

*Bsal* Task Force

# 2016 Annual Report

October 2016



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# Bsal Task Force: 2016 Annual Report

## Background

*Batrachochytrium salamandrivorans* (*Bsal*) is a fungal pathogen that infects amphibian skin. It was discovered in 2013 in Europe, related to mass mortality of Fire Salamanders (Martel et al. 2013), where it appears to be expanding in distribution (Spitzen-van der Sluijs 2016). A 2014 experiment (Martel et al. 2014) revealed susceptibility to the pathogen of salamanders from around the world, including some North American species. A 2015 Colorado workshop of researchers and managers discussed approaches to learn more about the *Bsal* and the related emerging infectious disease caused by it and to forestall potential biodiversity losses in the Americas where it was not known to occur (Grant et al. 2015).

The *Bsal* Task Force was initiated in June 2015 (Figure A, below). Seven interactive Working Groups (Figure B) were formed: 1) Surveillance/Monitoring, 2) Diagnostics, 3) Data Management, 4) Response, 5) Outreach/Communication, 6) Research and 7) Decision Support.

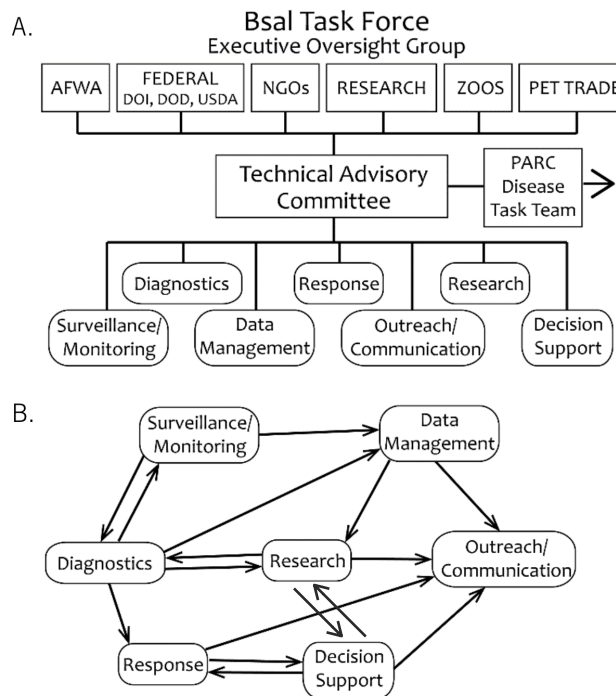


Figure A (top), Structure of the *Bsal* Task Force. Figure B, Interactive Working Groups within the task force.

Working Group leads serve on the Technical Advisory Committee, which also includes representatives from concerned partner groups such as the Pet Joint Advisory Council, Amphibian Survival Alliance, and US federal agencies. An Executive Oversight Group was envisioned for consultation. Related tasks have been taken up by the Disease Task Team founded by Partners in Amphibian and Reptile Conservation (PARC), and an independent working group in Canada, the Canadian Herpetological Health Working Group. National amphibian disease contacts in Mexico have been identified.

Actions to forestall *Bsal* transmission have been undertaken by two key partners. In 2015, the Pet Joint Advisory Council instituted a moratorium on Asian salamander imports. In early 2016, the USFWS implemented an Interim Rule of the Lacey Act 18 USC 42, naming 20 salamander genera as injurious, related to the salamander genera showing vulnerabilities in experiments. This report summarizes activities conducted by the *Bsal* Task Force through August 2016.

## Key Accomplishments in Year One

**Resources:** The **Communication/Outreach** group maintains a website, [www.salamanderfungus.org](http://www.salamanderfungus.org), and social media presence to help transfer new *Bsal* information among scientists, wildlife and land managers, and the public. A parallel effort in Canada by the **Canadian Herp Health Working Group** has been similarly productive at information outreach.

A second website was created to host the *Bsal* **Data Management** group's web portal at one of the leading amphibian conservation websites, AmphibiaWeb: <http://updates.amphibiandisease.org/>. This portal features a blog and a bibliography of *Bsal* publications (under Resources).

Several *Bsal* publications have resulted from the joint efforts of the *Bsal* Task Force and their partners (e.g., Gray et al. 2015, Grant et al. 2016; Grant et al. *in press*), including a variety of fact sheets and flyers (<http://www.salamanderfungus.org/resources/fact-sheets/>). Also published was an article written for the public and salamander enthusiasts in Sept/Oct's issue of **Reptiles Magazine** titled *The Salamander Crisis: They face a deadly fungal threat*. White et al. (2016) published the *Bsal* Case Definition and a list of diagnostic laboratories for *Bsal* testing has been assembled. Other products have included disinfection guidance for pet husbandry and field work, and laboratory Standard Operating Procedures – to keep it from being accidentally transmitted to nature. The **PARC Disease Task Team** created a “Who Ya Gonna Call?” list, to be used in the event of die-off reports from anyone; information will be relayed to contacts in the relevant jurisdiction, in Mexico, the USA, or Canada.

**Priorities:** Of paramount importance, the **Response** group has drafted guidance for the potential event that *Bsal* is found in North America, and for a variety of contexts that may accompany such detection (e.g., in captivity or the wild; with or without mortality). The **Decision Support** group is modeling the most effective places for scientists and managers to devote resources to forestall *Bsal* transmission. Others have developed two spatial risk models for North America salamanders (Yap et al. 2015; Richgels et al. 2016) which show both east- and west-coast centers of vulnerability. These results have been incorporated into the **Surveillance/Monitoring** group's coordination of US surveys for *Bsal*, including 10,000 samples being conducted by USGS and partners in 2016. The **Data Management** working group is gathering not only the results of *Bsal* surveys, but is creating a database and maps of where surveys are planned in order to maximize research planning efficiencies. The **Research** working group has assembled research priorities to guide scientific inquiry, and communicates among research scientists with ongoing *Bsal* studies in the US and abroad, again to maximize efficiencies in time and effort.

**Next Steps: A *Bsal* Strategic Plan will pull these various threads together for North America.**



A European Fire Salamander (*Salamandra atra*) infected with *Bsal*. Photo by Frank Pasmans

## **Bsal Task Force Organization**

The *Bsal* Task Force is an ad hoc group of scientists, managers, and citizens who are helping to understand and forestall the threat of *Bsal* in North America. Although a central focus is to coordinate strategic planning and efforts in the USA, there is networking between the USA and both Canada and Mexico, and also with European and Australian disease researchers.

**Organizational Progress: Working Groups** were initially organized in June 2015. Since then, they have met via conference calls on a regular basis to outline new tasks and discuss progress on existing efforts. Group membership is open and inclusive, but was initially founded with persons involved with disease research, natural resource management in state and federal agencies, environmental or conservation groups, non-governmental organizations, and the pet industry. Each group has one to three leads, who help to coordinate personnel, manage the workload, and report to the **Technical Advisory Committee**.

The **Technical Advisory Committee (TAC)** is populated by the Working Group leads and representatives from selected partner groups including federal agencies, the IUCN Amphibian Survival Alliance (ASA), and the Pet Industry Joint Advisory Council (PIJAC). The TAC meets by conference call monthly, with a focus on new items and round-robin reporting by participants. New items have included tasks to be assigned or delegated to others, opportunities for products and grant proposals, and communication-outreach and networking needs. Monthly meeting notes are routed to TAC members, then to their working group members, to ensure communication. There are two TAC co-leads, and these are rotated annually. Decisions of the TAC are made by consensus.



Alpine Newt (*Ichthyosaura alpestris*). Photo by Eric Isselée

An **Executive Oversight Group (EOG)** was originally envisioned to be created as a mechanism to inform managers or leaders of new *Bsal* information or emerging *Bsal* topics at higher organizational levels, potentially including US Department staff, the Association of Fish and Wildlife Agencies (AFWA), and PIJAC. The initiation of the *Bsal* Task Force EOG was proposed to national leaders at the North American Wildlife and Natural Resources Conference in March 2016. Discussion there expanded the need for such an oversight body not just for *Bsal*, but for other non-agricultural wildlife diseases with analogous task forces such as White-nose Syndrome in bats, as well as wildlife diseases without formalized task forces such as Sea-star Wasting Disease. An EOG for non-agricultural wildlife diseases is the topic of continued discussion, with possible additional censusing among potential participants to be conducted in Fall 2016. This topic segues to that of a recognized gap in US laws for wildlife health. Whereas the US Animal Health Protection Act (7 USC 109) covers agricultural wildlife health, there is no companion legislation for non-agricultural wildlife. This topic is an example of what the EOG could address. In summer 2016, the BAND Foundation, a private philanthropic foundation, funded a small grant to AFWA to help organize strategic planning for *Bsal*, WNS, and Sea-star Wasting Disease. Progress on this effort is reported to the TAC.



# Working Group Reports

## RESEARCH WORKING GROUP

**Summary:** The Research Initiatives group has developed a list of *Bsal* research priorities. These priorities include: validating *Bsal* diagnostic procedures, determining the most efficient modes of *Bsal* transmission, estimating susceptibility of North American amphibian species to *Bsal*, identifying protocols to inactivate *Bsal*, establishing effective methods to mitigate the disease threat in laboratory, survival assurance, and field settings, and determining the interactive effects of *Bsal* with stressors and other pathogens

**Lead:** Reid Harris (James Madison University, Amphibian Survival Alliance)

**Participants:** Cherie Briggs (UC-Santa Barbara), Doug Woodhams (Univ. Mass-Boston), Maria Forzan (Canadian Wildlife Health Cooperative), Gabriela Parra Olea (National Autonomous University of Mexico), Karen Lips (Univ. of Maryland), Matt Gray (Univ. of Tennessee), Frank Pasmans (Ghent Univ.), An Martel (Ghent Univ.), Vance Vredenburg (San Francisco State Univ.).

**Key Points:** A list of 6 *Bsal* research priorities has been created.

1. *Validating Bsal diagnostic procedures.* This is the top priority since all other research priorities depend on having effective, repeatable *Bsal* diagnostic procedures available. Issues to be addressed include *Bsal* standards, multiplexing with *Bd*, and DNA extraction methods.
2. *Determining the most efficient modes of Bsal transmission.* This research is critical in order to understand how to limit the spread of *Bsal*. Issues include estimating the relative importance of horizontal, vertical and environmental transmission among different host species and in different environments. The role of alternative hosts and the potential of a resting stage need to be addressed.
3. *Estimating susceptibility of North American amphibian species to Bsal.* This research is necessary to establish a “taxonomy of risk” and a “landscape of risk”, which can be used to focus mitigation efforts. To date, the labs of Matt Gray, Vance Vredenburg and Karen Lips are conducting susceptibility trials of North American salamanders and frogs, and they are coordinating efforts. An important issue is whether anurans are susceptible, especially if they are exposed to high concentrations of *Bsal*.
4. *Identifying protocols to inactivate Bsal.* This includes establishing the minimum concentrations of standard disinfectants needed to kill *Bsal*. The use of minimum concentrations will pose less safety risks to people.
5. *Establishing effective methods to mitigate the disease threat in laboratory, survival assurance, and field settings.* These methods include: a) vaccination; b) probiotics; c) selective breeding; d) *Bsal* removal methods (attractants – traps); e) potential use of disinfectants in the field to eradicate *Bsal* from a small area after a point source introduction (Bosch et al. 2015).
6. *Determining the interactive effects of Bsal with stressors and other pathogens.* This research is necessary to determine a landscape of risk, which can be used to focus mitigation efforts.

*If Bsal is detected in North America, then Number 6 is less critical than Numbers 1-5, Number 5 becomes a very high priority, and Number 2 remains a very high priority.*

**Research Progress:** The Research Initiatives working group created a list of Standard Operating Procedures for *Bsal* use in laboratory studies. These address biosecurity procedures needed if *Bsal* were to be used in laboratory experiments, for example husbandry practices for amphibians exposed to *Bsal*, and use of “Level 2” biosafety procedures developed by the US Center for Disease Control and Prevention ([http://www.cdc.gov/biosafety/publications/bmbl5/BMML5\\_sect\\_IV.pdf](http://www.cdc.gov/biosafety/publications/bmbl5/BMML5_sect_IV.pdf)).

Members of the Research working group and others have initiated research on some of the research priorities. The topic of validation of diagnostic procedures (#1, above) has largely been led by the *Bsal* Diagnostics working group at this time. Research on *Bsal* transmission (#2), inactivation (#4) and synergisms with other stressors (#6) have not yet been coordinated by this research group, but remains of key interest.

Estimating susceptibility of North American salamanders to *Bsal* (#3) has been the dominant research focus among members of the Research group, with at least three university laboratories in the USA examining this priority. Early *Bsal*

susceptibility results were presented at the World Congress of Herpetology in China in August 2016 by Matt Gray and colleagues (U of Tennessee). Results from other laboratories are not yet available.

In addition, salamanders' skin microbiota has been assayed for their inhibition of *Bsal* by members of Karen Lips' laboratory (Univ. of Maryland). This information may be able to contribute to a bio-augmentation (probiotic) disease mitigation strategy (#5).

**Research Challenges:** Difficulty in obtaining research funding is a dominant challenge for *Bsal* research.

**Research Outcomes or Impacts:** With limited *Bsal* research completed at this time, it is premature to address tangible outcomes of this work. However, the findings of the ongoing challenge experiments (#3) will allow comparison with the Martel et al. (2014) experimental results. As those earlier findings helped to inform the guidance of the interim Lacey Act rule (January 2016) formulated by the US Fish and Wildlife Service and the voluntary moratorium on salamander imports instituted by PIJAC, additional scientific information along this line will undoubtedly inform the finalization of the rule for the USA and PIJAC actions. Furthermore, wildlife health scientists and managers in Canada and Mexico will likewise benefit by the results of additional *Bsal* challenge experiments, and results could inform policies in those jurisdictions.

In addition, work by the Research group to address laboratory biosecurity procedures raised the issue for field-based biosecurity. Consequently, the *Bsal* TAC asked the PARC Disease Task Team to compile existing procedures for field biosecurity.



The juvenile and terrestrial 'Red Eft' stage of the Eastern Spotted Newt, *Notophthalmus viridescens*. This species of US salamandrid is potentially susceptible to infection from *Bsal*.

Photo by Marty Silver.

## DATA MANAGEMENT WORKING GROUP

**Summary:** Development of an online repository and website for data on the amphibian chytrid fungi *Batrachochytrium dendrobatidis* (*Bd*) and *B. salamandrivorans* (*Bsal*) is aimed to accelerate information sharing among global scientists, natural resource managers, and the public regarding planned and ongoing surveillance projects and scientific studies, as well as the results of completed studies. This web communication portal is especially important for rapid responses and to aid decision support for allocation of limited resources available for research and management of these amphibian emerging infectious diseases.

**Leads:** Michelle Koo (Univ. California, Berkeley and AmphibiaWeb) and Dede Olson (US Forest Service, Pacific Northwest Research Station)

**Participants:** Philip Kahn (UC Berkeley) - web and database developer; Vance Vredenburg (San Francisco State Univ.) - AmphibiaWeb advisor; Tiffany Yap (UCLA) - bibliography research; David Blackburn (Univ. Florida) - AmphibiaWeb advisor; Alessandro Catenazzi (So. Illinois Univ) - AmphibiaWeb advisor.

### Key Points:

1. After consultation and comparison of several possible web site options (including the current *Bd*-maps.net website operated by Imperial College, London, UK; EcoHealth Alliance, New York; US Geological Survey), the optimal web site for this new portal was determined to be AmphibiaWeb, operated by University of California, Berkeley. AmphibiaWeb was determined to be the best choice for this new application because: a) it already is the primary “go-to” web portal for amphibian information, used by amphibian biologists worldwide; b) it is available world-wide, and does not have a firewall preventing some users from access (like a US government website might); c) it is expected to have longevity for many years, due to the momentum of the larger website and ongoing support by the biodiversity informatics team at the Berkeley Natural History Museums, its host; d) some web programming resources were expected to be available from its extensive internal operations; e) the Board of Directors include amphibian and disease experts who were eager to provide additional portal oversight and were interested in supporting a next-generation data management product.

2. The beta version of the website is available at <http://amphibiandisease.org>, released in the spring of 2016. An agile software development approach was used where feedback from cross-functional teams, adaptive development and evolving requirements are continuous and transparent. This allows rapid deployment with incremental improvements and the ability to quickly address issues and user needs. The portal features: a secure online data repository, built on a MySQL database; uploading from a well-defined template (xlsx format), and downloading of search results; web mapping of public datasets, with map views by species, test results, pathogen intensity and prevalence; owner-set access as private or public; fields set to DarwinCore metadata standards allowing for interoperability with biodiversity repositories (GBIF, VertNet, BISON); metadata links to GenBank and other NCBI datasets; creation of areas of interest to indicate planned field work to facilitate coordination across partners; an open-access bibliographic library of *Bd* and *Bsal* literature (Zotero); a blog for informational posts; links to other relevant disease websites including AmphibiaWeb (<http://amphibiaweb.org>), and the *Bsal* Task Force communications portal (<http://salamanderfungus.org>).

3. A standardized website citation has been recommended by the AmphibiaWeb Board of Directors:

AmphibiaWeb. 2016. Amphibian Disease Portal <<http://amphibiandisease.org>>. University of California, Berkeley, CA, USA. Accessed 27 Sep 2016.

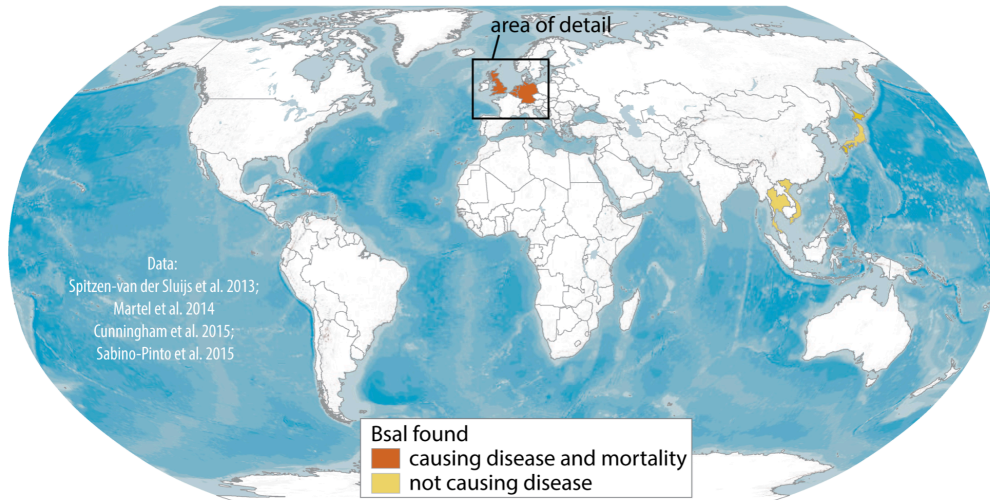
4. Presentations and demonstrations have been given at:

- Southern Appalachia Meeting on *Batrachochytrium salamandrivorans* (*Bsal*), Warren Wilson College, Asheville, NC. August 11, 2015. Presentation by Michelle Koo
- Society for the Study of Amphibians and Reptiles (SSAR) Annual Meeting, University of Kansas, Lawrence, KS. July 31, 2015. Michelle Koo presented.
- California/Nevada Amphibian Population Task Force Annual Meeting, Univ. California, Davis. January 8, 2016. Keynote presentation by Vance Vredenburg.
- Joint Meeting of Ichthyologist and Herpetologists Annual Meeting, New Orleans, LA. July 8, 2016. Michelle Koo and Jennifer Ballard presented.
- World Congress of Herpetology, Hangzhou, China. August 17, 2016. David Blackburn presented.

**Data Management Challenges:** Migration of *Bd*-maps.net data to the AmphibianDisease database is anticipated, but represents a significant challenge. We will need to reconcile different data models, first by standardizing the *Bd*-maps data to DarwinCore metadata conventions as well as importing bibliographic records from one system to another. As with any

data migration, data checking and fixing will be a high-priority, intensive task. Much of this work will likely be dependent on bulk-loading capabilities that will use the current validation process of the AmphibianDisease portal, which has not been built yet.

Another challenge is presenting an easy-to-use interface for both the user looking for data and for those seeking to deposit data. We continue to improve our interface and documentation in response to different sets of users in this phase.



*Bsal* detections in the wild as of February 2016

#### Data Management Outcomes or Impacts:

1. *Beta release of the AmphibianDisease Portal.* We released the main database portal at <http://amphibiandisease.org> where samples tested for *Bd* and *Bsal* are aggregated and searchable. There are weekly meetings with the developer, and regular communication with *Bsal* Task Force and USFS. We have collaborated with the Biocode Field Information Management System (FIMS) project to use portions of their validation process to ensure minimum data quality standards. In the first three months, we have uploaded 1,189 records from publications on *Bd* in California (Yap et al 2016), Peru (Catenazzi and Tito 2016), Gabon (Jongsma et al 2016). We are working with graduate students from SFSU to incorporate the AmphibianDisease portal template into past and ongoing research on *Bd* and *Bsal* in California and Asia (up to 25,000 records). Bulk-loading is planned for later 2016 or early 2017 to address the *Bd*-maps.net database and the large monitoring dataset from the USGS-ARMI sampling effort this summer (ca. 10,000 samples from ca. 180 sites). Currently coordination has begun with Koo and Donn Holmes and Hardin Waddle (USGS).
2. *Resources for Bsal research.* To aid researchers and students on the state of knowledge about the newly discovered *Bsal* threat, we initiated a few online resources: an information page on AmphibiaWeb (<http://amphibiaweb.org/chytrid/Bsal.html>), we created a bibliography on the literature for *Bd* and *Bsal* research. These are linked on the blog website at <http://updates.amphibiandisease.org>, where the Task Force can access relevant scientific publications freely as part of our collaboration.
3. *Citable data.* As part of our collaboration with the Biocode FIMS tools the portal creates DOI (digital object identifiers) for all uploaded datasets, which increases the immediate and long-term value of data in AmphibianDisease. All our data so far are reported in the primary literature and can cite AmphibianDisease datasets reliably with DOI (specifically ark identifiers). See our Data Use Policy (<http://updates.amphibiandisease.org/portal/2016/05/24/DataUse.html>)
4. *Transparent development and documentation.* All code and current issues can be accessed on the code-sharing repository Github (<https://github.com/AmphibiaWeb/amphibian-disease-tracker>) while simultaneous documentation can be found in our online 'manual' (<https://amphibian-disease-tracker.readthedocs.io/en/latest>)

**Interactions with other working groups:** Members of the Data Management group attend the **Surveillance working group**, where user needs can be directly addressed. Initial impact of our interactions include implementing "Projects" and User profiles in the portal where sampling intention can be documented and mapped allowing users to see other related efforts and facilitate collaboration. We also are active with the **Communications & Outreach working group**, such as sharing the Zotero bibliography and other news between the main *Bsal* outreach sites.



## RESPONSE WORKING GROUP

**Summary:** The Response Working Group intends to serve as a resource for issues related to eradication, containment, or other management response should *Bsal* be detected in North America. The group is actively finalizing a *Bsal* Rapid Response Plan template, intended for customization by management unit or captive salamander facility, which provides guidance for suggested actions upon a salamander mortality event or confirmed *Bsal* detection. The plan will be made available via [www.salamanderfungus.org](http://www.salamanderfungus.org) once completed.

**Lead:** Priya Nanjappa (AFWA/PARC)

**Participants:** Michael Adams (USGS ARMI); Jenn Ballard (USFWS); Jeremy Coleman (USFWS, White-nose Syndrome National Coordinator); Evan Grant (USGS ARMI); Matt Gray (Univ of Tennessee – Knoxville); Camille Harris (USGS, Wildlife Disease Coordinator); Blake Hossack (USGS ARMI), Jonathan Kolby (James Cook University); Robert Lovich (Dept of Defense/Navy); Joe Mendelson (Zoo Atlanta); Jenny Powers (NPS); Dede Olson (USFS); Mary Kay Watry (NPS)

**Key Points:** The response team helped to develop a Rapid Response Plan (RRP) template document for agencies and institutions to customize based on their own capacities and resources.

The RRP provides suggested actions to take when:

1. A mortality event involving wild salamanders is observed, but cause is still unknown
2. A mortality event involving captive salamanders is observed, but cause is still unknown
3. A sample during surveillance of known animals or locations returns a *Bsal*-positive result in either wild or captive animals, but there are no signs of mortality or visible signs of infection
4. *Bsal* has been confirmed in a wild population
5. *Bsal* has been confirmed in a captive population.

**Response Progress:** The RRP is actively being finalized, with some test scenarios helping to inform and refine response processes suggested in the plan template. Once completed, it will be posted to the *Bsal* Task Force website, [www.salamanderfungus.org](http://www.salamanderfungus.org).

**Response Challenges:** An initial draft of the RRP was completed in August 2015, and was reviewed by various stakeholders, including members of several standing committees within AFWA. As the comments were being integrated, the USFWS released their interim final rule listing 20 salamander genera as “injurious” under the Lacey Act. This changed some aspects of the response plan in order to make the suggested actions compliant with the rule, or to ensure that anyone using the plan would be aware of the rule and how to be compliant. In addition, there were some test scenarios of responses to potential *Bsal* detections that helped identify areas of weakness in the initial draft; these are being refined now to provide the best guidance possible. We do anticipate that the RRP will be a living document, where guidance will continue to be refined as new treatment, mitigation, or management opportunities become available. We will also incorporate any lessons learned when or if actual *Bsal* detection scenarios occur that demonstrate new or improved approaches to be integrated into the plan.

**Response Outcomes or Impacts:** The RRP, once completed, will serve as a template to increase preparedness among agencies and institutions with respect to *Bsal*. The guidance within is also applicable to other instances of amphibian diseases, and could potentially serve as a model for responses to other fish or wildlife diseases. After its release, the Response Working Group, in collaboration with AFWA, will distribute the plan broadly and write letters to appropriate agency officials and institutional leadership to facilitate its use, as well as to facilitate their preparedness and implementation in the event of a *Bsal* detection. In addition, the Response Working Group will serve as a go-to group when real world situations require expert input or consultation.

**Response Interactions with Other Working Groups:** The Diagnostics Working Group leadership assisted in refining the details of the RRP with respect to obtaining and confirming a *Bsal* detection. The Response Working Group will work with the Decision Support Working Group to develop workshops or other opportunities to assist agencies and other stakeholders in determining how best to customize the RRP for their purposes, available capacities, and resources. We are in contact with the Research and Surveillance Working Groups as well, so that we can stay on top of the latest findings that can inform or improve the RRP, and so that we can assist when response actions are needed.

## DIAGNOSTICS WORKING GROUP

**Summary:** The *Bsal* Diagnostics working group has worked from Summer 2015 – Summer 2016 to coordinate the activities of diagnostic laboratories around the country for *Bsal* testing. The group is composed of private and public laboratories, each with a vested interest in the consistency and accuracy of *Bsal* testing nationwide. The group has been exceptionally productive this year in addressing the needs and concerns of the diagnostic community. Their accomplishments are described below.

**Lead:** Jake Kerby (Univ. South Dakota) and Jenn Ballard (US Fish and Wildlife Service)

**Participants:** Allan Pessier (San Diego Zoo), Heather Fenton (Southeastern Cooperative Wildlife Disease Study), LeAnn White (USGS – US Wildlife Health Center), Jeff Lorch (USGS – US Wildlife Health Center), Dan Grear (USGS – US Wildlife Health Center), Deb Iwanowicz (USGS – National Fish Health Research Laboratory), Deb Miller (Univ. of Tennessee), James Lewis (ASA), Maria Forzan (Canadian Cooperative Wildlife Health Centre), An Martel (Gent University), Frank Pasmans – Gent University), Julie Ellis (Northeast Wildlife Disease Cooperative), John Wood (Pisces Molecular), Steven Lloyd (Zoologix), Matt Allender (Univ. of Illinois), Robert Ossiboff (Univ. of Illinois), Tom Waltzek (Univ. of Florida), Michael Garner (Northwest ZooPath), Alessandro Catenazzi (Southern Illinois University), Laura Sprague (USFWS Idaho Fish Health Lab), Teresa Lewis (USFWS Midwest Fish Health Center)

### Key Points:

1. The Diagnostics working group has compiled a list of the testing modalities available for a variety of amphibian diseases at the member laboratories and placed this on the salamanderfungus.org website to help encourage and inform those who might want to conduct disease testing.
2. Due to equipment restrictions and other limitations, it was decided that a single protocol was not ideal for *Bsal* testing. Instead, the group compared the protocols being used, as well as those available in the literature, and organized a voluntary ring-test to compare results between laboratories and techniques.
3. The group recognized a need for a consistent, peer-reviewed case definition for *Bsal* that could be referenced by other researchers and worked to address this need.

### Diagnostics Outcomes or Impacts:

1. The group compiled a list of the testing modalities available for a variety of amphibian diseases at the member laboratories and compared the PCR protocols being used for *Bsal*. The group organized a voluntary ring-test to compare *Bsal* testing results between laboratories and techniques, and laboratories teamed up to improve testing where needed. A manuscript for this work is being written, and additional testing is planned for the future.
2. The group facilitated communication between diagnostic laboratories and US Fish and Wildlife Service Law Enforcement and Permitting personnel to help the laboratories understand their requirements under the new Lacey Act listing and to assist them with permit application questions.
3. We have compiled a list of the labs available for *Bsal* testing and made that publicly available. Most, if not all, of the labs have permits and protocols in place, such that they are prepared to provide testing services for surveillance, research, and outbreak response.
4. The group wrote and published a case definition of *Bsal*:

White CL, Forzán MJ, Pessier AP, Allender MC, Ballard JR, Catenazzi A, Fenton H, Martel A, Pasmans F, Miller DL, Ossiboff RJ, Richgels KLD, Kerby JL. 2016. Amphibian: A Case Definition and Diagnostic Criteria for *Batrachochytrium salamandrivorans* Chytridiomycosis. *Herpetological Review* 47: 207-209.

**Diagnostics Interactions with Other Working Groups:** Moving forward, the Diagnostics working group would like to increase communication with the research and surveillance groups to see what tasks need to be accomplished without creating redundancy. The Diagnostics group would also like to work with the response group to better outline the roll of the diagnostic labs should *Bsal* be found in North America. Finally, communication among all groups can create a greater cohesiveness in the Task Force.



# DECISION SUPPORT WORKING GROUP

**Summary:** The Decision Support Working Group conducted a *Bsal* risk assessment and developed a decision support model to assess proactive management actions to forestall the likelihood of *Bsal* introduction to the United States, or transmission if it were to be detected in the US, and identified challenges to successful proactive management.

**Lead:** Evan Grant (USGS)

**Participants:** Robin Russell (USGS), Katie Richgels (USGS), Rachel Katz (USFWS)

**Key Points:** At the June 2015 *Bsal* Workshop in Fort Collins, Colorado, this group initiated development of a model of *Bsal* introduction and transmission pathways. The group continued to work on this objective into 2016. Several group-led products have resulted:

1. **First workshop report:** Grant, E.H.C., E. Muths, R.A. Katz, S. Canessa, M.J. Adams, J.R. Ballard, L. Berger, C.J. Briggs, J. Coleman, M.J. Gray, M.C. Harris, R.N. Harris, B. Hossack, K.P. Huyvaert, J.E. Kolby, K.R. Lips, R.E. Lovich, H.I. McCallum, J.R. Mendelson, III, P. Nanjappa, D.H. Olson, J.G. Powers, K.L.D. Richgels, R.E. Russell, B.R. Schmidt, A. Spitzen-van der Sluijs, M.K. Watry, D.C. Woodhams, and C.L. White, C.L. 2016. Salamander chytrid fungus (*Batrachochytrium salamandrivorans*) in the United States—Developing research, monitoring, and management strategies: U.S. Geological Survey Open-File Report 2015–1233, 16 p., <http://dx.doi.org/10.3133/ofr20151233>.

2. **Second workshop report:** Grant, E.H.C., E. Muths, R.A. Katz, S. Canessa, M.J. Adams, J.R. Ballard, L. Berger, C.J. Briggs, J.T.H. Coleman, M.J. Gray, M.C. Harris, R.N. Harris, B. Hossack, K.P. Huyvaert, J.E. Kolby, K.R. Lips, R.E. Lovich, H.I. McCallum, J.R. Mendelson, III, P. Nanjappa, D.H. Olson, J.G. Powers, K.L.D. Richgels, R.E. Russell, B.R. Schmidt, A. Spitzen-van der Sluijs, M.K. Watry, D.C. Woodhams, and C.L. White. In press. Even with forewarning, challenges remain in developing a proactive response to emerging infectious diseases. *Frontiers in Ecology and the Environment*.

This paper recognizes that reactive approaches to disease mitigation may limit the potential for control and increase total response costs. However, it is difficult to plan and implement proactive management. We identify four main challenges to developing proactive management strategies for *Bsal*, including a lack of disease policy, fragmented management responsibility, multiple competing objectives, and few effective options for post-emergence control. Decision analysis can help create and evaluate trade-offs among proactive (pre-emergence) and reactive (post-emergence) management.

3. **Manuscript in review:** Russell et al. (submitted) characterized uncertainties in developing initial models for disease management. We outlined three components essential to building a predictive modeling framework that researchers and managers should consider early in the emergence of a wildlife disease: a) which modeling frame is most appropriate, b) which parameters or factors are critical to making preliminary predictions, and c) how to collate existing data to parameterize the initial models.

4. In addition, a *Bsal* risk assessment initiated by group participants before the Fort Collins workshop has been published: Richgels et al. 2016. *Spatial variation in risk and consequence of Batrachochytrium salamandrivorans introduction in the USA*. *R. Soc. Open Sci.* 3:150616.

Although data are inevitably limited for new pathogens, disease-risk assessments use best available data to inform management decisions. Using characteristics of *Bsal* ecology, spatial data on imports and pet trade establishments, and salamander species diversity, this paper identifies high-risk areas with both a high likelihood of introduction and severe consequences for local salamanders: it is predicted that the Pacific coast, southern Appalachian Mountains and mid-Atlantic regions will have the highest relative risk from *Bsal*. This risk assessment informed the USFWS decision to ban 201 species of salamanders as injurious under the Lacey act.

5. Presentations to broader audiences have resulted from these products, including an overview of decision analysis and decision framing to Wildlife Management Institute's North American Wildlife and Natural Resources Conference, Pittsburgh, PA in 2016.

**Decision Support Progress:** Although preventing the arrival of a pathogen is most effective for controlling an emerging infectious disease, prevention is not failsafe. Additionally, resource managers often consider multiple social, economic, and ecological objectives, and are challenged with confronting difficult trade-offs for any given disease management strategy

(i.e., an optimal action for managing a wildlife disease may result in declines in recreational or economic values). A set of questions was sent to Federal and State land managers, with the goal of helping to get a better sense of the management issues in developing a response to the salamander chytrid fungus (*Bsal*), and to better understand the context in which these decisions take place. This survey of manager issues is ongoing with a focus on state and federal natural resource management agencies.

**Decision Support Challenges:** Challenges include engaging managers when risk is low (*Bsal* has not been detected in the US). Some managers report that they have many issues on their lands, and don't have the ability or the time to consider problems before they exist. This effectively limits the ability to identify and implement proactive management – representing a major challenge for developing management strategies for *Bsal* and other emerging infectious diseases. Specific and measurable amphibian management objectives are not common among natural resource agencies and we are working with several agencies to set objectives for amphibians in communities vulnerable to *Bsal*.



The Marbled Salamander, *Ambystoma opacum*. Photo by Eric Isselée

#### **Decision Support Outcomes or Impacts:**

1. The risk assessment developed by this group was integral to the USFWS in banning 201 species of salamanders as injurious, a good first step in reducing the risk of introduction of *Bsal* to the United States.
2. Richgels et al. (2016) helped to frame the US *Bsal* surveillance and monitoring priorities conducted by USGS and partners for 2016.
3. The Decision Support group has received completed questionnaires of management issues from managers in NPS, FS and FWS, and have begun to characterize the scope of the decision problems faced by these agencies. Workshops with a set of managers with 'common' decision problems will be organized and work will begin in the next year to begin to frame these decisions, beginning with the first draft of the conceptual model developed during the June 2015 Powell Center workshop.
4. The group has been working with the US FWS to frame emerging disease problems for local management and treatment decisions for White-nose Syndrome in US bats. The intention is to use insights from this disease to inform *Bsal* decision problems, and vice versa.

**Decision Support Interactions with Other Working Groups:** Discussion with the Surveillance & Monitoring working group occurred about using the Richgels et al. (2016) risk assessment to determine priority species and areas for sampling. Also, the Decision Support group had many discussions with the USFWS injurious species group about the risk assessment and what information would be most useful for their interim Lacey Act rule. Ongoing work includes collaboration with the US FWS S to frame emerging disease problems for WNS local management and treatment decisions, with the intention to use insights to inform *Bsal* decision problems.

## SURVEILLANCE & MONITORING WORKING GROUP

**Summary:** While there is not currently a surveillance program, there are many entities that are conducting surveys for *Bsal*. The surveillance working group seeks to coordinate sampling activities that might detect *Bsal* in North America such that overlap is reduced and our collective ability to detect *Bsal* is increased.

**Lead:** Michael Adams (USGS)

### Participants:

Caleb Hickman (Eastern Band of Cherokee Indians), Craig Stephen (Canadian Wildlife Health Cooperative), Daniel Gear (USGS), Evan Grant (USGS), Hardin Waddle (USGS), Jennifer Ballard (USFWS), Jonathan Kolby (James Cook Univ.), Laura Sprague (USFWS), Lesley Howes (Canadian Wildlife Service), Matt Gray (Univ. of Tennessee), Michelle Koo (Univ. of California), Natalie Nguyen (USGS), Purnima Govindarajulu (BC Ministry of Environment), Vance Vredenburg (San Francisco State Univ.).

### Key Points:

1. USGS Amphibian Research and Monitoring Initiative (ARMI) is conducting a one-year effort with the National Wildlife Health Center to find *Bsal* in the US. They are attempting to sample 10000 individuals across the country with more effort in areas thought to have higher risk.
2. The USFWS network of Fish Health Labs has begun testing salamanders for *Bsal* in conjunction with fish disease screening. This testing is expected to increase in future years.
3. AmphibiaWeb has built a *Bsal* data portal that, in addition to aggregating results of *Bsal* testing, can be used to indicate the intent to sample somewhere in the future. We need to increase the use of this tool.
4. A group has organized to coordinate *Bsal* sampling in the Appalachian Region.
5. Evan Grant took multiple reporters in the field representing the ARMI *Bsal* Surveillance effort.
6. The USGS National Wildlife Health Center screened skin swabs and carcasses of transport mortalities of an imported shipment of Chinese Firebelly Newts for detection of the salamander chytrid fungus (*Bsal*). All animals tested negative for *Bsal*, but a virus that affects fish and has health concerns for native and farmed fish, spring viremia of carp virus (SVCV) was found.
7. Jonathan Kolby created a citizen science project on iNaturalist.org to help detect salamander mortality events ("[Saving Salamanders with Citizen Science](#)"). This iNaturalist project has 30 members and is open for anyone to join.

### Surveillance & Monitoring Outcomes or Impacts:

1. Media coverage of ARMI Surveillance in NY Times, Vermont Public Radio, and multiple outlets that picked up an AP article.
2. At present, the iNaturalist project has logged 69 dead salamander records comprised of 25 species. California, Canada, and USFWS have requested information from the iNaturalist site.
3. USFWS has requested information from USGS ARMI on *Bsal* sampling on refuges.

**Surveillance & Monitoring Interactions with Other Working Groups:** Members of the Decision Support, Diagnostics, and Database groups participate in the Surveillance group calls.

## COMMUNICATIONS & OUTREACH WORKING GROUP

**Summary:** The *Bsal* Communications & Outreach working group manages *Bsal*-related communication and products for outreach, especially relative to providing informational materials for a myriad of interested groups and people with concern for salamander health and well-being.

**Leads:** Jillian Farkas (Univ. South Dakota), Mark Mandica (The Amphibian Foundation, Inc), Alex Shepack (Southern Illinois Univ.)

**Participants:** Adriane Lewis (Evergreen State College, WA), Amanda Thimmayya (US National Guard), Candace Hansen-Hendrix (Amphibian Survival Alliance), Dede Olson (US Forest Service), Gail Moede-Rogall (US Geological Survey), Laura Sprague (US Fish and Wildlife Service), Leland Pierce (New Mexico Department of Game and Fish), Lesley Howes (Canadian Wildlife Service, Environment and Climate Change Canada, Government of Canada), Louise Rollins-Smith (Vanderbilt Univ.), Megan Serr (North Carolina State Univ.), Natalie Hambalek (Oregon State Univ.), Christina Meister (US Fish and Wildlife Service), Natalie Nguyen (US Geological Survey).

### Key Points:

1. **Organization:** By December 2015, it was apparent that a Communications & Outreach working group could have an expanded role and new participants were solicited via the PARC listserv. In January 2016, the Communications & Outreach leadership shifted to volunteers across North America. This group was formed just as the US Lacey Act interim rule and the USGS technical report (Grant et al. 2015) were released. The group self-organized into social media and writing teams, and has worked on social media products, writing products, and had some emerging interest in film.
2. **Website:** The website [salamanderfungus.org](http://salamanderfungus.org) was created to act as a hub where all *Bsal* information can be accessed. This includes information on disinfection procedures, *Bsal* articles, informational flyers, presentations, and who to contact if *Bsal* is encountered.
3. **Social Media Outreach:** A salamander fungus Facebook page (<https://www.facebook.com/salamanderfungus/>) and a twitter account (@salamanderfungi) were created to post any and all articles and information that give updates about *Bsal* in order to reach a broad audience.
4. **Flyers:** Working with Canadian partners, the group developed *Bsal* handouts to inform and involve different partners, including the general public and pet owners, and the scientific community. Flyers highlight preventing introduction and movement of the disease, disinfection protocols, and reporting any skin abnormalities to a veterinarian to prevent contamination of wild populations.
5. **Writing Products:** In addition to the informational flyers, the group is close to completing and submitting a *Bsal* review paper that states what we currently know about *Bsal* and what still needs to be answered. The group also published an article in the September/October issue of Reptile Magazine that discusses *Bsal* and its impacts: Communications & Outreach Group of the *Bsal* Task Force. 2016. *The Salamander Crisis: They face a deadly fungal threat*. 2016. **Reptiles Magazine**, September/October issue: 26-29.

**Communications & Outreach Progress:** The Communication & Outreach team is keeping up to date on newly released articles and media reports so we can distribute the information on our various social media interfaces. We are working on a *Bsal* review paper, which will be submitted in the near future.

**Communications & Outreach Challenges:** This working group includes a wide variety of participants with interest in natural resource issues, although not always doing *Bsal*-related work for their jobs. The pulsed nature of new *Bsal* information results in periodic slow time intervals for communications. Now that the group has existed for almost a year, submitting reports and creating flyers about the metrics we've met will cause a need for more active involvement.

**Communications & Outreach Outcomes or Impacts:** Our Facebook page has 226 followers, and typically our posts on the page reach 900-1,300 people. Additionally, our twitter account has 231 followers, and our original posts have reached 200-1,100 people, depending on the post, with an engagement rate between 2-5%. These statistics may not reflect the full extent of impact that our posts have had, because a lot of the information is "retweeted", and we cannot determine the engagements from those posts. At this point in time, we are unable to report any analytics about the engagement with the [salamanderfungus.org](http://salamanderfungus.org) website.

## PARC DISEASE TASK TEAM



**Summary:** The PARC Disease Task Team was initiated in January 2015, and has taken on specific tasks to further the *Bsal* strategic response in North America in addition to addressing topics for other herpetofaunal diseases that have bearing on *Bsal*.

**Leads:** Matthew J. Gray (Univ. Tennessee) and Matthew C. Allender (Univ. Illinois)

**Participants:** Michelle Christman (USFWS), Allison Sacerdote-Velat (Lincon Park Zoo, IL), Craig Stephen (Canadian Wildlife Health Cooperative), Gabriela Parra Olea (Main Univ., Mexico City, Mexico), Katie Haman (WA Dept. Fish and Wildlife), Jennifer Ballard (USFWS), Jenny Powers (US National Park Service), Kristin Stanford (Northern Illinois Univ.), Mike Adams (USGS), Priya Nanjappa (AFWA), Scott A. Smith (Maryland Dept. Natural Resources), Tracy Thompson (US National Park Service), Dede Olson (US Forest Service), Jennifer Williams (US National Park Service), Reid Harris (Amphibian Survival Alliance, James Madison Univ.)

### Key Points:

1. Published PLoS Pathogens paper calling for a National *Bsal* Strategic Plan (Gray et al. 2015).
2. Produced a salamander briefing flyer on *Bsal*. <http://www.salamanderfungus.org/wp-content/uploads/2015/11/Bsa/Brief-1-Page-Flier2015.pdf>
3. Produced the “Who Ya Gonna Call?” list: A list of wildlife and health professionals in each state and Canadian province, and for the nation of Mexico, who can be contacted if a die-off of a herpetofaunal species from apparent disease symptoms is observed. An email notification system was created to route notifications. A data archive tracks notifications and responses.
4. Manuscript submitted to Herpetological Review on techniques and considerations for pathogen surveillance in herpetofaunal populations (Gray et al. submitted).
5. Helped organize a meeting on *Bsal* in Asheville, North Carolina (August 2015) with scientists and biologists in the southern Appalachian region.
6. Created a LISTSERV ([BSALNTF@LISTSERV.UTK.EDU](mailto:BSALNTF@LISTSERV.UTK.EDU)) to enhance communication among *Bsal* TAC and working groups.
7. Assisted in creating the Global Ranavirus Reporting System, which became a template for a new reporting system for *Bd* and *Bsal* data management portal: [amphibiandisease.org](http://amphibiandisease.org)
8. Developed a table on the efficacy of various disinfectants at inactivating common herpetofaunal pathogens.
9. Drafted a summary of the risk of pathogen translocation associated with heavy equipment.
10. Commented on the USFWS Rule on regulating trade of salamander species that could be suitable hosts to *Bsal*.

## CANADIAN HERPETOLOGICAL HEALTH WORKING GROUP

**Summary:** A Canadian Inter-agency Working Group was initiated in response to *Bsal* as an emergent disease and the need to consult with experts in salamander health. The working group reports to the Canadian Wildlife Directors Committee (CWDC). At the CWDC meeting in May 2016, it was decided to expand the working group’s mandate to include reptile and amphibian health issues. Endorsement of the working group (now the Herpetological Health Working Group or Herp Health WG) by the CWDC will better allow the CWDC to guide and provide feedback on their activities.

**Lead Liaisons:** Lesley Howes (Canadian Wildlife Service/Environment and Climate Change Canada, Government of Canada) and Rachel Vallender (Environment and Climate Change Canada, Government of Canada)

## Key Points:

1. *Terms of Reference*: A Draft Terms of Reference for the operation the Canadian Inter-agency Herpetological Health Working Group has been developed (summer 2016).
2. *Opinion Statements in support of Canadian Salamander Trade Restrictions*: The Herp Health Working Group developed two opinion statements regarding *Bsal* and salamander trade restrictions. These statements were provided to the Canadian Wildlife Service as the working group's opinion of the best approach to reduce the risk of *Bsal* to native salamanders. (These statements reflect the opinion of the Working Group and may or may not influence any policy decisions).

*As an interim, precautionary measure to protect native salamanders and newts from Bsal infection, and while a longer-term approach can be considered and implemented, importation of all species of salamanders and newts into Canada should be restricted under the urgency provision of WAPPRITTA section 21.1. A permitting policy should be developed to allow movement of salamanders and newts for specific justifiable purposes ensuring that all imported animals adhere to Bsal risk avoidance strategies.*

*The most effective risk reduction method apart from banning all imports, is to ensure salamanders and newts and their transportation environments entering Canada are determined to be free of Bsal infection by a recognized diagnostic laboratory or come from a facility or supplier that adheres to biosecurity practices that have been shown to be effective in excluding Bsal from the facility and its inhabitants through on-site Bsal monitoring.*



The federally listed Frosted Flatwoods Salamander, *Ambystoma cingulatum*.

Illustration by Mark Mandica



3. *Outreach*: Outreach materials for public, pet owners and research community have been developed and distributed.
  - a. **Information flyers** on *Bsal* and salamander health for the general public and pet shop owners and a flyer targeting the scientific community were created. Both flyers are available in French and English (Spring 2016).
  - b. A **Social media** campaign ran in spring –summer 2016 with several organizations including Environment and Climate Change Canada (ECCC) posting multiple messages aimed at the general public and the scientific community. Messages informed about *Bsal*, potential risks, how to decontaminate waste water and field gear etc.
  - c. **Pet Industry Joint Advisory Council of Canada (PIJAC)**: is the national non-profit organization dedicated to ensuring a high level of pet care and represents all facets of the Canadian pet industry. PIJAC initiated a voluntary trade ban of two species of salamanders in the pet trade. PIJAC is interested in collaborating with our working group to continue to promote the voluntary trade ban and other outreach to the pet trade industry. Our Working Group has drafted a letter thanking PIJAC for their swift and proactive response on a voluntary trade ban and has accepted their offer to collaborate on outreach to the pet trade industry. The Working Group will develop outreach messages and dissemination plan to be ready for spring 2017.
  - d. **The Canadian Herpetology Society** conference (<http://canadianherpetology.ca/conf/index.html>) will be held at the Toronto Zoo on September 16-19, 2016. The Canadian Wildlife Health Cooperative (CWHC) is developing an informational poster and there will be a lightening talk to highlight the work of this group.
4. *Decontamination protocol*: A Canadian decontamination protocol has been developed and is posted on CWHC website (<http://www.cwhc-rcsf.ca/Bsal.php>) in French and English (Spring 2016).
5. *Canadian lab standards* are being developed for *Bsal* testing in Canadian labs to ensure consistency in testing, detection and reporting (ongoing).
6. *A Draft Response Plan* was developed (Spring 2016).
7. *BC Pilot Surveillance Project*: The BC government is swabbing wild salamanders (80 so far) and pet store salamanders (<5) to test for *Bsal*. There are very few pet salamanders because BC pet stores and wholesalers are complying with the voluntary trade ban. Results of the pilot to come. A Vancouver based salamander importer/wholesaler has offered to partner with BC government to test newly imported salamanders for *Bsal* before sale. The Working Group decided that this is a valuable opportunity to pilot program management and assessment of biosecurity protocols and will respond that t we appreciate this opportunity but we need some additional time to develop the pilot project.
8. *Salamander/ Bsal surveillance and monitoring plan*: The working group reviewed and discussed the proposed salamander/ *Bsal* surveillance and monitoring plan. It was decided that an alternative model should be considered that offers flexibility for surveillance and monitoring and incorporates other herp health issues.

## PET INDUSTRY JOINT ADVISORY COUNCIL (PIJAC)



**Summary:** PIJAC represents the responsible pet trade, and has worked closely with the U.S. government and international organizations involved with the management and conservation of wildlife. PIJAC has been instrumental in developing and implementing proactive educational programs to minimize the impact of diseases and invasive species on pets, people, and the environment.

In November 2015, PIJAC recommended a voluntary moratorium on imports of Asian salamanders to the USA. Continued participation in the *Bsal* Task Force aids further liaison with the pet industry in order to address topics relative to pets, the pet trade, and other captive animal situations.

**Lead Liaisons:** Scott Hardin and Bob Likins (PIJAC)

## AMPHIBIAN SURVIVAL ALLIANCE



**Summary:** The ASA is the world's largest amphibian conservation collaborative group, and maintains a close partnership with the IUCN Species Survival Commission, Amphibian Specialist Group. Their leadership has benefited the *Bsal* Task Force immensely. They created and maintain the salamanderfungus.org website for *Bsal* communication, and have worked closely with the *Bsal* Data Management working group to ensure complementary information was uploaded on this informational website in comparison to the *Bsal* database web portal amphibiadisease.org, knitting the two together seamlessly.

**Lead Liaison:** Reid Harris (James Madison Univ.); past lead liaison, James Lewis

**Communication lead:** Candace Hansen (ASA)

### European *Bsal* Research and Conservation

The *Bsal* Task Force maintains new *Bsal* information from the world community at its informational web portal salamanderfungus.org. Under the "New in 2016" tab, publications and announcements are included in monthly updates. New information from the European Union is available in the March, June and September 2016 updates.

#### Research and Monitoring

*Bsal* was initially detected in *Salamandra salamandra* in the Netherlands and Belgium (Martel et al. 2013, 2014), with *Bsal* disease-related losses now reaching an estimated 99.9% of a population (Spitzen-van der sluijs 2016). *Bsal* is also known from wild and captive animals in Germany and captive animals in the United Kingdom (Cunningham et al. 2015; Sabino-Pinto et al. 2015; Spitzenvan der Sluijs 2016).

*Bsal* is hypothesized to have been introduced to Europe through the trade of Asian salamanders (Martel et al. 2014). Effects of trade is similarly implicated for the spread of other amphibian pathogens, including *Batrachochytrium dendrobatidis* (*Bd*), Ranavirus, and mycobacteria, and trade and legislative recommendations have been developed (reviewed by Auliya et al. 2016).

#### Conservation

Whereas *Bd* and Ranavirus are notifiable diseases listed by the World Organization of Animal Health (OIE 2011), with associated biosecurity recommendations for partner nations, at this time the list has not been updated to include *Bsal*.

In 2015, the Bern Convention recommended adoption of *Bsal* prevention and control measures including restrictions on salamander and newt trade until further risk assessments and disease prevention measures were developed (Bern Convention 2015).

In 2015, the Swiss Federal Food Safety and Veterinary Office established a ban on the importation of all salamander species into Switzerland (B. Schmidt, KARCH & University of Zurich, personal communication).

In June 2016, the Scientific Working Group of the European Union proposed to stop Asian salamander imports, placing them on Annex B of the EU regulation 338/97, for likely decision and implementation in 2017 (UNEP-WCMC 2016; Auliya et al. 2016).

Auliya et al. (2016) provide a list of recommendations for improved global amphibian trade regulations including increased inclusion of amphibian provisions in the World Customs Organization, expanding CITES species listings, establishment of disease-free trade, restricting illegal trade, and suspending trade for at-risk species.



Marbled Newt, *Triturus marmoratus*. Photo by Eric Isselée

## Next Steps

1. The *Bsal* Technical Advisory Committee adopted a charter in May 2016. It covers the committee background, purpose, responsibilities and authorities, composition, and procedures for amendment, and duration. The first amendment to the charter was agreed upon in September, to formalize an annual rotation of committee chairs, with a single chair responsible for organizing meetings and agendas, and an incoming chair chosen one year in advance of their term to serve as a back up to the chair as needed.
2. With more formal development of the Canadian Herpetological Health Working Group in 2016, and inclusion of a representative from that group on the monthly *Bsal* Technical Advisory Committee conference calls, discussions have begun to consider if there is a need to adapt the *Bsal* Task Force organizational structure, or if participation of such independent international groups is already sufficiently integrated.
3. Working group directions are as follows:
  - a. Surveillance/Monitoring – Identify priority areas for targeted surveillance that were not sampled in 2016 or that warrant repeat sampling due to risk or results.
  - b. Diagnostics – Repeat ring-testing among laboratories, and examine efficacy of extraction protocols, sample types, and variations in PCR methodology that may affect sensitivity.
  - c. Data Management – Continue website programming to improve user interfaces and accommodate surveillance projects, and import the *Bd*-maps.net database to the amphibiandisease.org web portal.
  - d. Response – 1) Complete site-specific response plan template; 2) Initiate development of a broad Strategic Plan to guide national and international efforts.
  - e. Outreach/Communication – Enhance communication and outreach tools and products relevant to *Bsal* science and management.
  - f. Research – 1) Look for new sources of funding for continued *Bsal* research; 2) Continue and initiate additional research in accordance with existing priorities.
  - g. Decision Support – Continue to work with land managers to identify their decision support priorities, and develop relevant tools to meet those needs.
4. The PARC Disease Task Team is continuing to develop guidance for pathogen biosecurity.
5. The Canadian Herpetological Health Working Group is continuing to develop laboratory standards for *Bsal* testing in Canada, and a surveillance and monitoring plan.

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