring these diseases to free countries, zones or farms, from infected waters, unless otherwise proven (see example given in Box 8.5). Alternative methods of surveillance and zonation may be used for diseases of importance to the region, but not listed as "notifiable" by OIE e.g., EUS (see *Technical Guidelines* Sections 8 and 9).

Box 8.4. The movement principle of zoning.

Live aquatic animals may be moved between zones with the same infectious agents present, or from zones with fewer/none of the same infectious agents that are present in the receiving waters. They may not be moved from zones with infectious agents that are absent from the receiving zone.

8.5 Requirements for Disease-Free Zoning

General requirements

Free zones can be developed within a country, according to a surveillance scheme developed by that country or by mutual agreement between neighboring countries sharing one or more river systems. In most cases, the OIE guidelines are followed in order to meet international trade requirements under World Trade Organization (WTO) protection from non-tariff trade barrier disputes. OIE requirements to achieve disease-free zone status are the following:

- effective organization and infrastructure within a country for aquatic animal disease control, including administrative, legal and financial resources;
- effective disease control and surveillance, including resources to supervise boundaries, ensure prompt reporting of disease outbreaks, and within-country capability to diagnose OIE-listed diseases (or have access to OIE reference laboratories);
- mandatory reporting of all OIE-listed diseases and/or disease agents, as soon as they are detected (see Annex V);
- establishment and enforcement of zones by national legislation;
- clear delineation of zones by effective boundaries;

Box 8.5. Example - export of carp from a VHS-infected zone into a country recognized as VHS free

A fish farmer in a VHS-free country wishes to import carp for grow-out. A potential supplier is located in a neighboring country, within a VHS-infected zone. Although carp are not listed as being susceptible to VHS, they could potentially transfer the virus. Based on OIE guidelines, all live fish imported into a VHS-free country must be from other countries with VHS-free status or from VHS-free zones within a country not declared VHS-free. This import restriction should only be lifted when a particular species is clearly demonstrated to be unable to carry viable VHS virus.

³OIE *International Aquatic Animal Health Code* (3rd edn., 2000) Part 1. Section 1.5. Import/Export Procedures. Chapter 1.5.2. Aquatic Animal Health Measures Applicable Before and After Departure. Article 1.5.2.2.; and Chapter 1.5.5. Aquatic Animal Health Measures on Arrival. Article 1.5.5.1., item 3.

prevention of the movement of live animals across zone boundaries, unless from a zone of equal or better (disease agents present in receiving waters but absent from exporting waters) aquatic animal health status.

For zonation in countries lacking some or most OIE requirements, it is important to note that these are aimed at international trade and are not necessary for establishing zones based on mutual regional or intra-national health concerns. In addition, diagnostic expertise, related infrastructure, and legal foundations often require time to become established. Under these circumstances, the OIE requirements can be used as guidelines, since *any* surveillance data will be a valuable resource to enhance identification and development of potential OIE-level zones. If not already underway, this work should be started as soon as possible for all aquatic animals with live trade value. Diagnostic capabilities for Level I-III screening are described in Section 6 and surveillance strategies are described in the *Technical Guidelines*, Section 9.)

Disease-specific requirements

The OIE code provides a generic template of requirements for the diseases notifiable to the OIE. However, different diseases may have different profiles within a country, including host range and mode(s) of spread. Thus, different diseases usually require different zoning boundaries.

A disease-free zone may be established within the territory of one or more countries if:

- aquaculture establishments and wild populations containing susceptible species have been tested in an official fish health surveillance scheme for at least the previous two years using the procedures described in the OIE *Diagnostic Manual for Aquatic Animal Diseases* (OIE 2000c);
- the disease agent⁴ has not been detected during this two-year period.

Such free zones must comprise:

- one or more entire water catchment areas from the sources of the waterways to the sea, **or**
- part of a catchment area from the source(s) to a natural or artificial barrier that prevents the upward migration of fish from lower stretches of the waterway, **or**
- part of a coastal area, or estuary, with a precise geographical delimitation, that consists of an homogenous hydrological system.

Such zones must be clearly delineated on a map of the territory of the country concerned by the Competent Authority and must observe the conditions referred to in Articles 2.1.1.2., 2.1.1.3. and 2.1.1.4 of the OIE code (see OIE 2000b).

8.6 Practical Application of Zoning in the European Union

The legal framework: Directive 91/67/EEC

The application of a zoning system for aquatic animal diseases has been operated in the European Union (EU) since 1993. In the late 1980s, EU Member States agreed that a "single market" should be established within the European Community to allow free movement of goods, including live animals, between all Member States. However, it was recognized that animal health controls would be required to prevent disease spread within the EU, since Europe does not have a uniform fish health situation. This led to the introduction of harmonized fish disease control measures (EC Directive 91/67/EEC – see references), which came into force on 1 January 1993. This directive stipulates the animal health conditions used to govern marketing of aquaculture animals and products within the EU and from outside the EU i.e., from "third countries."

⁴ Note that it is not sufficient to declare absence of clinical disease outbreaks!

Three categories of disease are listed according to seriousness and economic impact

List I covers highly infectious diseases exotic to the European Community and deemed likely to have a major impact should they be imported. Member States of the EU are required to take *immediate* action to eradicate any outbreaks that occur (currently restricted to infectious salmon anaemia [ISA]).

List II deals with highly infectious diseases of major economic impact present in certain parts of the EU but absent from other parts. Examples of such diseases are viral haemorrhagic septicaemia (VHS) and infectious haematopoietic necrosis (IHN) of finfish, and bonamiosis and Marteiliidiosis of bivalve molluscs. Zoning is applied for these diseases.

List III covers diseases that have a significant economic or ecological impact under certain circumstances and are considered by some Member States to warrant national control measures, particularly when a country is free of the disease(s) in question.

Approved zones and farms

In order to reduce the risk of List II fish diseases spreading within the EU, Member States with zones (or farms) deemed to be free of these diseases may undertake surveillance to maintain this status. The EU uses the term "approved zones" instead of "free zone" (used by OIE). In addition, the EU Directive does not recognize "disease-free country." Instead, emphasis is placed on establishing "approved zones," whether these are within a country, comprise the entire country, or cover parts or the whole of one or more country(ies).

Box 8.6. Continental and coastal zones.

Continental zones for fish

"A continental zone consists of:

a part of the territory comprising an entire catchment area from the source of the waterways to the estuary, or more than one catchment area, in which fish is reared, kept or caught,

or a part of a catchment area from the source of the waterways to a natural or artificial barrier preventing fish from migrating from downstream of that barrier.

The size and the geographical situation of a continental zone must be such that possibilities for recontamination, e.g. by migrating fish, are reduced to a minimum. That may require the establishment of a buffer-zone in which a monitoring programme is carried out without obtaining the status of approved zone."

Coastal zones for fish

"A coastal zone consists of a part of the coast or sea water or an estuary with precise geographical limits which consists of a homogeneous water system or a series of such systems. If necessary, a coastal zone may be deemed to consist of a part of the coast or sea water or an estuary situated between the mouths of two watercourses or of a part of the coast or sea water or an estuary where there are one or more farms, provided that *provision is made for a buffer zone on both sides of the farms*

Coastal zones for molluscs:

"A coastal zone consists of a part of the coast or sea water or an estuary with a precise geographical delimitation which consists of a homogeneous hydrological system."

There is provision for "coastal zones," covering estuaries or lengths of coastline, or 'continental zones,' consisting of one or more water catchment areas. Such zones are delineated by the CAs of the country(ies). The CAs must have legal powers to enforce the rules and conditions that apply to establishment and maintenance of an "approved zone." The EU definitions of continental and coastal zones are given in Box 8.6.

For continental territory, a zone usually comprises a minimum of an entire river system, including all tributaries, from their source(s) to the sea. Where a river system originates in

one country and then passes through one or more other countries before reaching the sea, management requires cooperation and harmonization of rules/services in the countries involved, if conditions for approval of the zonation are to be met. As with OIE zonation, rivers with impassable barriers can have upstream sub-zonation and coastal zones are delineated using hydrographical parameters e.g., bay or coast between two peninsulas, or areas separated by tide or currents.

Achievement and maintenance of "approved zone" status

Where a Member State of the EU considers that its territory, or part of its territory, is free of one or more of the List II diseases, it may submit to the European Commission evidence that the zone(s) concerned meet(s) the conditions laid down in Directive 91/67/EEC and, in particular, the detailed requirements of Annex B. In essence, all farms within the zone must have been under supervision of Official Services (Competent Authority) for at least two years, during which they have been found to be free from any clinical or other sign of List II disease(s) with two health inspections per year at a time when the water temperature favors development of the disease in question. The health inspections require examination of samples at an approved laboratory. The Member State (country) concerned must also provide evidence of its legal powers to enforce movement restrictions on fish (or bivalve molluscs) into the specified zone during the period of inspections, sampling and laboratory tests over this two-year period and thereafter. The European Commission examines the results, together with representatives of all EU Member States, and a decision (EC) for approval is reached based on these results.

Once a zone is approved, movements of aquatic organisms into the zone are restricted to those from other approved zones, where exporter and importer zone status is dependant upon continuing evidence that the disease agents(s) in question is (are) absent. This requires regular inspection of all the farms in the zone, with sampling and laboratory tests conducted at a defined maintenance size and frequency.

The EU Directive also provides for suspension, withdrawal and restoration of "approved zone" status if abnormal mortalities or clinical signs constitute grounds to suspect a listed disease. The CA(Official Services) of the country must be notified immediately and samples of clinically affected aquatic organisms sent to an approved laboratory to be tested for the listed pathogen. If results are positive, the CA (Official Services) will withdraw approved zone status for the entire zone or part of the zone, as necessary. The latter normally applies where an infected area can be separated from surrounding zones. Restoration of approved status is achieved following evidence of eradication.

Trade in aquatic animals between zones

Box 8.7. Examples of EU-approved zones

Since Directive 91/67 EEC came into force, approved zones have been established for VHS and IHN in several EU Member States (UK, Ireland, Denmark, France, Italy Sweden and Spain). Maps showing the delineated zones were submitted in support of the application for approved zone status. The European Commission provides a verbal description of the zones, based on these maps, in the Official Journal but the maps themselves are not published.

The movement of live farmed, or wild, fish and molluscs to waters within an "approved zone" is restricted to animals originating from within the same zone or from another zone with equal designation i.e., zones which are free of the same disease(s). There are no health-based restrictions to trade in live fish or bivalves, whether farmed or wild, within or between approved zones, or for introduction to any waters in non-approved zones within the EU (irrespective of which country the waters are in) other than for any safeguards agreed to by all Member States

for List III diseases. For all movements of live fish and their ova, or of live molluscs, *into* approved zones, documentation is required certifying that the fish (or molluscs) originate from a zone having the same List II disease status. Such documents are completed by the national Competent Authority for every consignment, within 48 hours of loading, and must accompany the fish throughout their transportation.

8.7 Issues to Consider in Individual Countries of Asia

Implementing a disease zoning system in the Asia Region

Although it may not be possible in the near future for some Asian countries to meet all the provisions for zoning specified by OIE or as practiced in the EU, the general principles for zoning and movement can be applied. As experience is gained in the compilation of disease surveillance data, and national legislation and infrastructures developed to control disease spread, the accuracy of zone definitions will increase. During any data collection period, however, there are a number of important basic considerations for initial development of zones.

Selection of diseases for zoning should take into account the benefits *versus* the cost of setting up and maintaining the zoning system. Benefits include reduction of disease spread and enhancing trade to other countries, or zones with the same disease status. Costs include the costs of surveillance, legislation, enforcement, certification, etc. An additional consideration is where establishment of a zone in shared water bodies such as, for example, coastal areas or the Mekong River, requires cross-border cooperation between neighboring countries.

When a country wishes to gain official recognition as being free from one or more diseases it believes to be exotic to its territory, it will need to establish an official health surveillance and monitoring system (see *Technical Guidelines*, Section 9). The diseases selected must be notifiable (mandatory reporting), and resources for these activities have to be allocated with responsibility given for long-term maintenance of the zoning system.

Clarification of jurisdictional issues is essential, especially determination of the CA for aquatic animal diseases for each country and, in the case of shared water resources, the mechanism for harmonizing each party's activities and administration of the process. Within a country, the CA may be the veterinary authority, or some other regulatory agency with responsibility for the health of aquatic resources e.g., the national fisheries department. In the case of shared water resources, the CA may be a mutually agreed existing authority or a newly established bi- or multi-lateral decision-making body. The CA must have, or have access to, aquatic animal health expertise used to specify, delineate and control the boundaries of each zone, including aquatic animal movements into and out of each zone.

Although zoning presents logistical challenges, with sufficient political will, technical and human capacity, infrastructure and cooperation, it is a mechanism with proven efficacy in decreasing the spread of aquatic animal diseases and providing clear benefits in terms of facilitating trade activities.

8.8 References

- Council Directive 91/67/EEC of 28 January 1991 concerning the animal health conditions governing the placing on the market of aquaculture animals and products (O. J. No. L 46/1, 19.2.1991 as amended by Council Directive 93/54/EEC (O. J. No. L 175/35, 19/7/1993), Council Directive 95/22/EEC (O. J. No. L 243/1, 11.10.1995), Council Directive 97/79/EC (O. J. No. L 24/31, 30.1.1998) and last amended by Council Directive 98/45/EC (O. J. No. L 189/12, 3.7.1998).
- OIE. 2000a. International Animal Health Code. Ninth edn., Office International des Épizooties, Paris, 473 p.
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