

## 5 PATHOGENS TO BE CONSIDERED

### 5.1 Purpose

The purpose of this section is to support the criteria outlined in the *Technical Guidelines* Section 5 - "Pathogens to be Considered" on developing national and regional lists of pathogens. One of the foundations in the development of health management procedures for responsible movement of live aquatic animals is the identification of pathogens of major concern. The development of a national pathogen list may take several years of monitoring and/or surveillance for specific disease agents. It will also require investigation of the regional and international literature, as well as public domain databanks (see Section 5.6 - Regional Disease/Pathogen Inventories and Databases), for disease information relevant to aquatic animals present in the country's waters.

### 5.2 Reasons for Inclusion of a Pathogen on a National List

Diseases which are included on a national list of significant pathogens should merit the effort which will be required to control their entry, establishment or spread within the country and Region. Although this usually means that diseases of commercially important species are given priority, diseases of other species that may be of socio-economic importance (e.g., those affecting artisanal fisheries) should not be overlooked. An example of the process of preparing a national disease list is given in Box 5.1).

#### ***Pathogen status within a country***

##### **Exotic to an entire country**

The disease and its causative agent have never been found, or reported, in any aquatic animal species in the country (see Box 5.2). The disease is known to have a significant socio-economic impact in other countries growing the same or related aquatic animal species. If no form of surveillance is in place to provide data to show the disease is absent, a specific surveillance program may be required.

##### **Occurs in certain parts of a country only**

Significant or persistent losses occur in one part of the country due to infectious disease. Other parts of the same country are unaffected, but contain susceptible aquatic species. Surveillance is required to clearly delineate the areas/stocks that are affected and unaffected.

##### **Occurs in part of a country -active control and eradication programs underway**

A disease is under a strict control program designed to reduce or eliminate it from the area of the country affected. If successful, some areas (or zones) may change disease status, or the disease may be redefined as exotic (this is rare).

**Box 5.2** Regional Example of Exotic Pathogen which merits inclusion on a national list.

Yellowhead Disease (YHD) of shrimp is exotic or not native to Australia; the disease had significant impact on aquaculture elsewhere in the world and there is a range of susceptible species in Australia; the disease is listed in Australia's 'National List of Reportable Species of Aquatic Animals'.

**Box 5.1.** An Example of Development of a National Lists of Diseases.

In early 1998, Australia's Fish Health Management Committee (FHMC) formally proposed to establish a *National List of Reportable Diseases of Aquatic Animals*. FHMC recommended that States and Territories implement the *National List* under State/Territory notifiable disease legislation or equivalent. In mid-1998, after considerable consultation with State and Territory governments and the private sector, the Commonwealth Government and the States and Territories governments endorsed the *National List*, as well as the formally proposed generic reporting strategy (see below).

The *National List* is a list of diseases, some exotic to Australia and some occurring in parts of Australia. The *National List* is **not** an inventory of diseases occurring in Australia. Diseases listed meet at least one of the following criteria:

- a disease is internationally notifiable to OIE;
- a disease is reportable to NACA/OIE under a regional reporting scheme (note that there is no legal reporting obligation to NACA/OIE); **or**
- a disease is of national and genuine concern to Australia..

For a disease to be listed because it is deemed to be of national and genuine concern to Australia, the following criteria must apply:

- a disease is exotic to Australia, or a disease does occur in parts of Australia, but vigilance is necessary to minimize its spread; **and**
- a disease would have significant socio-economic impacts if it occurred; **and**
- a disease can be clearly described by its etiology (causative agent).

An additional, but not compulsory criterion is met when control or eradication programs exist in one or several States/Territories, so that other States/Territories may wish to gain information on the status of the disease in the particular State/Territory administering the controls.

Whereas the OIE and NACA/OIE lists are internationally agreed upon, it is Australia's decision to add to, or delete from, the *National List*.

The *National List* is meant to be a tool to collate and disseminate information on diseases of national importance. "Reportable" in the national context implies merely the reporting *sensu stricto*. The *National List* is not intended to impose mandatory control measures for these diseases; therefore, the term "notifiable" has been deliberately avoided due to the connotations it carries in some States/Territories. Control measures would fall into the State/Territory portfolios and it is at their discretion to decide on appropriate control strategies.

Reporting on the diseases on the *National List* of reportable diseases of aquatic animals shall:

- meet international disease reporting obligations;
- provide a tool for negotiations in trade fora to support export certification and quarantine import policy;
- enable international acceptance of disease free "zones;"
- enhance the effectiveness of the control programs administered by individual States/Territories by ensuring national awareness of the diseases of concern of each State/Territory;
- guide the further development of diagnostic tests and surveillance protocols to meet the needs of Australian aquatic industries; and
- guide the development of an aquatic animal disease surveillance and monitoring system.

## **Pathogenicity**

A disease to be listed should not only be exotic, but also demonstrate a significant impact on species present in the unaffected country. This is relatively easy where the same species affected by the disease elsewhere, is/are present in the unaffected country, and where growing conditions are similar. Complications may arise, however, if the disease to be listed as "exotic" occurs in species and growing environments that differ significantly from those in the unaffected country. For example, the listing of white spot syndrome virus disease as an exotic disease in a national disease list for Nepal would be inappropriate, as penaeid shrimp do not occur in Nepal and the country has growing conditions which differ significantly from countries which have WSSV disease.

## **Infectious etiology of the disease**

The disease is caused by an infectious agent which can be transmitted horizontally (from individual to individual by direct contact; or via water-borne infectious stages, contamination of food or environmental surfaces; or vertically (through inclusion within eggs of infected broodstock (mainly viruses) or surface contamination of spawning products. Pathogens can also be included in national lists where they can be introduced by transmission via an intermediate or carrier host that exists in both affected and unaffected countries or zones. If transmission requires a specific intermediate host (e.g., many digeneans), and that host does not exist in the importing waters, such parasites may not merit listing, since they will have a curtailed life-span without their required host(s).

## **Adverse socio-economic or ecological impacts**

In addition, to a disease having a direct impact on the health of the susceptible aquatic animal species, it may also be listed if that impact is known, or likely, to cause significant adverse impacts on:

- socio-economics – (e.g., loss of jobs)
- food production
- traditional community structure
- the environment (e.g., via enhanced susceptibility to predation or reduced biodiversity through population reduction or ecological niche competition)
- mass mortality
- degradation of water quality

Pathogens of public health significance are not covered under the *Technical Guidelines*, although such concerns can justify national listing. Human health concerns usually fall under the mandate of public health or food inspection authorities.

## **5.3 Reasons for Exclusion of a Pathogen from a National List**

Pathogens which do not merit control efforts should not be included on national lists. These include pathogens which:

- have a broad geographic range, making control of entry/spread difficult to impossible, e.g., *Vibrio harveyi* (see Box 5.3);
- are opportunistic and whose pathogenicity is reduced by improved husbandry or handling, e.g., *Aeromonas hydrophila*;
- are difficult or impossible to distinguish from related established pathogens, using available diagnostic screening techniques.

**Box 5.3.** Reasons for excluding *Vibrio harveyi* (luminescent vibriosis) in the Philippines from the FAO/NACA and OIE pathogen lists:

- the bacterium is ubiquitous in the environment
- it occurs in the gut of healthy shrimp as part of their normal microflora
- it is an opportunistic pathogen that can be controlled by improved husbandry and/or water quality.

## 5.4 Existing International Pathogen Lists

As indicated above, not all infectious agents believed to be exotic to country need quarantine measures or health certification. Those which do are described in the following lists, and more details on their screening and diagnosis are provided in the *Asia Diagnostic Guide to Aquatic Animal Diseases* (ADG).

### **OIE lists of diseases of aquatic animals**

The OIE has two lists of diseases of aquatic animals (see Annex V):

#### **Diseases notifiable to the OIE**

Previously known as "List B" diseases, these diseases are now defined as "...the list of transmissible diseases that are considered to be of socio-economic and/or public health importance within countries and that are significant in the international trade of aquatic animals and aquatic animal products" (see Annex IV and OIE 2000). These diseases are normally reported only once a year, unless specific conditions require more frequent or interim reporting (e.g., the emergence of a notifiable or a significant "new" disease for the first time).

#### **Other significant diseases**

These diseases are defined as "...diseases that are of current or potential international significance in aquaculture but that have not been included in the list of diseases notifiable to the OIE because they are less important than the notifiable diseases; or because their geographic range is limited; or it is too wide for notification to be meaningful; or it is not yet sufficiently defined; or because the aetiology of the diseases is not well enough understood; or approved diagnostic methods are not available" (see Annex IV and OIE 2000a).

Information on OIE-listed diseases is available via *the International Database on Aquatic Animal Diseases*, which is housed at the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) Laboratory, Weymouth, United Kingdom (<http://www.cefas.co.uk/oie/index%5Fold.html>).

#### **NACA/FAO and OIE lists of diseases of aquatic animals**

The NACA/FAO and OIE lists of diseases reportable in the Asia-Pacific Region were developed to reflect the Asian situation. These lists include all OIE "notifiable diseases" and "other significant diseases," as well as a number of other serious diseases that occur in the Asia-Pacific Region (see Annex VI). This list is expected to be refined, as more data begins to emerge from national surveillance programs and development of diagnostic infrastructure. The diseases included on this list have been reviewed by NACA, FAO and OIE representatives, as well as the National Co-ordinators (NCs) and the Regional Working Group (RWG) at the two RWG meetings of the FAO/NACA Regional Technical Cooperation Programme (TCP) on "Assistance for Responsible Movement of Live Aquatic Animals" (TCP/RAS/6714 (A), TCP/RAS/9605 (A)). This review process became the responsibility of the Advisory Group on Aquatic Animal Health (AG), under the NACA Governing Council, following completion of the FAO/NACA Regional TCP. The OIE and FAO/NACA Quarterly Aquatic Animal Disease Reports (Asia and the Pacific Region) are published on a quarterly basis by FAO/NACA and OIE Regional Representation for Asia and the Pacific; available on the website of the OIE Regional Representation for Asia and the Pacific (<http://oie-jp.org>); while the FAO/NACA disease reports will be made available at the website of NACA (<http://www.enaca.org>).

## 5.5 Process of Compiling a List of Diseases

The list of diseases, as described above, should take into account the risk associated with a potential introduction into or spread within a country. The former is a fundamental component of import risk analysis (see *Technical Guidelines* – Section 11 and *Manual of*

*Procedures* - Section 10 - Import Risk Analysis). The decision-making process should be a consultative and transparent process, involving responsible agencies (fisheries, border control, quarantine officers, industry stakeholders, aquatic animal pathologists and epidemiologists, etc.).

## **5.6 Regional Disease/Pathogen Inventories and Databases**

### ***Background***

To prepare pathogen lists and evaluate the risks posed by proposed importations of live aquatic animals, quarantine workers and government policy makers must have access to accurate, comprehensive and up-to-date information on the known and potential pathogens occurring in their countries (e.g., identities, hosts, distributions, pathogenic significance, life cycles, zoonotic importance, etc.), as well as comparable information from the exporting countries. This information is essential for scientifically based risk assessments. Decisions based on such risk assessments must be timely, and be reached using standardized, rational and defensible decision-making procedures.

As noted by Humphrey (1995), the long-term management of national fisheries resources and protection of the aquatic environment require a thorough knowledge of the prevalence, distribution and pathogenic significance of infectious agents. A comprehensive understanding of the national disease status is also essential for establishing effective national strategies for aquatic animal health risk analysis, quarantine, certification, treatment, control and eradication programs. This is also a fundamental component of strategies for the protection of national biodiversity. Inventories of pathogens and parasites, therefore, form an essential component of any program that aims to prevent the international spread of diseases of aquatic animals. Some idea of the extent of our current knowledge on the parasites and diseases of aquatic animals can be gained by examining the number of species of fish occurring in the waters of countries of the Asia Region and, where possible, comparing these numbers with the numbers of species studied to any extent for parasites. For example:

- More than 2198 species of fish occur in Philippine waters (1916 marine, 166 freshwater and 116 euryhaline species) (FishBase 97). In the checklist of Arthur and Lumanlan-Mayo (1997), only 201 named species of parasites are recorded from 172 species of fish. Thus, less than 8% of the fish species found in the Philippines have been studied to any extent. The parasite and pathogen faunas are reasonably well known for only a handful of cultured species, and most of these are exotics introduced from other countries.
- For the nematodes of South Asian fishes (Soota 1983, Sood 1988) slightly over 410 species are reported from 180 species of fish. Since India alone has almost 1400 species of fish occurring its waters (FishBase 97), less than 13% of the species occurring in this region have been studied.
- Gussev (1974) reported that the Monogenea of about 60 of the 400+ freshwater fish species in the Indian fauna had so far been studied. He estimated that the number of monogeneans on the Indian subcontinent must be at least 5-10 times greater than the number of known forms.

These examples highlight the fact that the parasites and diseases of fishes of the Asia Region are very poorly known. However, it must be recognized that the knowledge base for cultured species is much stronger. Arthur and Ogawa (1996) noted that more than 70 marine and diadromous fishes are cultured in East and Southeast Asia. The economic importance of these species has lead, in some cases, to their intensive study. Furthermore, some species cultured in Asia (e.g., the carps and tilapias) have been widely distributed around the world for culture and other purposes, and thus their diseases have received additional attention in other regions, including Europe and North America.

Although the number of inventories of parasites and pathogens of molluscs has recently increased (e.g., Liu *et al.* 1993, Bower *et al.* 1994, Anderson *et al.* 1995, Cuif and Dauphin 1996, Hine 1996, Perkins 1996, Hine and Wesley 1997, Pass *et al.* 1997, Hine *et al.* 1998, Hine and Thorne 1998, Miyazaki *et al.* 1999, Wu and Pan 1999), our knowledge of their diseases is still less comprehensive than for many fish species. In contrast, the diseases of important cultured Asian crustaceans, such as the black tiger prawn (*Penaeus monodon*), the kuruma prawn (*P. japonicus*) and the giant freshwater prawn (*Macrobrachium rosenbergii*) are well studied. Since Lightner's *A Handbook of Pathology and Diagnostic Procedures for Diseases of Penaeid Shrimp* (Lightner 1996) was produced, there have been close to 200 new publications on prawn diseases, most of which have been from the Asia-Pacific Region. A few recent examples include: Flegel 1997, Owens 1997, Wang *et al.* 1997, Zhou *et al.* 1997, Zhan *et al.* 1998, Vandenberghe *et al.* 1998, Owens *et al.* 1998, Park *et al.* 1998, Sudha *et al.* 1998, Peng *et al.* 1998, Lavilla-Pitogo *et al.* 1998, Karunasagar *et al.* 1998, Tsai *et al.* 1999, Sukhumsirichart *et al.* 1999, Otta *et al.* 1999, and Liu *et al.* 1999.

## **Sources and status of existing data**

### **Historical Data**

With the possible exception of a few countries such as Australia and Japan, the published literature is the sole source of historical data on diseases and pathogens occurring in the Region. Original records of pathogens are widely scattered in the scientific literature, and appear in various types of documents. These range from peer-reviewed articles published in internationally recognized journals; reviewed and unreviewed proceedings, reports and abstracts of meetings and conferences; regional and national journals; departmental reports (both published and internal); and society and institutional newsletters; to photocopies of manuscripts and handouts distributed at workshops and training sessions and, more recently, electronic media (e.g., webpages).

The quality and reliability of data contained in these sources are quite variable, and reflect both the expertise of the workers and the stringency of scientific review given the publication. Individual data reports are also quite variable in the details given. While some authors give precise and detailed descriptions of pathogens, disease outbreaks, species affected, pathogen prevalence and intensities of infection, estimates of mortalities and economic losses, etc., such detailed reports are few. Many reports are only taxonomic (descriptive) in nature, which is also important in diagnosis, however, they contribute little information in other areas required for health management use.

In general, there is a paucity of trained specialists in the Asia Region. This, and other problems (e.g., lack of access to scientific literature, inadequate/inaccurate taxonomic descriptions, etc.), have led to difficulties in understanding the geographic distributions of individual pathogens that occur in the Region. As a result, much taxonomic review and revision is needed.

Summaries (e.g., synopses, checklists, guidebooks, identification guides, keys, etc.) of the parasites and pathogens infecting aquatic animals in the region are few. The following paragraphs briefly review the status of knowledge for the various sub-regions and mention some of the key references available to regional workers as starting points for the compilation of national pathogen databases.

### **South Asia**

The parasites of fishes were included in the series *The Fauna of British India including Ceylon and Burma* (Baylis 1936, 1939; Southwell 1930; etc.). The monographs of Soota (1983) and Sood (1988) summarize the nematodes reported from fishes of the South Asian Region, including records for Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka (Sood 1983, also includes Burma (Myanmar)). Soota (1983) deals with over 200 species of nematode infecting some 156 named marine and freshwater fishes of the Region. Sood (1988) considered the nematode fauna of fishes in South Asia to be fairly well known. He listed over 410 named species occurring in 180 named species of fishes. For the Digenea,

Mehra (1980) provides a monograph of the Order Fasciolatoidea infecting the Indian fauna, including species described up to about 1963. This volume was up-dated to 1978 by Srivastava (1982).

Gussev (1974) found that 27 of 37 fish species examined were infected by a total of 57 monogenean species, 40 of which were new to science. The total number of freshwater monogeneans described from the Indian subcontinent prior to Gussev (1974) was 80 species from 45 fish species, approximately 10% of the total freshwater fish fauna. An additional 20 species were noted in Sri Lankan freshwater fishes, Sri Lanka being considered faunistically indivisible from the Indian Peninsula.

Das and Das (1997) recently published *Fish and Prawn Diseases in India - Diagnosis and Control*, a volume useful to fish health workers and aquaculturists of South Asia. The book contains chapters on water quality, viruses, bacteria, fungi, protozoans, helminths, crustaceans, epizootic ulcerative syndrome, laboratory methods, disease management and surveillance. Another recent volume by Das (1997) provides a review of the status of epizootic ulcerative syndrome in India, while the diseases of cultured penaeid shrimp in India have recently been reviewed by Karunasagar *et al.* (1998).

### **Southeast Asia**

Kabata (1985) provided keys and illustrations to the parasites and diseases occurring in cultured fish of Southeast Asia. Unfortunately, the field of aquatic animal health has advanced so rapidly in the region that this volume is now out-dated.

Arthur (1992) compiled a comprehensive bibliography, including abstracts, from the fish health literature of Southeast Asia up to the end of 1990. Information is presented from over 800 articles originating from nine countries. In the only monograph on fish parasites so far published for Southeast Asia, Velasquez (1975) listed 50 named species of adult and 20 named species of larval Digenea occurring in 43 named species of marine and freshwater Philippine fish.

Arthur and Lumanlan-Mayo (1997) provide a comprehensive checklist of the parasites of Philippine fish. These authors list 201 named species of parasites (1 Apicomplexa, 16 Ciliophora, 2 Mastigophora, 1 Microspora, 9 Myxozoa, 90 Trematoda, 22 Monogenea, 6 Cestoda, 20 Nematoda, 5 Acanthocephala, 1 Mollusca, 12 Branchiura, 21 Copepoda and 5 Isopoda), but note that the parasites of the vast majority of native freshwater and marine fishes in the Philippines remain poorly studied or completely unknown.

Lavilla-Pitogo and de la Peña (1998) recently reviewed the bacterial diseases of cultured black tiger shrimp in the Philippines. Other valuable texts include a short review of the parasites of Malaysian fish by Leong (1979) and the volume *Health Management in Shrimp Ponds* by Chanratchakool *et al.* (1998). The latter contains a chapter on diseases of black tiger shrimp based on the authors' experiences in Southeast Asia (mainly Thailand). Another recent addition to shrimp disease information for Southeast Asia is the CD-ROM "*Diagnosis of Shrimp Diseases with Emphasis on the Black Tiger Shrimp (Penaeus monodon)*" by Alday de Graindorge and Flegel (1999), based mainly on the authors' experiences in Thailand.

Most recently, Tonguthai *et al.* (1999) have published a very useful diagnostic manual for finfish diseases that was developed especially to assist workers in the least developed countries of Southeast Asia.

### **East Asia**

In Japan, there has been considerable research effort on the parasites and diseases of the principal cultured species. A number of recent papers have reviewed the bacterial and viral diseases of kuruma shrimp (*Penaeus japonicus*) (Takahashi *et al.* 1998) and the parasitic (Ogawa and Yokoyama 1998), viral (Nakajima *et al.* 1998), and bacterial diseases (Kusuda and Kawai 1998) of cultured marine fishes. Japanese publications on fish health are listed in the bibliography published by the Fish Health Section, Asian Fisheries Society

(Wakabayashi 1994). A checklist of the parasites of Japanese salmonids has also been published (Nagasawa *et al.* 1987), as has a checklist of the parasites of freshwater fishes of Hokkaido (Nagasawa *et al.* 1989). However, to date, no comprehensive guidebook to the Japanese fauna has been prepared. Books in Japanese dealing with fish diseases and pathology include those of Hara (1972) and Egusa (1978, 1983).

For China, *An Illustrated Guide to the Diseases and Causative Pathogenic Fauna and Flora of Fishes of Hubei Province* was published some 27 years ago (Anon. 1973), and the series *Fauna Sinica* includes volumes on the Digenea (Chen *et al.* 1985), Hirudinea (Yang 1996) and Myxosporea (Chen and Ma 1998). A handbook on the diagnosis and prevention of fish diseases has also been published (Pan 1988), and a review of white spot syndrome of shrimp in Taiwan Province of China has recently become available (Lo and Kou 1998). Recently, Zhang *et al.* (1999) have published *Parasites and Parasitic Diseases of Fishes*, a guide to the genera of fish parasites reported from China.

For Korea, a review of the viral diseases of cultured marine fish was recently published by Sohn and Park (1998).

### **Australia**

Humphrey (1995) provides a checklist and selected bibliography of the pathogens, parasites and commensals of Australian aquatic animals. These data are the basis for definition of diseases exotic to Australia, disease diagnosis and control within Australia, and as a reference for research on diseases of aquatic animals. Information is presented in 52 tables giving: the etiological agent, disease name, host species affected in Australia, geographic distribution by province, and the reference(s) used. For each host category (finfish, crustaceans, and molluscs), individual tables for each taxon of disease agent (viruses, bacteria, fungi, protozoa, algae, poriferans, acanthocephalans, nematodes, annelids, cestodes, digeneans, monogeneans, aspidogastreaans, turbellarians, molluscs, branchiurans, copepods, isopods, decapods, ostracods, insects, and arachnids) are presented. In addition, tables are included for bacteria and fungi isolated from Australian aquatic organisms, but not associated with disease. More than 1700 transmissible agents have been reported from Australian aquatic animals, however, only a few are considered as having major pathogenic or socio-economic importance, and most have a restricted geographic distribution. The majority of are protistans or metazoans with no ascribed pathology. A recent review of the viral diseases of fish and shellfish in Australian mariculture has also been published (Munday and Owens 1998).

The Australian Quarantine and Inspection Service (AQIS) has recently published the results of import risk analyses (IRA) on non-viable salmonids and non-salmonid marine finfish (AQIS 1999a) and on live ornamental finfish (AQIS 1999b), and a handbook on the AQIS IRA process (AQIS 1998). Another useful publication is the *Australian Aquatic Animal Disease Identification Field Guide* (Herfort and Rawlin 1999). *Aquaplan. Australia's National Strategic Plan for Aquatic Animal Health 1998-2003*, was published in 1999 (AFFA 1999).

### **Other sources of information**

Because aquatic animal health is a relatively new field in most countries of the Asia Region, few, if any countries have yet attempted to establish national pathogen databases. Unpublished diagnostics records exist at a number of regional and national lead centers (e.g., AAHRI, Bangkok, Thailand; the Agri-Food and Veterinary Authority of Singapore (AVA); the National Fisheries Research and Development Institute (NFRDI) of Korea RO) and SEAFDEC-AQD, Tigbauan, Philippines;), however, the extent and potential usefulness of these for national aquatic health programs has not yet been examined.

Some countries, such as Japan and Australia, which report regularly to the Office International des Épizooties (OIE), have a significant amount of epidemiological data for nationally important pathogens in national data banks. However, many countries have little or no epidemiological data. OIE has developed an *International Database on Aquatic Animal Diseases*, which is housed at the Centre for Environment, Fisheries and Aquaculture



Science (CEFAS) Laboratory, Weymouth, UK<sup>2</sup>. Information on recent outbreaks of internationally important diseases can also be obtained through the OIE and FAO/NACA Quarterly Aquatic Animal Disease Reports (Asia and the Pacific Region) (e.g., see NACA/FAO 1999), and are also available from the websites of the OIE Regional Representation for Asia and the Pacific (<http://www.oie-jp.org>).

Following work conducted some time ago by regional contributors, under partial IDRC support, the FAO assembled a bibliography and abstracts of the aquatic animal health literature for South Asia. Although this bibliography was considered too incomplete to justify publication (only an estimated 40-50% of the vast Indian literature was included), it has been made available to National Co-ordinators and will be incorporated into the Aquatic Animal Pathogen and Quarantine Information System (AAPQIS).

## **5.7 Aquatic Animal Pathogen and Quarantine Information System (AAPQIS)**

AAPQIS provides a mechanism for the comprehensive tracking and reporting of diseases and parasites on a regional basis. It can also be adapted by national governments for use in establishing national systems of disease reporting and tracking. The information system is delivered via Internet and the world-wide web (WWW). The initial server for the Asia-Pacific Region is operated by NACA (<http://www.enaca.org>). The software framework to support the system has been developed to meet the specific information needs of fish health quarantine officers, diagnosticians, researchers and government policy makers. The capabilities of AAPQIS include:

### ***Pathogens/parasites***

The system permits users to find information on pathogens and parasites reported from any region or country. A variety of types of information are (or can be) included: taxonomic and systematic information, hosts, geographic distributions, pathogenicity, OIE disease status, economic and zoonotic importance, biology, identification problems, list of taxonomic experts capable of confirming identification, possible treatments, line drawings, photomicrographs, etc. The system permits the construction of dynamic distribution maps, allowing users to see the currently known distribution of any pathogen. Although this information is currently being compiled on a regional and national scale, it is hoped that it will expand to other aquatic animal producing regions (Latina, Mediterranean and Africa).

### ***Hosts***

Users can obtain current information on pathogens and parasites from fish, crustaceans, molluscs or other commercially important invertebrates. For more comprehensive information on the taxonomy, common names, distributions, introductions, etc. of fish hosts, AAPQIS users are referred to the species database of FishBase (ICLARM/EC/FAO; <http://www.fishbase.org>).

### ***Country check***

Users can obtain a list of pathogens and parasites reported to occur in a host from a particular country. They can compare this list with the list of pathogens/parasites known from the same host (if it is present) in their own country. This will facilitate accurate health risk analysis of proposed live aquatic animal imports or highlight areas that require greater surveillance.

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<sup>2</sup> <http://www.cefas.co.uk/oie/index%5Fold.html>

### ***Country lists***

It will be possible to generate a current listing of all parasites/pathogens listed by host species for any country.

### ***References***

A literature database, including all references used to construct the pathogen/parasite database is maintained.

### ***Other components***

These will be added as required by the user community. This could include information on the status of quarantine legislation in each country, lists of institutions and researchers working on fish health (by country or region) and Internet connection information, fora for discussion of specific problems, newsletters (e.g., newsletters of the Asian Fisheries Society, Fish Health Section; the American Fisheries Society, Fish Health Section; Aquatic Animal Health Research Institute; International Ichthyoparasitology Newsletter) etc.

### ***Database structure***

The structure of the database has been developed by FAO through collaboration with aquatic animal health researchers and/or the responsible quarantine officers from (or linked to) focal points in participating countries. These national focal points, along with other interested parties, within and outside the region, are able to contribute to developing and maintaining the database. Experts can "adopt" a given pathogen species or taxonomic group (data moderator) and, along with other recognized international specialists, will ensure the accuracy of information entered for that pathogen/group into the database. Users from within and outside a region will be able to comment, contribute and correct information contained in the database via communication with the relevant moderator. Database security is the responsibility of a "data master" who has sole control over final entry changes into the master database.

### ***National responsibilities and participation***

AAPQIS is being established in the national fisheries or veterinary department responsible for implementing quarantine and certification programs for aquatic animals in each participating country. These departments are the focal point for AAPQIS, and have responsibility for data collection and networking within the country. Due to the large size of some countries, particularly China and India, a large network of in-country disease institutions ("nodal points") is necessary to access the relevant information. These nodal points are responsible for collating data for entry into AAPQIS on a regular basis. They have access to the regional database to deliver data, however, data already entered and screened at the national level within the database can only be accessed via password through the Internet.

AAPQIS is designed for use by the following:

- National policy makers responsible for assessing individual country's needs for aquatic animal quarantine and certification programs.
- International and regional agencies involved in research or policy formulation for aquaculture and aquatic animal health.
- Aquatic animal health workers, diagnosticians and scientists from governments, universities and private sector aquaculture.

## 5.8 References

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