A Risk Analysis to Assess the Potential to Spread Aquatic Invasive Species via the Seaplane Pathway

Recommendations to Enhance Aquatic Invasive Species-Seaplane Prevention Efforts in the United States

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Executive Summary

This project, led by Creative Resource Strategies, LLC, Conservation Collaborations, LLC, the National Sea Grant Law Center, and Pacific States Marine Fisheries Commission, was funded by U.S. Fish and Wildlife Service Grant F23AP0102600, and was intended to assess the risk of spreading AIS via the seaplane pathway and develop measures to mitigate this potential risk.

The Federal Aviation Administration (FAA) has exclusive authority in regulating the airspace over the United States and oversees the design, production, and airworthiness of aviation products, the training and certification of pilots, and the certification and operation of airports. Although there are an estimated 35,000 active seaplane pilots (this number represents about 3% of all registered pilots), the FAA maintains few statistics on seaplane activity in the United States.

Invasive species can be moved among waterbodies when a seaplane comes in contact with aquatic invasive plants, such as *Elodea* spp., or microscopic AIS in the water, such as Spiny Waterflea. Trained seaplane pilots can mitigate the risk of transporting AIS by implementing best practices, such as enhanced pre-flight and post-flight inspections.

Many federal agencies have regulations pertaining to seaplanes. States may enact a variety of statutes and regulations governing on-the-ground airport operations if they do not conflict with federal law. Thirty states have at least one statute or regulation referring to seaplanes. These laws fall into several broad categories: grants of state agency or municipal authority, pilot or seaplane base license requirements, safety requirements, specific geographic restrictions, and aquatic invasive species regulation.

During the project, seaplane pilot engagement included an online survey and regional focus groups with seaplane pilots in the lower 48 states and Alaska. Both types of engagement were instrumental in exploring seaplane pilot perspectives and recommendations relative to reducing the spread of AIS by seaplanes. Recommendations by pilots to modify best practices were reviewed and incorporated at the conclusion of the survey and focus groups. Additional recommendations on topics other than best practices were considered and incorporated into the overall list of recommendations.

Eight representatives from the seaplane manufacturing industry and Seaplane Pilots Association as well as the American Boat and Yacht Council convened to discuss potential strategic and collaborative approaches industry could take to reduce the risk of transport of AIS via seaplanes. During the meeting, industry representatives shared their level of interest in convening in the future to address some of the AIS-seaplane issues in greater detail.

The following recommendations will help mitigate the risk of spreading AIS via the seaplane pathway:

A. Address Current Gaps in Seaplane Pilot Statistics

- Incorporate additional seaplane pilot-related questions into the annual FAA pilot survey and sort the results by straight and amphibious floats to inform estimates regarding the total number of seaplanes, how much use occurs on an annual basis, states in which the aircraft are flown and for what purpose, and number of water landings. Additionally, consider an annual FAA pilot survey focused specifically on pilots with seaplane ratings to obtain accurate, updated information about seaplane pilot statistics in the United States and seaplane pilot inspection and decontamination behaviors.

B. Conduct Research

- Invest in research that uses technology to inform seaplane pilots when AIS is detected on their rudders or in their floats.
- Work with industry and the Environmental Protection Agency to identify a product (e.g., chemical) or treatment (e.g., UV light) that kills AIS prior to pumping out a float. In the interim, provide seaplane pilots with guidance relative to chemical use.
- Explore modifications to rudder conformations to lessen attachment of aquatic plants.
- Explore the potential for the use of anti-fouling paints on floats.
- Investigate the efficacy of saltwater landings in killing freshwater AIS transported by seaplanes.
- Host a more in-depth Think Tank with industry to produce a technical bulletin for the seaplane industry similar to what the watercraft industry produced: *Design and Construction of Watercraft and Watercraft Accessories in Consideration of Aquatic Invasive Species*.

C. Address Gaps in Seaplane Regulations

- To address coverage gaps in state regulations, states should review their existing AIS laws and consider expanding their scope of current CDD obligations to include seaplanes. States without CDD requirements should consider adopting these requirements to further national alignment of state AIS policy.

D. Expand Outreach to Seaplane Pilots

- Implement efforts to increase the transparency and accessibility of local seaplane ordinances and restrictions. State Departments of Transportation could maintain websites that compile information on seaplane bases and local water body restrictions. The Wisconsin Department of Transportation's Seaplane Information webpage is a potential model for such a resource.
- Provide information to pilots on where they can report suspect AIS to the responsible state agency or entity to advance prevention efforts, particularly in places such as Alaska, where seaplanes are a common mode of transportation.
- Provide the seaplane industry with tools to raise awareness of AIS and the seaplane pathway, e.g., produce AIS inspection checklists on airplane struts, distribute regional case studies to all U.S. seaplane schools.
- Ensure float manufacturers provide information about AIS in the information and manuals they provide when they sell their products.
- Incorporate real-time AIS data layers to apps used by seaplane pilots to inform flight planning.

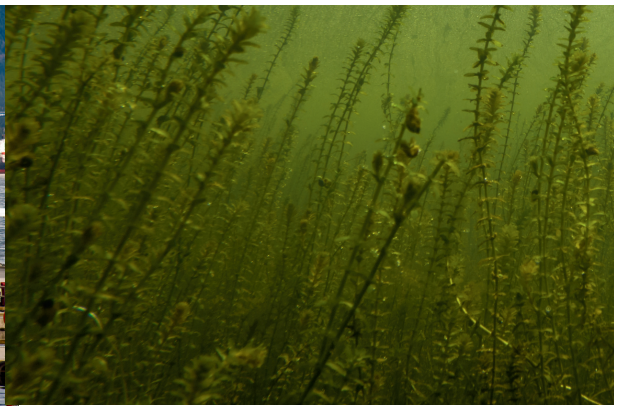
- Work with Transport Canada to share the results of the seaplane project, including case studies and education modules, and encourage enhanced engagement on AIS-seaplane issues with Canadian-licensed seaplane pilots.

E. Ensure AIS Training is a Mandatory Component of FAA Seaplane Rating Training

- Ensure AIS training is a mandatory component of FAA seaplane rating training by including information on the seaplane pathway-AIS nexus and seaplane pilot best practices in the FAAH808323, Seaplane, Skiplane, and Float/Ski Equipped Helicopter Operations Handbook.
- Produce and distribute an FAA Advisory Circular on the seaplane-AIS nexus and best practices.

F. Enhance AIS Decontamination Infrastructure

- Prioritize AIS outreach and cleaning infrastructure at FAA-recognized seaplane bases and high output seaplane schools to maximize strategic investments that facilitate reducing risk of AIS transport via the seaplane pathway. Infrastructure could include signage, cleaning stations, dry docks, and other tools to raise awareness and assist pilots with decontamination procedures.

Project Background

The Aquatic Nuisance Species Task Force (ANSTF) Strategic Plan (2020–2025), Objective 2.2 and 2.3, identifies a need to evaluate and prioritize pathways, develop risk management strategies, and encourage implementation of non-regulatory and regulatory measures to prevent the establishment and spread of aquatic invasive species (AIS) in waters of the United States. The ANSTF determined that more information is needed to assess the risk of spreading AIS via the seaplane pathway and that prevention measures could potentially mitigate this risk.

Based on data collected at U.S. Department of Agriculture inspection stations (McCullough et al. 2006), international air travel is a significant pathway for the introduction of nonnative pest species. A few examples, such as the spread of *Elodea* spp. in Alaska, conclusively quantify the risk of transport of AIS by seaplanes.

The U.S. Fish and Wildlife Service initiated this project via Grant F23AP0102600.

Phase I of this project included a literature review, which compiled information about risk assessments and risk assessment frameworks, seaplanes and pilots in the United States, federal and state laws governing seaplane use, information about high-risk AIS, impacts of AIS on ecosystem services, the nexus of climate change, AIS, and seaplanes, and seaplanes as a pathway for AIS spread.

Phase II of this project included a survey to seaplane pilots in the lower 48 states and Alaska, regional seaplane pilot focus groups, creation of regional case studies illustrating the role seaplanes can play in the spread of high-risk AIS, high-risk AIS seaplane pilots may encounter in their FAA region, seaplane pilot best practices to reduce the spread of AIS, and a webinar to share project progress. In addition, a set of Environmental Systems Research Institute, Inc. (ESRI) data layers was compiled that mapped U.S. seaplane schools, FAA-recognized seaplane bases, and observations of AIS reported to the U.S. Geological Survey Nonindigenous Aquatic Species database.

Phase III of the project included the development of a risk assessment framework that characterizes various factors that contribute to the risk of seaplanes serving as a pathway for the spread of AIS as well as a "Think Tank" summit with industry representatives to discuss the

potential for more detailed convenings and products, such as technical reports for industry, similar to what was produced as part of the American Boat & Yacht Council (ABYC)/watercraft/AIS effort.

Phase IV of the project included the development of an FAA Advisory Circular on seaplanes and AIS, an education module to be incorporated into FAA-H-8083-23 (*Seaplane, Skiplane, and Float/Ski Equipped Helicopter Operations Handbook*), and two pages of information on seaplane pilot best practices to be incorporated into the book, *Guide to Seaplane Flying* (Fenster and Fenster 2019). The project concluded with this final report and recommendations as well as presentations to ANSTF, the U.S. Fish and Wildlife Service, and pilots.

The Alaska Case Study

Studies of the seaplane transportation pathway in Alaska concluded that seaplanes have contributed to the spread of common waterweed (*Elodea* spp.), an herbaceous perennial aquatic plant (Figure 1) (Schwoerer 2017). *Elodea* spp. was first detected in 1982 (Professional Fisheries Consultants 1985) in Eyak Lake in Cordova, Alaska, and was subsequently discovered in 2010 in the Chena Lakes and Badger Slough (Carey et al. 2016). In 2014, *Elodea* spp. was detected in Alexander Lake in the Matanuska-Susitna Basin and has since been detected in numerous remote Alaska water bodies accessible only in the summer by boat or floatplane (Alaska Public Media 2014). In 2015, *Elodea* spp. was detected in Lake Hood, the world's busiest seaplane base (Hollander 2015). In 2017, *Elodea* spp. was detected on Sports Lake on the Kenai Peninsula, likely the result of one of five private float planes on the lake (Schwoerer and Morton 2018). Currently, half of existing *Elodea* spp. populations are in floatplane-accessible water bodies (Larsen et al. 2020). Known *Elodea* spp. populations are believed to be the results of independent introductions followed by dispersal by floatplane and other pathways (Schwoerer and Morton 2018).

The spread of *Elodea* spp. could have significant economic impacts on fisheries, businesses, and recreation, if left unchecked. Currently, the significance of the seaplane pathway as a vector for high-risk AIS species, such as dreissenid mussels, within the contiguous United States, and between Alaska and the contiguous United States, is poorly understood.

Figure 1. Map (left) illustrates the locations of seaplane bases near Anchorage, Alaska (red and white airplanes). The green and yellow colors designate Elodea spp. populations (yellow indicates high concentrations of Elodea spp., and green indicates low concentrations). Photo shows Elodea spp. in Alexander Lake, Alaska (Source: Kristine Dunker, Alaska Department of Fish and Game). Proximity of seaplane bases to Elodea spp. populations in Alaska has precipitated interest in assessing the risk of the seaplane pathway and proposing proactive measures to mitigate that risk.

Compilation of Information on Seaplanes, Pilots, and Aquatic Invasive Species

Seaplanes and Seaplane Equipment

Seaplanes are airplanes designed to take off from and land on water. The Federal Aviation Administration characterizes seaplanes as either flying boats (referred to as hull seaplanes) or floatplanes (FAA 2004) whereas others describe three types of seaplanes: floatplanes, flying boats, and amphibious aircraft (Gudmundsson 2013). The bottom of the fuselage is the primary landing gear of a flying boat whereas floats, called pontoons, are fitted to float planes and serve as landing gear. Floats and hulls are designed to optimize hydrodynamic and aerodynamic performance (FAA 2004).

Seaplane floats must contain at least four watertight compartments about equal in volume (Figure 2) to prevent the entire float from filling with water if it becomes ruptured.

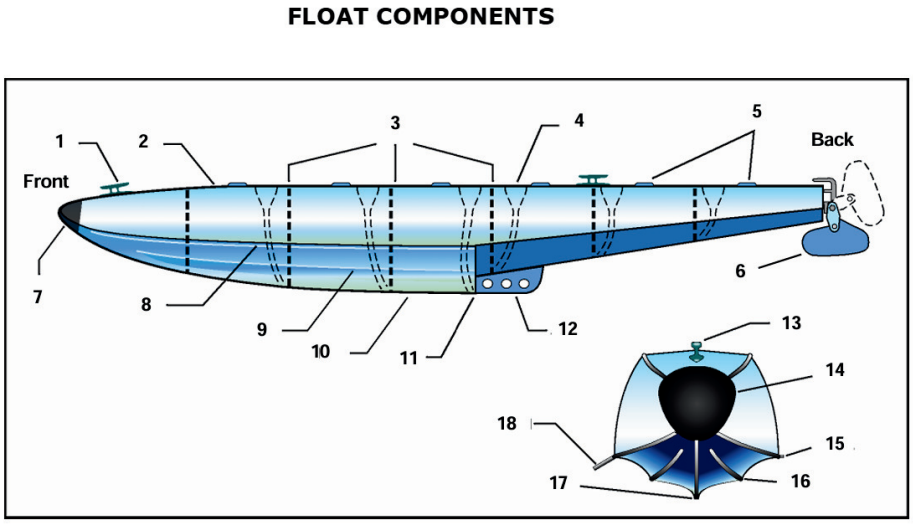


Figure 2. Anatomy of a seaplane float, illustrating internal and external components. Source FAA (2004). Mooring cleat (1), Deck (2), Internal bulkheads dividing compartments (3), Bilge pump openings (4), hand hole covers (5), retractable water rudder (6), bumper (7), chine (8), sister keelson (9), keel (10), step (11), skag (12), mooring cleat (13), bumper (14), chine (15), sister keelson (16), keel (17), and spray rail (18).

There are two types of floats for planes—amphibious, which have retractable landing gear that allow the plane to land on both water and hard surfaces—and straight floats, which can be landed only on water. Most general aviation and small commercial aircraft have versatile landing gear fittings such that their wheels can be replaced with floats. In many areas of the northern United States and Canada, this is done on a seasonal basis.

Because seaplanes are designed to land on and take off from water, nautical terms are used when referencing them (e.g., port and starboard designate left and right, respectively; the nose of the airplane is called the bow; the aft end of the aircraft is called the stern) (Gudmundsson 2013). Nautical symbology is also used when depicting the three types of seaplane bases—those with either no facilities or for which there is incomplete information about the base (top symbol), civil seaplane bases with fuel and services (middle symbol), and military seaplane bases with fuel and services (bottom symbol) (Figure 3). Lake Hood, a civil seaplane base with fuel and services in Anchorage, Alaska, is the largest seaplane base in the world (Figure 4).

Figure 3. Seaplane base symbology (right graphic). Source: FAA (2004). The top symbol is used to describe a seaplane base that has either no facilities or has incomplete information associated with the base. The middle symbol is used to describe a seaplane base with fuel and services. The bottom symbol is used to describe a military seaplane base with fuel and services.

Figure 4. Lake Hood in Anchorage, Alaska, is the busiest floatplane base in the world, servicing an average of 190 flights daily. The base is located adjacent to the Ted Stevens Anchorage International Airport.

Seaplane Ratings

See Test Standards for Airplane Pilots section, which provides additional context to this section.

It is rare for pilots to obtain standalone seaplane ratings to fly seaplanes. Generally, land plane-certified pilots interested in flying a seaplane add a seaplane rating to their existing pilot license.

There are several types of ratings that pertain to seaplanes:

- Private Airplane Single Engine Sea (ASES)
- Commercial Airplane Single Engine Sea (ASES)
- Airline Transport Pilot Single Engine Sea Ratings (ATPSES)
- Combined Seaplane Ratings (ASES & ASEL)
- Multi-Engine Sea (MSES)

There is no requirement for an FAA written exam for individuals that seek to obtain an ASES rating if they have a current pilot certificate.

Seaplane Bases

Seaplane bases can serve as sources for AIS, particularly in areas with remote seaplane-accessible waterbodies (Schwoerer et al. 2022). In the short term, ensuring float plane bases are free from AIS is the most effective action that can be taken to prevent the transport of AIS to waterbodies (Schwoerer et al. 2022).

The FAA Airmen Certification System lists 529 seaplane bases in the contiguous United States and Alaska (Table 1, Figure 5). On a percentage basis, 76% of all U.S. seaplane bases are in three regions: the Eastern Region (26%), followed by Alaska (25%) and the Great Lakes Region (25%). The remaining five regions comprise a total of 24% of all U.S. seaplane bases. The number and location of seaplane bases may provide an indication of the amount of seaplane use within a particular region (Figure 6).

Table 1. Seaplane bases in the United States by both state and FAA region.

Region	States	Total
Alaska	AK (132)	132
Central	IA (0), KS (0), KY (0), MO (3), NE (1), TN (1)	5
Eastern	CT (4), MD (4), ME (49), MA (18), NH (15), NJ (7), NY (15), NC (1), PA (8), RI (0), VA (3), VT (5), WV (10)	139
Great Lakes	IL (6), IN (32), MI (12), MN (58), ND (1), OH (3), SD (1), WI (16)	129
NW Mountain	CO (2), ID (4), MT (3), OR (2), WA (22)	33
Southern	AL (7), GA (3), FL (64), SC (2)	76
Southwest	LA (8), NM (1), TX (3)	12
Western Pacific	CA (3)	3
	Total	**529**

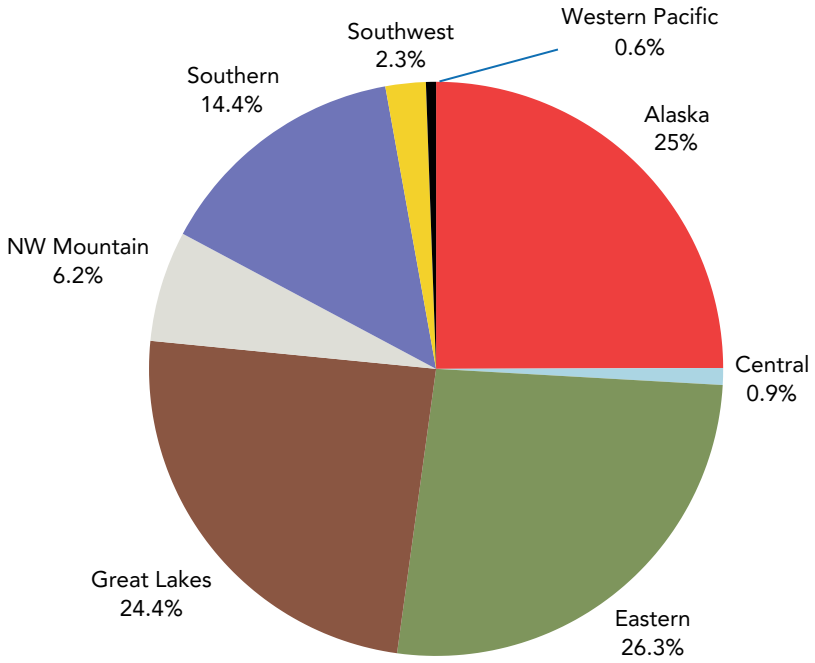


Figure 5. Percent of FAA-recognized seaplane bases in eight FAA regions.

Pilots with ASES Ratings in the United States

There were a total of 753,180 registered pilots in the categories of Student Pilot, Sport Pilot, Private Pilot, Commercial Pilot, and ATP Pilot in the continental United States (50 states plus District of Columbia) as of 1 September 2023 (Airmen Certification System 2023) (Appendix A).

Several seaplane training schools, websites, and seaplane associations estimate there are 35,000 certified pilots with seaplane ratings[1] in the United States. The FAA does not have an accurate number of pilots that possess seaplane ratings and are actively flying. The Seaplane Pilots Association notes that as of December 31, 2023, the number of rated seaplane pilots was 21,329 (Seaplane Pilots Association, pers. comm.). However, the FAA pilot database only identifies pilots that have one or more seaplane ratings; it does not identify active pilots. The FAA U.S. pilot database (2023) lists 257,730 U.S. pilots with Airplane Single Engine Land (ASEL) or Airplane Single Engine Sea (ASES) ratings. The FAA requires pilots to have a pilot certificate, a current flight review, currency in the aircraft, a photo identification, and a valid medical certificate – registered pilots without an active medical certificate are not legally licensed to fly. There are no expiration dates for seaplane ratings and pilot certificates. However, currently requirements and medical certificates have expiration dates.

The U.S. Civil Airmen Statistics is published annually and includes information not published in other FAA reports (e.g., estimated active airmen certificates, estimated active women airmen certificates, average age of active pilots, etc.). This database also does not reveal the number or percentage of pilots that possess seaplane ratings that are actively flying.

[1] An aircraft rating is a flight crew qualification that allows you to operate particular aircraft. The rating(s) you need depends on the type of pilot license you hold and the aircraft you want to fly.

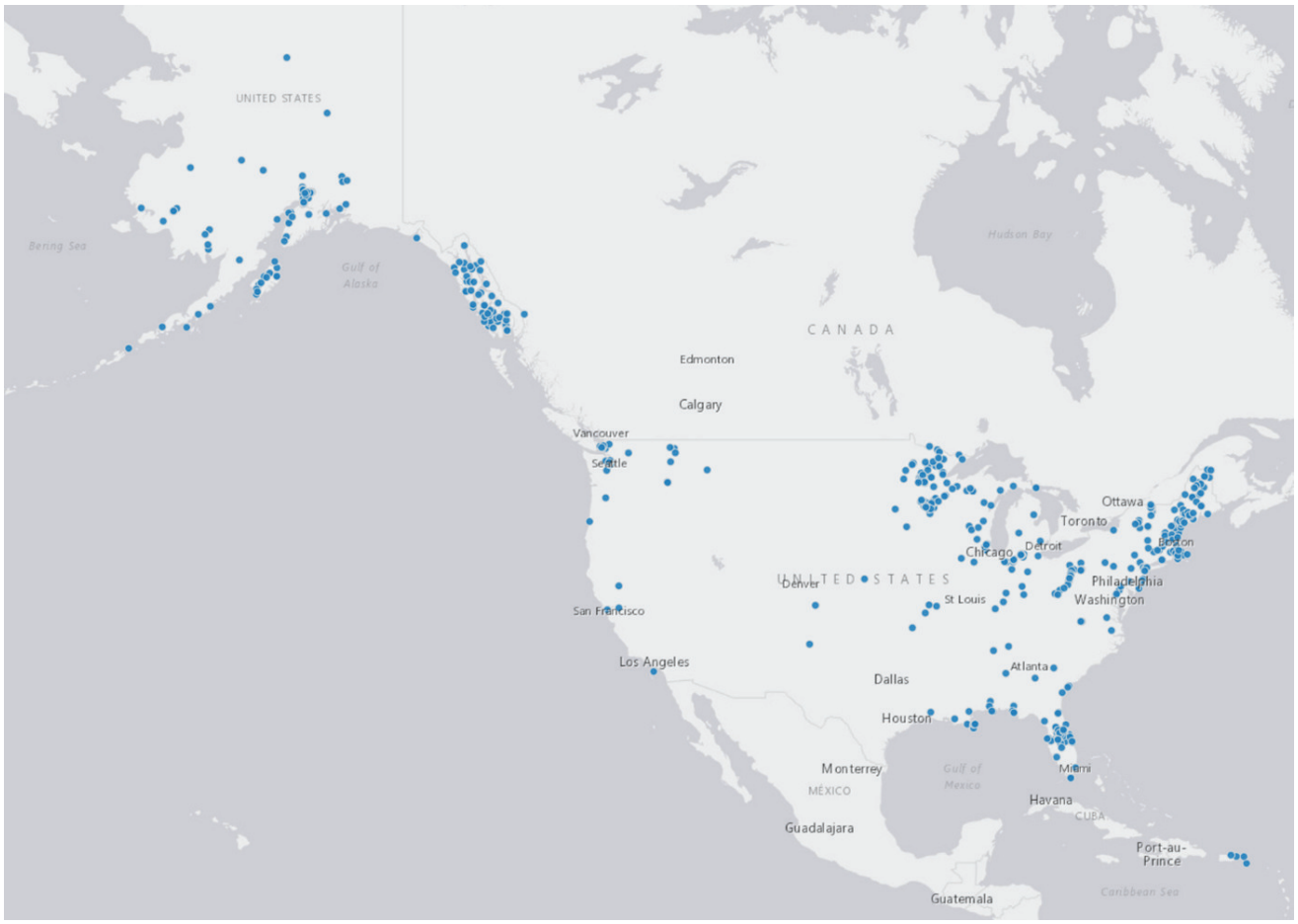


Figure 6. Locations of FAA-recognized seaplane bases in the lower 48 contiguous states. Source: Bureau of Transportation Statistics Aviation Facilities.

Seaplane Numbers and Use

Understanding trends in seaplane use can help inform AIS risk assessments. The average number of hours flown by all fixed wing aircraft, both piston and turboprop, remained relatively stable from 2012–2022 (Table 2). Seaplanes comprise a subset of this larger group of aircraft. The total estimated number of active fixed wing piston and turboprop aircraft in 2022 was 137,728 and 10,713, respectively (https://www.faa.gov/data_research/aviation_data_statistics/general_aviation/cy2022). In 2022, 68.3% of active fixed wing piston aircraft had fixed wheels and 29.7% had retractable wheels; 24.5% of active fixed wing turboprop aircraft had fixed wheels whereas 72.9% had retractable wheels. The average airframe hours for active fixed wing piston aircraft were 7,293 (in thousands) (single engine 3,123; twin engine 4,170). The average airframe hours for active fixed wing turboprop aircraft were 10,340 (in thousands) (single engine - 3,108; twin engine - 7,232).

The estimated active aircraft, flight hours flown, and average flight hours by FAA region is generated annually by the FAA General Aviation Survey (Table 3).

Table 2. Average number of hours (in thousands) flown by fixed wing piston and turboprop aircraft, 2012–2022. Source: FAA General Aviation and Part 135 Activity Survey results.

Year	Fixed Wing Piston	Fixed Wing Turboprop
2012	117	265
2013	116	269
2014	114	267
2015	117	261
2016	121	277
2017	121	264
2018	126	276
2019	126	256
2020	115	227
2021	133	262
2022	137	266
	Total	**2,890**

Table 3. Estimated active aircraft, flight hours flown, and average flight hours by FAA region (2022). Source: FAA General Aviation and Part 135 Activity Survey 2012–2022.

Region	Estimated Active Aircraft	Estimated Total Flight Hours Flown	Estimated Average Flight Hours
Alaska	6,049	757,611	125
Central	11,678	1,139,343	98
Eastern	30,036	3,693,338	126, 112
Great Lakes	30,821	3,552,640	115
NW Mountain	29,073	3,927,850	135
Southern	41,934	5,608,600	134
Southwest	31,760	4,509,453	142
Western Pacific	28,188	3,764,544	133
Total	**209,540**	**26,953,420**	**129**

Airplane Pilot Test Standards

The FAA publishes *Airline Transport Pilot and Type Rating for Airplane: Airman Certification Standards* (ACS) (FAASACS11) – 2019 to communicate aeronautical knowledge, risk management, and flight proficiency standards for airline transport pilot certification (ATP) and type rating certification. The ACS includes the totality of airman certification. The ACS is the guidance instructors follow to ensure their curriculum meets FAA expectations and their students are prepared for practical tests. The ACS also helps to ensure private sector-Designated Pilot Examiners and government FAA inspectors test for the knowledge, skills, and judgment standards the FAA desires on the practical test. The ACS is part of the safety management system framework the FAA uses to mitigate risks associated with airman certification training and testing, and includes the following functional components:

- Safety Policy that defines and describes aeronautical knowledge, flight proficiency, and risk management as integrated components of the ACS;

- Safety Risk Management processes through which internal and external stakeholders identify and evaluate regulatory changes, safety recommendations, or other factors that require modification of airman testing and training materials;

- Safety Assurance processes to ensure the prompt and appropriate incorporation of changes arising from new regulations and safety recommendations; and

- Safety Promotion in the form of ongoing engagement with both external stakeholders (e.g., the aviation training industry) and FAA policy division.

The standards include Preflight Preparation for different types of certifications, including "Water and Seaplane Characteristics, Seaplane Bases, Maritime Rules, and Aids to Marine Navigation" (ASES, AMES). Within the ACS for seaplane rating, the objective of Preflight Preparation is to determine if the applicant exhibits satisfactory knowledge, risk management, and skills associated with water and seaplane characteristics, seaplane bases, maritime rules, and aids to marine navigation (References 14 CFR part 61; FAAH80832, FAA H80833, FAAH808323; USCG Navigation Rules, International Inland; POH/AFM; Chart Supplements; AIM).

Individuals obtain an airman certificate based on the category and/or class aircraft appropriate to the task, e.g., ASES, AMES. To become a seaplane pilot, an individual earns an SES or MES rating on their airman's certificate or earns a sea plane endorsement in his/her Sport Pilot logbook if flying a sport or light sport aircraft.

- FAAH80833C is the *Airplane Flying Handbook* produced by the FAA (Figure 7). The most recent version of the handbook is 2024 (the earlier version, 3B, was produced in 2016). The handbook, developed by the Flight Standards Service, Airman Testing Standards Branch, and aviation educators and industry, provides basic knowledge that is essential for pilots. Updates to the manual include information such as new graphics, new or modifications to existing programs, and safety procedures. Practical tests for FAA pilot certificates and associated ratings are administered by FAA inspectors and Designated Pilot Examiners (DPE) using FAA Airman Certification Standards (ACS), which contain structured areas of operation, tasks, and standards. Practical test consists of the tasks specified in the areas of operation for the airman certificate or rating sought. To pass the test, the applicant demonstrates mastery of the aircraft performing each task successfully, with proficiency and competency, and within the approved standards, and sound judgment (FAA 2021). The pilot must "exhibit knowledge of the elements related to preflight inspection, including which items must be inspected, the reasons for checking them, and how to detect possible defects; inspect the airplane with reference to an appropriate checklist, and verify the airplane is in safe condition for flight."

- FAAH808323 is the *Seaplane, Skiplane, and Float/Ski Equipped Helicopter Operations Handbook* (Figure 7) was revised in 2004 and is slated to be updated in 2025. This handbook introduces the basic skills necessary for piloting seaplanes, skiplanes, and helicopters equipped with floats or skis. It was developed by the Flight Standards Service, Airman Testing Standards Branch, and various aviation educators and industry. The handbook assists pilots that hold private or commercial certificates and seek to learn how to fly seaplanes, skiplanes or helicopters equipped for water or ski operations. Chapter 4 provides information on seaplane preflight and takeoff procedures. Page 42 of the handbook instructs pilots to, "Remove any water weeds or other debris lodged in the water rudder assembly." "Noting their position before landing can prevent fouling the water rudders with weeds while taxiing or puncturing a float on a submerged snag."

- FAAH808325C is the *Pilot's Handbook of Aeronautical Knowledge* updated in 2023 (earlier version was 2016) (Figure 7). The handbook provides basic knowledge essential for pilots and is used for both beginning pilots and those seeking advanced pilot certificates, and was produced by the FAA with the assistance of the Safety Research Corporation of America.

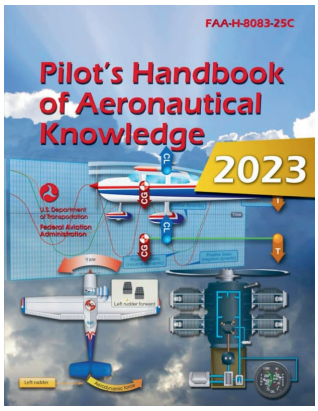


Figure 7. Covers of the FAA pilot training publications.


Mitigating the Risks of AIS Via the Seaplane Pathway

AIS-Seaplane Self-inspection Protocols and Pilot Outreach

Invasive species can be moved among waterbodies when a seaplane comes in contact with aquatic invasive plants, such as *Elodea* spp., or other AIS in the water, such as dreissenid mussels. Training manuals, online materials, checklists, and verbal information are provided to pilots seeking their seaplane credentials. These training materials and instructions include guidance to identify the weather and water conditions that may influence the landing and takeoff of a seaplane. Pilots conduct preflight inspection of seaplanes to ensure the safe operation and maintenance of the plane. Close examination of Federal Aviation Administration's *Seaplane, Skiplane and Float/Ski Equipped Helicopter Operations Handbook* (FAA 2004) does not explicitly mention aquatic invasive species, however, there is mention of debris in the case of identifying safe landing conditions and checking for accumulated water within seaplane floats as an important step in maintenance.

There are numerous resources available to seaplane pilots to learn about preventative actions to avoid the spread of invasive species. The following are examples, and are not intended to be comprehensive:
Numerous seaplane pilot associations share links to information about AIS and seaplanes:

- Aircraft Owners and Pilots Association
- Columbia Seaplane Pilots Association
- Montana Seaplane Pilots Association

The Seaplane Pilots Association (SPA) dedicates a portion of their website to aquatic invasive species. "Stopping the Spread" addresses the potential for bilge water to be contaminated and recommends four general rules seaplane pilots can follow to minimize the risk of transporting invasive species. The SPA also provides audio podcasts to members. The Seaplane Foundation dedicates a page of its website to Invasive Species Education, promoting Stop Aquatic Hitch-hikers!™ and illustrating examples of seaplane decontamination.

The Pacific Northwest training video and certification is maintained by the Washington Seaplane Pilots Association. This resource provides a short video on inspection and cleaning of seaplanes, a test, and a certificate. The certification is not required for seaplane pilot operation, but the states of Washington, Oregon, Montana, and Idaho endorse its completion. Numerous seaplane associations and organizations reference the video, information, and protocols promoted by the State of Washington.

British Columbia published, "Best Management Practices: Seaplane Operations and Invasive Species: A Pocket Guide for Commercial and Recreational Seaplane Operators," in 2023. The 51-page publication, produced collaboratively with the BC Floatplane Association, the Washington Seaplane Pilots Association and numerous members from the Invasive Species Council of British Columbia Seaplane Advisory Committee, includes information about invasive species, best management practices for floatplane and seaplane operators, a best practices checklist (before and after flying as well as during storage and mooring), and information about reporting invasive species and contacting regional invasive species organizations.

Numerous federal agencies promote best management practices and guidelines to mitigate risk of AIS and seaplanes:

- U.S. Forest Service (2012)
- U.S. Army Corps of Engineers (2016)
- National Park Service
- National Wildland Fire Coordinating Group
- Pacific States Marine Fisheries Commission's (PSMFC) Recommendations for Seaplane Inspection and Decontamination for Aquatic Nuisance Species, published in August of 2010, documents actions seaplane pilots can take to mitigate AIS. The PSMFC website, Western Aquatic Invasive Species Resource Center, describes the seaplane pathway and procedures seaplane pilots can follow to minimize transport of AIS.

Numerous state agencies share information about AIS and seaplanes. Examples include:
Alaska | Idaho | Minnesota | New Hampshire | Wisconsin

Several municipalities and counties share protocols and training for seaplane pilots:
Whatcom County, Washington requires seaplane pilots to enter into a cooperative agreement with the City of Bellingham stating the pilot will follow required procedures. They also ask that pilots voluntarily submit information for each landing on Lake Whatcom or Lake Samish, including the date of landing, origin of the flight, and other lakes visited on their trip. Whatcom County provides pilots with an AIS-Seaplane Guide and Log Book.

In 1996, the Great Lakes Panel on Aquatic Nuisance Species, a regional body under the federal ANSTF, created voluntary guidelines for seaplanes, which were subsequently adopted by the ANSTF as national guidelines in 1999 (Zook and Phillips 2015). In 2011, the ANSTF revised those guidelines for seaplanes and other recreational activity vectors (ANSTF 2013). The intent of the guidelines is to provide consistent, practical, and effective information to prevent the spread of AIS, consider pathways and AIS life histories, and promote voluntary actions (ANSTF 2013). Since

the development of these guidelines, numerous jurisdictions have implemented mandatory inspection protocols for seaplanes as well as ordinances and regulations that prohibit the landing of any seaplane contaminated with AIS, e.g., Lake Tahoe region (Wittman and Chandra 2015).

The Pacific Northwest training video and certification has been one of the most well-accepted and supported set of seaplane self-inspection protocols developed to date. The 2023 publication produced in British Columbia mirrors many of the Washington protocols.

Climate Change-AIS-Seaplane Nexus

Climate change alters ecosystem conditions, which enables the spread of invasive species via range expansion as well as creation of habitats and conditions suitable for newly introduced invasive species (U.S. EPA 2008). Climate change will influence the likelihood of new species becoming established by eliminating cold temperatures or winter hypoxia that currently prevents survival and by increasing the construction of reservoirs that serve as invasive species hotspots (Rahel and Olden 2008). Climate change will facilitate expansion of invasive species into new areas and magnify the effects of established invasive species (Rahel and Olden 2008). Climate change, in combination with changes in use of the land and sea, facilitate both establishment and spread of invasive species, particularly in fragmented ecosystems (IPBES 2023). Climate change will contribute to reductions in water quality and quantity, including the spread of and shifts in invasive species (Woolway et al. 2022). Lakes are changing rapidly in response to natural and anthropogenic stressors (Woolway et al. 2022); climate change is a threat multiplier in lakes (Smol 2010), particularly in lakes with seasonal ice cover (Hampton et al. 2017).

Some regions, particularly in Alaska, may have more months with ice- and snow-free conditions as a result of a warming climate. Rising temperatures are contributing to a shortened snow-cover season, melting glaciers, thawing permafrost, and less predictable sea ice extent in the Bering, Chukchi, and Beaufort Seas (USDA Northwest Climate Hub[2]).

Human actions at the individual, institutional, and societal levels contribute to invasive species-climate change issues (Bradley et al. 2023). Facilitating information exchange and incorporating climate change into invasion risk assessments are two approaches that involve minimal expense and working within existing frameworks to incentivize climate-smart actions to reduce invasion risk and impacts (Bradley et al. 2023). Engaging with stakeholders and ensuring regulatory agility exists to respond to climate and other change drivers is a key requirement for strengthening the management response to biological invasions (Robinson et al. 2020).

Although predicting where invaders may spread and their impacts are important, engaging with stakeholders to understand their values relative to invasive species and the environment has the most utility (Tebboth et al. 2020). McCumber et al. (2023) found geographical patterns in "lake ethic"—attitudes, goals, and management—of stakeholders interviewed across lake communities in four U.S. states, focusing on the cultural meanings of nature for stakeholders. Communities represented by the public good lake ethic are more likely to respond to approaches that

2] https://www.climatehubs.usda.gov/hubs/northwest/topic/alaska-and-changing-climate

minimize invasive species while recognizing the value of the lake community for recreation and human enjoyment whereas those represented by the exclusive resource lake ethic are more likely to respond to approaches that seek to remove and minimize invasive species in recognition of the value of other nonhuman aquatic species and the lake community as a whole (McCumber et al. 2023).

The Transport-Stowaway Pathway

The Convention on Biological Diversity defines pathway as "any direct or indirect human activity, which enables the entry or spread of nonindigenous invasive species" (CBD 2014). Identification and prioritization of pathways help prevent the establishment and spread of invasive species (Roy et al. 2014). This is often referred to as biosecurity planning—managing and lowering the risk associated with invasive species.

Although little has been quantified about the risk of aviation-based AIS transmission (Carey et al. 2016), seaplanes have been identified as a pathway for the spread of aquatic invasive species (U.S. Coast Guard 2000, Aquatic Nuisance Species Digest 2001, National Invasive Species Council 2007, Randall 1999, Warren and Sytsma 2009, Strayer and McNeil 2009, McNeil and Strayer 2010, Lake Superior Binational Program 2014, Ontario Invasive Species Awareness Program 2021, Invasive Species Council of British Columbia 2023).

The 18th Subsidiary Body on Scientific, Technical, and Technological Advice to the Convention on Biological Diversity determined there were six principle ways nonindigenous species are introduced, one of which is Transport-Stowaway, which refers to the moving of live organisms attached to transporting vessels and associated equipment and media (Lipinskaya et al. 2020). Seaplanes are in the transport-stowaway pathway.

Lipinskaya et al. (2020) analyzed pathways of introduction and spread of AIS in Belarus. They identified 24 aquatic nonindigenous species that arrived in Belarus via six pathways involving 10 separate vectors. The most introductions occurred through the "transport stowaway" pathway, and hull fouling played an important role in the spread of these species to and through Belarus (Lipinskaya et al. 2020). They document the Transport-Stowaway pathway, which includes hull fouling and hitchhikers, both of which pertain to seaplanes (Figure 8).

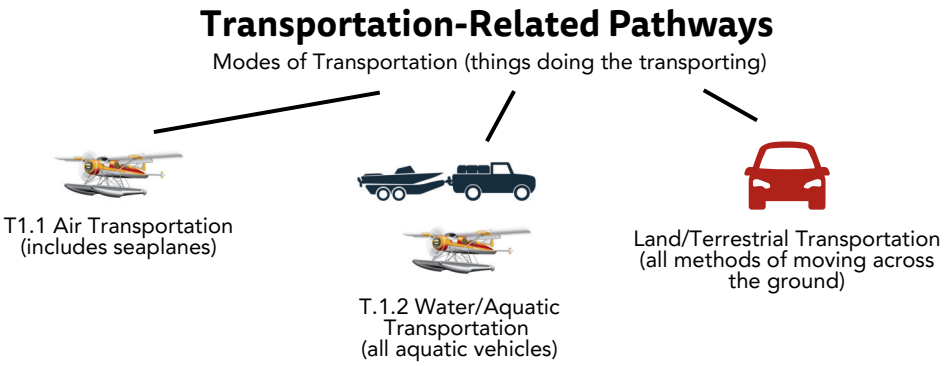


Figure 8. Transportation-related pathways contribute to the spread of AIS. Source: National Invasive Species Council 2007. Seaplanes are in categories T1.1 and T.1.2.

Although long-distance dispersal of AIS by aircraft has been attributed to the accelerated rate of spread across vast and remote landscapes (Schwoerer et al. 2022), Warren and Sytsma (2009) characterized the risk of seaplanes transporting AIS to Oswego Lake in Oregon as minimal because seaplanes land infrequently on the water body. However, seaplanes were determined to be a key pathway for the transport of *Elodea* spp. in Alaska (Schwoerer et al. 2022); management recommendations to mitigate risk include maintaining floatplane bases free of AIS and immediate cleanup of *Elodea* spp. to reduce risk of reintroduction (Schwoerer et al. 2022).

There may be factors associated with seaplane construction as well as operations that create opportunities for AIS to be unintentionally transported from one water body to another. Seaplanes naturally must come in contact with water during takeoff and landing. The high dynamic water pressure and the physical stresses of takeoffs and landings can momentarily open tiny gaps between float components, allowing small amounts of water to enter (FAA 2004), especially on older riveted aluminum floats (fiberglass Aerocet floats are essentially waterproof). Sitting idle in the water also results in a small amount of seepage and condensation. Small amounts of water may contain microscopic AIS, such as larval dreissenids. Further, movement of a seaplane through vegetation on the waterbody can result in vegetation becoming entangled with seaplane components.

The Minnesota Department of Natural Resources (n.d.) identified locations on seaplane floats where pilots should check for aquatic invasive species. They include water rudders, the transom, step area, wheel wells, trailing line, and chine (Figure 9). The U.S. Army Corps of Engineers (2016) suggested that aquatic invasive species can be transported via fouling of cables, cross members, rudders, transoms, step areas, wheel wells, and chine of the floats/pontoons, or the water inside the floats. Aquatic invasive species can become attached to seaplanes during taxiing, storage and moorage, landing, and takeoff (USACE 2016).

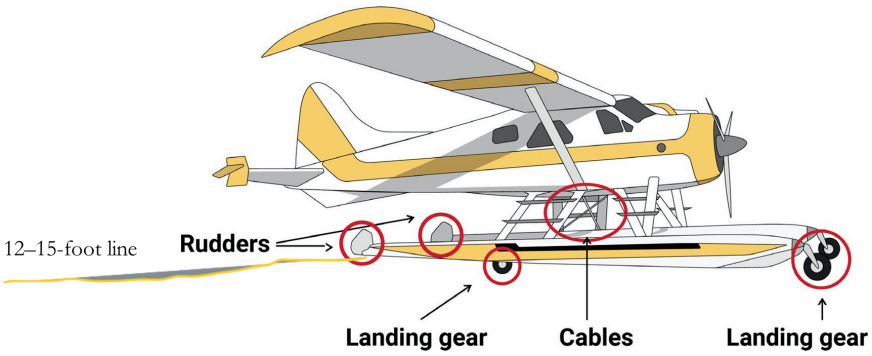


Figure 9. Locations on a seaplane where pilots should inspect for aquatic invasive species include the water rudders, landing gear, and cables. Floats should be inspected and pumped to minimize transport of AIS in water in the floats. Source: Invasive Species Council of British Columbia (2023).

Because it is difficult for floats to be cleaned between lake landings, seaplanes create an opportunity for AIS to be transported among watersheds when they land on multiple lakes (Bayfield County Lakes Forum 2008). Adult zebra mussels can attach to submersed areas of the plane, such as floats/pontoons and rudders, and species such as spiny waterflea (*Bythotrephes longimanus*) and microscopic larval dreissenids (Dreissena spp.) can be found inside any space that holds water,

including floats and pontoons. Acorn Welding describes one of six unique maintenance problems for seaplanes being water forces that lead to cumulative damage of the float, including distorting skin, dents, or loose rivets or gaps that open between floats; they note that water in more than one-fourth of a compartment indicates a maintenance problem. Water that accumulates in a float creates an opportunity for the transport of aquatic invasive species.

Some AIS, such as invasive freshwater snails in the Great Lakes region, move into shallow water in the summer (Jokinen et al. 1982, 1992), which increases their susceptibility for being transported by seaplanes. Once established in a waterbody, AIS can more easily spread to nearby waterbodies (Havel et al. 2015), and once established in a region, the change of persistence is enhanced (Hanski 1999).

Survivability of AIS on Seaplanes

Numerous studies have examined the survival of aquatic plants, bivalves, snails, and other aquatic species and aquatic invasive species to desiccation, however, none of these studies have documented the compounding effects of altitude, lower levels of oxygen, and temperature with air drying and wind speed to estimate survivability of AIS on seaplane structures. Examples of survivability studies include:

- Bruckerhoff et al. (2014) found that single aquatic plant stems were viable up to 18 and 12 hours of air exposure, respectively, coiling stems extended the viability up to 48 hours of air exposure, and turions sprouted after 28 days of drying.

- Havel et al. (2013) concluded invasive snails readily survive long periods of overland transport desiccation after two species of snail that invaded the Great Lakes region survived for 42 days, one species survived for 63 days, and viable young were released by one species after 54 days.

- Multiple studies have examined the survival of dreissenid mussels to desiccation or air exposure. Adult mussels may survive up to five days or longer based on temperature and humidity conditions (Ricciardi et al. 1995, Ussery and McMahon 1995) whereas veligers can survive up to 24 days in small amounts of water (Craft and Myrick 2011, Snider et al. 2014, Campbell et al. 2016).

- Collas et al. (2018) noted three conditions must be met before boats become successful vectors of dreissenids, including attachment to the hull, air exposure survival during overland transport, and the ability to establish a viable population either after detachment or release of spat during launching and sailing. Collas et al. (2018) found alive detachment during rewetting was significantly higher after 24 hours compared to 48 hours of air exposure, and concluded zebra mussels were more likely to attach to common boat materials than quagga mussels. Collas et al. (2018) noted that shaking and vibration of boats may affect the number of mussels that attach, survive air exposure, and subsequently detach during rewetting. This conclusion has implications for seaplanes, which undergo considerable shaking and vibration during takeoff and landing.

Helping Seaplane Pilots Address AIS

Acme Tools sells a Turbo Float Pump, which is designed to be used with a cordless drill to pump up to six gallons a minute from seaplane floats (Figure 10). An additional "Invasive Species Water Filter Kit" can be purchased as an option – it claims to "stop invasive species as small as 20 microns" from exiting the pump. Patent is pending. It is recommended the invasive species water filter needs be changed after 2,000 gallons have been pumped.

The Seaplane Pilots Association created a Water Landing Directory Smartphone App in 2013 (Figure11). The app allows pilots to search for bodies of water, seaplane bases, fuel, flight training, destinations, upcoming events, and share information about ways pilots can get involved or advertise with, or donate to, the Seaplane Pilots Association. Adding real-time USGS NAS mapped observation would allow pilots to identify bodies of water with known high-risk AIS so that they can either avoid those waterbodies, or ensure their seaplanes are decontaminated before visiting another water body.

Working with industry to identify technology and strategies, such as installing sensors that detect when vegetation or anything else is attached to a seaplane float or rudders, would help detect the presence of aquatic invasive species prior to takeoff from an AIS-infested water body. This type of technology would improve pilot safety, helping pilots ensure that their aircraft is free from any type of debris either attached, or clinging to seaplane gear/parts.

A long-handled adjustable length brush with an articulating joint would help pilots reach the bottom of floats and awkward spots near water rudders.

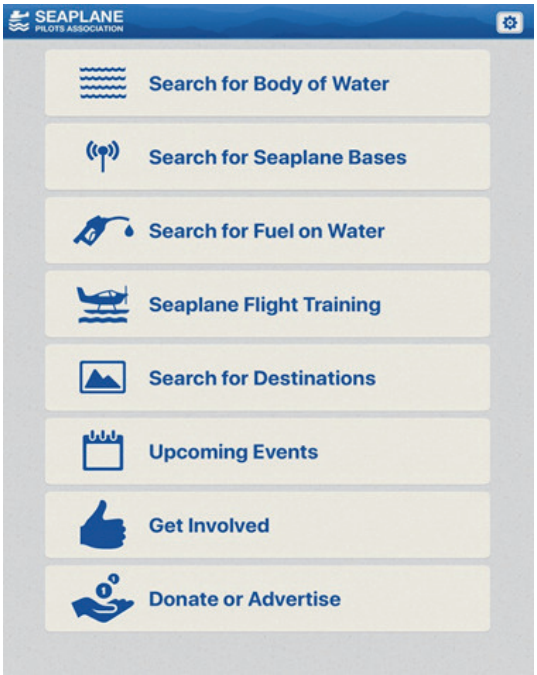


Figure 10. Turbo Float Pump by Acme Tools.
Figure 11. Screenshot of the Seaplane Pilots Association Water Landing Directory app.


Characterizing Risk - Seaplanes as a Pathway for Invasive Species Introduction and Spread

The ANSTF and National Invasive Species Council (NISC) identified air transportation as a pathway for invasive species introduction and spread. Seaplanes, which broadly include flying boats, amphibious planes, and float planes, have also been identified as a vector in the spread of high-risk invasive species. Seaplane transportation was directly correlated to the spread of Elodea sp. from high traffic seaplane bases to remote waterbodies in Alaska (Schwoerer 2017). Despite this key example, it is challenging to quantify the role of seaplanes as an AIS vector because of a variety of dynamic factors. This seaplane pathway risk assessment framework is meant to characterize various factors that contribute to the risk of seaplanes serving as a spread vector of AIS. The risk assessment identifies and characterizes risk, rather than assigning a quantitative value of seaplane pathway compared to other pathways.

Risk Assessments and Frameworks

A risk assessment is a systematic approach to assess the scale and likelihood of arrival, establishment, spread, and impact of nonnative species (Robertson et al. 2021, Venette et al. 2021). Risk assessments analyze, identify, and estimate the dimension, characteristics, and type of risk (Commission for Environmental Cooperation 2009). There are three categories of risk assessments—approaches that target lists of potential species, species-focused approaches, and pathway-focused approaches (Lonsdale 2011). Risk assessments inform prediction, a process to forecast the likelihood and consequence of an invasion, and pathway analysis, a process to evaluate how invasive species might be introduced (Venette et al. 2021). Venette et al. (2021) emphasized pathway analyses and subsequent regulation of those pathways as frontline in the prevention of biological invasions (Hulme 2009) and cost-effective approaches (Leung et al. 2002, Keller et al. 2007, Essl et al. 2015; Tidbury et al. 2016). The discipline of risk assessment is an important area of analysis to identify strategies for managing potential threats. Invasive species risk assessment and horizon scans have been successfully used to develop watch lists, prioritize funding and management activities.

Species risk assessments differ from pathway risk assessments in a variety of ways. Species assessments examine multiple predictors of species risk, such as climate suitability and history of invasiveness. Further, species assessments may include specific possible pathways for the

introduction of a specific species. Pathway assessments examine the various ways that multiple species may be moving globally or regionally under intentional and unintentional scenarios. Further, pathway assessments may consider the likely taxa that may be introduced and spread by way of specific pathways.

Multiple efforts have described the pathways that can result in the introduction of species from one area to another (e.g., Hulme et al. 2008, Hulme 2009). The 18th Subsidiary Body on Scientific, Technical, and Technological Advice to the Convention on Biological Diversity documented six principal pathways of nonindigenous species introduction, including transport stowaway, which refers to the movement of live organisms attached to transporting vessels and associated equipment and media (Convention on Biological Diversity 2014). This pathway most closely describes the role seaplanes may play in AIS transport and introduction. Many pathway frameworks suggest describing pathways as mechanisms of commodity, vector and dispersal (see Hulme et al. 2008, Convention on Biological Diversity 2014, Faulkner et al. 2020). The specific pathway of transport stowaway indicates a transportation mechanism where invasive species are unintentionally moved. Many different transportation pathways can provide hitchhiking opportunities including aviation, international shipping and land transport. A recent analysis of high impact species pathways and their economic cost indicates that the transport stowaway pathway represented the primary mechanism and greatest cost globally compared to other pathways (Turbelin et al. 2022). Measures that may be taken to address transport stowaway pathways on a global landscape could include strengthening institutional legal frameworks and improving quality assurance of border inspections.

Horizon scans and species-specific risk assessments have been used to evaluate risk for species establishment in new areas. An improved understanding of the relative risk that various pathways and the associated vectors can pose will assist managers in decision making to adequately address possible invasive species introduction and spread. For example, there has been considerable effort to mitigate the risk that trailered watercraft pose in the secondary spread of dreissenid mussels and other aquatic invasive species (AIS) throughout North America. This effort has relied on states and provinces to conduct prevention programs, enact legislative provisions, and engage industry partners in innovation.

It is critical to consider strategies that minimize spread regionally (Paini et al. 2010), where established species could spread shorter distances and between states based on seaplane traffic and activities.

Elements to consider when characterizing the risk of seaplanes spreading AIS

Seaplane pilot behavior and knowledge

- AIS training is not mandated as part of Federal Aviation Administration (FAA) seaplane pilot training or certification.
    - Training on AIS at the time of seaplane pilot certification is an opportune time to instill proactive prevention behaviors.

- Not all seaplane pilots are aware of AIS information or the resources to mitigate AIS risks associated with unintended transport.
- Seaplane pilots travel among waterbodies, either as discrete or multiple events. Flights to numerous types of waterbodies are general components of seaplane school curriculum. AIS training as part of certification and refresher training could greatly influence pilot choices and behavior post-training.
- Information about seaplane-AIS transport risk is not consistently communicated or provided by the FAA, regional and local training, or via other common mediums where pilots receive information.
- Although the Seaplane Pilots Association (SPA), an advocacy nonprofit organization, promotes awareness of seaplane-AIS risk, not all seaplane pilots are members of the SPA, and not all seaplane pilots affiliated with the SPA are aware or knowledgeable about AIS or best practices to mitigate the spread of AIS.

Seaplane regulatory information

- There is incomplete information about the number of pilots with seaplane ratings that are currently flying and how much they fly. The FAA does not track comprehensive seaplane activity information, yet comprehensive information on seaplane pilot numbers and activity would enhance opportunities to communicate with seaplane pilots, and better target management and prevention efforts.
- Although 30 states have at least one statute or regulation referring to seaplanes, only a few of these laws address the risk of AIS spread (see the regulatory crosswalk that was conducted as part of this project for additional details). Without consistent regulations across the states or within the federal government, inconsistent behaviors among pilots and inconsistent protections for waterbodies are fostered.

Aquatic invasive species

- Data of species presence for all waterbodies in the United States is incomplete, and the vast majority of waterbodies in the United States are not sampled regularly for AIS.
- Many plants, invertebrates, and microorganisms can survive diverse environmental conditions, such as desiccation, and extreme temperatures. There are various biological characteristics that may allow some species to be more likely to spread and survive transport by seaplanes. Although there are currently no applied studies that have directly examined the survivability of specific species attached or transported on a float plane or flying boat, there are numerous studies that have examined the mortality of species under various conditions, some of which can be used to estimate the probability of survival while hitchhiking on a seaplane.
- Several aquatic invasive species are microscopic, making it difficult for seaplane pilots to prioritize inspection and decontamination protocols to address an invasive species that cannot be seen with the naked eye.
- Under a changing climate, some invasive species may survive under previously unfavorable conditions or in expanded geographic areas and may require new consideration and assessment (Vilizzi et al. 2021).

Several high priority species have been examined for variables that may influence mortality or dispersal success (Table 4).

Table 4. Variables that influence AIS mortality or dispersal success.

AIS Species	Survival Variable of AIS	Summary
Dreissenid Mussels	Aerial exposure	Adult mussels may survive out of water for 5 days in typical temperate summer conditions and 10-15 days in cool conditions (Ricciardi et al. 1995)
	Desiccation resistance	Drying time to effectively kill adult mussels will vary based on geography, season and air temperature (Ussery and McMahon 1995)
	Thermal tolerance	Veligers can live in standing water for up to 24 days at 50°F (Craft and Myrick 2011)
	Seasonal air temperature	Veligers experience 100% mortality after 5 days of summer conditions and 27 days under autumn conditions (Choi et al. 2013)
	Thermal, temporal and emersion conditions	Immersed veligers in small droplets of water can survive for at least 7 days at temperatures of 77°F or lower (Snider et al. 2014)
	Airflow	Adult mussels survive air speeds of 50 km/h for at least 18 hours (Collas et al. 2021)
Macrophytes and Algae	Desiccation during transport	Invasive plant fragments that experienced desiccation for more than 24 hours had high mortality (Jerde et al. 2012)
	Desiccation regimes	Under various temperatures and relative humidity exposures, invasive aquatic plants exhibit the ability to survive depending on desiccation regime (Coughlan et al. 2018)
	Cell viability	*Didymosphenia geminata* cells are viable following cool damp conditions for at least 40 days (Kilroy 2005)
	Temperature and desiccation	*Caulerpa taxifolia* survive aerial exposure of ~24 hours on anchor rope (West et al. 2007)
Invertebrates and Microbes	Dispersal	Waterfleas successfully dispersed in live wells (Kerfoot et al. 2011)
	Desiccation tolerance	Multiple species of freshwater snails survive more than 40 days out of water (Havel et al. 2014)
	Air tolerance	New Zealand mud snails survive more than 40 hours out of water (Alonso and Castro-Diez 2012)
	Spore viability	*Myxobolus cerebralis* (parasite that causes whirling disease) spores are viable under various conditions including sustained freezing temperatures (Steinbach Elwell et al. 2009)

Seaplane equipment

Some types of seaplanes or seaplane design features may influence the probability of AIS being transported. Considering the various types of seaplanes helps to inform relative risk.

  - Flying boat – the hull provides buoyancy. The overall design is simple, and the surfaces that come in contact with water include the hull, auxiliary floats, rudder, crossmembers, wires and cables, and mooring lines.
  - Floatplane – conventional aircraft is fitted with external floats that provide buoyancy. The surfaces of the floats, rudder, crossmembers, wires and cables, and mooring line come in contact with water. Floats, depending on their construction (e.g., composite or aluminum with rivets) can take on water. Floats that leak, or take on water, are capable of transporting microscopic aquatic invasive species. Completely removing all water from floats that are capable of taking on water is not possible with current designs and pump-out systems.
  - Amphibious – seaplanes with retractable landing gear can land on the ground or water. The landing gear creates additional interstitial spaces (wheel wells) or apparatus that come in contact with water.
- Many seaplanes are older planes that have been flying for 50 or more years. This fleet has equipment with design features that make them vulnerable to AIS spread (e.g., aluminum floats with leaking rivets). In addition, it is virtually impossible to remove every drop of water from a float compartment that is capable of taking on water (i.e., all floats other than fiberglass floats).
- Future design of seaplanes could include variations that could minimize leakage, or interstitial spaces where water or debris could collect as well as shape and design of rudders and rudder cabling covers or hoods to minimize vegetation entanglement.

Seaplane base infrastructure

- Not all seaplane pilots have access to infrastructure, or resources, to fully clean or decontaminate their aircraft before flying to the next waterbody. This is particularly true in Alaska, where most seaplane pilots fly straight floats and keep their planes in water throughout the short summer season.
- Infrastructure that is available for cleaning seaplanes, disposal of debris or vegetation, or removal for drying is variable, and in some regions of the country, nonexistent.

Communication

- Exposure to invasive species information and education can come in a variety of forms, such as social media, billboards, press articles, podcasts, posters, FAA information, and more. In addition, regional certifications for AIS knowledge in the Pacific Northwest, participation in special interest groups that directly share AIS information (national, local, regional clubs or organizations), and personal curiosity can inform pilots. Mandatory AIS training and certification could increase awareness and encourage preferred pilot behaviors.
- Consistent messaging and requirements from states and federal agencies could prevent significant geographic jumps in newly AIS introduced species.


Crosswalk of Federal and State Seaplane Regulations

In the past decade, federal and state policy makers have directed significant policy attention to the trailered watercraft pathway because of the role this pathway can play in moving AIS. More than half of the U.S. states have enacted laws and regulations that require boaters to clean, drain, and dry watercraft and related equipment prior to launch or upon removal from a waterbody to prevent the transport of aquatic animals and plants from one waterbody to another. Despite the ability to unintentionally transport AIS among waterbodies, seaplanes have not received much consideration.

The FAA has exclusive authority in regulating the airspace over the United States. (49 U.S.C. § 40103(a)). The FAA oversees the design, production, and airworthiness of aviation products, the training and certification of pilots, and the certification and operation of airports. The regulation of aircraft in flight, however, does not preempt state and local regulation of aircraft landing sites. (Gustafson v. City of Lake Angelus, 76 F.3d 778, 783 (6th Cir. 1996)). States, Tribes, and local governments may enact statutes, regulations, and ordinances governing on-the-ground airport operations as long as they do not conflict with federal law. Thirty states have at least one statute or regulation referring to seaplanes. Only a few of these laws address the risk of AIS spread.

To better understand state efforts to manage the seaplane pathway, the National Sea Grant Law Center created a regulatory crosswalk. Regulatory crosswalks provide a systematic approach to mapping the different attributes associated with a policy issue to enable further analysis. Crosswalk mapping can help policy makers prioritize activities to achieve desired outcomes, including addressing identified gaps or increasing interstate consistency. For this project, the policy attributes selected for analysis were drawn from the Seaplane Pilot Best Management Practices, developed as part of this project.

The Seaplane Pilot Best Management Practices can be grouped into three broad categories with relevance for policy development. These categories are:

1. Follow Clean, Drain, and Dry (CDD) Practices: CDD messaging is a component of Stop Aquatic Hitchhikers!, a national campaign that helps recreational water users be part of the solution to help

prevent and slow the spread of AIS. With respect to seaplanes, CDD encompasses the following actions seaplane pilots should take before each flight:

- Inspect exterior of seaplane, including submerged floats, and remove visible vegetation, attached animals, and debris.
- Pump any water from bilge compartments.
- Allow aircraft floats to completely drain and dry, if possible, between trips.

2. Report any observed invasive species to the respective state AIS reporting system in accordance with current state guidance.

3. Be informed about the types of AIS that might be encountered in local or regional waterbodies and the steps pilots can take to minimize the spread.

From these broad categories, the Law Center identified five legal obligations equivalent to the above BMPs to include in the regulatory crosswalk.

- Duty to Inspect: A legal obligation to inspect the exterior of a seaplane for attached aquatic plants, animals, or debris.
- Duty to Clean or Remove Species: A legal obligation to clean or remove visible aquatic plants, animals, or debris from a seaplane.
- Duty to Drain: A legal obligation to drain floats, bilges, and other components that may contain water before takeoff.
- Duty to Report: A legal obligation to report any invasive species found on a seaplane to the responsible state agency.
- Duty to Train: A legal obligation to complete an AIS training as part of a licensing program.

Also included in the regulatory crosswalk is the "Duty to Dry", or a legal obligation to completely dry a seaplane. As most pilots do not have access to dry docking facilities for their seaplanes, this sixth duty should be considered optional, but recommended when feasible.

The Law Center then reviewed the invasive species laws of each of the 50 states for the presence or absence of these legal obligations. A summary of the research findings is set forth below. The full regulatory crosswalk is included in Appendix B.

State Laws

Only four states – Illinois, Minnesota, Washington, and Wisconsin – require seaplane pilots to take action to mitigate the risk of AIS transport. The scope of these legal obligations vary. The obligations in Illinois and Wisconsin are limited to cleaning, whereas Minnesota and Washington require cleaning and draining. No state imposes drying requirements on seaplane operators.

- Illinois law requires seaplane pilots to clean seaplanes before takeoff. It is unlawful to place, operate, or takeoff a vehicle, seaplane, or watercraft with aquatic plants attached. 625 ILCS 45/5-23.

- Minnesota law requires seaplane pilots to clean and drain seaplanes. It is unlawful to place water-related equipment, which includes seaplanes, into Minnesota waters if plants or prohibited invasive species are attached. M.S.A. § 84D.10. When leaving a water of the state, a person must drain water-related equipment holding water and live wells and bilges before transporting the water-related equipment.
- Washington law requires seaplane pilots to clean and drain seaplanes. A person in possession of an aquatic conveyance, which includes seaplanes, must meet clean and drain requirements after the conveyance's use in or on a water body. RCWA 77.135.110. In addition, Washington law requires owners of seaplanes to purchase an AIS prevention permit before placing or operating the seaplane in any waterbody in the state. RCWA 77.135.210.
- Wisconsin law requires seaplane pilots to clean seaplanes before takeoff. It is unlawful to "take off with a seaplane … with aquatic plants or aquatic animals attached to the exterior of the seaplane." W.S.A. 30.07.

Watercraft

The law in 28 additional states impose some CDD requirements on watercraft operators, although the scope of the legal obligations varies among states. All of these states require operators to clean or drain their watercraft either upon exit of a waterbody or before launch. Inspection is generally implied as part of the cleaning requirement, but five states do expressly require operators to "inspect" watercraft. Eleven states require reasonable measures be taken to dry watercraft or remain out of the water for a certain period of time. These obligations, however, do not apply to seaplanes as they are excluded from the definition of watercraft in these states.

As demonstrated by Minnesota and Washington, state CDD requirements can be imposed on seaplane operators simply by expanding the scope of coverage beyond watercraft. This is accomplished in both states by using a more expansive term to define the scope of regulatory coverage – "water-related equipment" in Minnesota and "aquatic conveyance" in Washington. New definitions are not necessarily required, as states could add a reference to seaplanes wherever watercraft are mentioned.

Recommendation: To address this coverage gap, states should review their existing AIS laws and consider expanding their scope of their CDD obligations to include seaplanes. States without CDD requirements should consider adopting these requirements to further national alignment of state AIS policy.

Reporting

Due to funding, personnel, and time constraints, agencies are unable to continuously survey and monitor all the waters in their respective states for the presence of AIS. Reporting requirements help states obtain information about and respond to AIS threats. Six states require individuals with knowledge of the presence of certain aquatic invasive species to report the sighting to the appropriate state agency. The reporting triggers are different in each state.

The reporting requirement in California and Utah is limited to the discovery of dreissenid mussels (Cal. Fish & G. Code § 2301; U.C.A. 1953 § 23A-10-202). In Colorado, any person who knows that an aquatic nuisance species is present at a specific location must immediately report. (C.R.S.A. § 33-10.5-106). In Montana, a person who learns of the presence of an invasive species on that person's vessel or property must immediately report (MCA 80-7-1012). In Idaho, the reporting requirement is limited to the discovery of species classified as "EDRR AIIS" (IDAPA 02.06.09.131). In Wyoming, only unreported AIS must be reported (W.S.1977 § 23-4-202).

States without mandatory reporting requirements encourage the public to report AIS they observe within the state. Many states host websites that provide guidance on how to report. These states facilitate reporting through the use of online forms and apps. For example:

- Vermont: https://dec.vermont.gov/watershed/lakes-ponds/aquatic-invasives/report
- Ohio: https://ohiodnr.gov/discover-and-learn/safety-conservation/fish-management/aquatic-invasive-species/reporting-aquatic-invasives
- North Carolina: https://survey123.arcgis.com/share/710337fbf02140599fd788ebfdd72744
- Wisconsin: https://dnr.wisconsin.gov/topic/Invasives/report
- California: https://wildlife.ca.gov/Conservation/Invasives/Report

Recommendation: States should encourage seaplane pilots to report any observations of aquatic invasive species to the responsible state agency or entity in accordance with current state guidance.

Training

The failure of seaplane pilots to comply with the best practices listed above increases the risk of AIS spread and, in a few states, violates the law. Seaplane pilots may not know about AIS, how species may be accidentally transported on seaplanes, or the steps they can take to minimize the risk. Training courses or other training requirements can help ensure seaplane pilots are equipped with the knowledge of relevant laws, regulations, and recommended practices. Training can also help seaplane pilots learn how to identify AIS and report sightings. Trainings may be offered in-person or through online, on-demand modules. Research suggests that online educational courses are an effective means of increasing awareness and understanding of invasive species issues, as well as encouraging behavior change (Weber et al. 2022).

States recognize the AIS educational needs of boaters. Three states – Connecticut, New York, and Washington – mandate that boater safety courses include information on AIS and CDD requirements. Utah requires boaters to annually complete an online "Mussel-Aware Boater Course" (https://stdofthesea.utah.gov/). Boater safety courses offered in other states (e.g., Florida) also include modules on AIS.

Recommendation: States should consider requiring seaplane pilots to complete AIS training either as part of the curriculum of required safety courses or as stand-alone programs similar to that required for other water users such as boaters. The Washington Seaplane Pilot Association has developed a Seaplane AIS Training for pilots that provides information on CDD practices and how to minimize the risk of AIS transport. Washington, Oregon, Idaho, and Montana recognize the

course as a resource for pilots to learn how to self-inspect their seaplanes, and its approval could be expanded to other states.

Tribal Laws

Tribal Nations have authority to regulate seaplane use on water bodies within their reservations. There are 574 Federally Recognized Tribes in the United States. Researching Tribal laws can be difficult because no comprehensive database exists. Some Tribal codes are available online through Tribal websites and other sources. Two examples of Tribal regulations relevant to seaplanes are:

- A resolution enacted by the Red Lake Band of Chippewa Indians in 2017 restricting access to Red Lake Indian reservation lakes to band member-owned boats to address the threat from AIS. (Resolution No. 62-17).
- An ordinance enacted by the Swinomish Tribe in Washington State that prohibits aircraft in Kukutali Preserve and on Kukatali Tidelands (Swinomish Code Sec. 2-03.250(C)).

Pilots should contact individual Tribes to learn about whether seaplane access is permitted, including any relevant laws and regulations.

Local Laws

Due to a general lack of state regulation of seaplanes as detailed above, numerous water body managers and municipalities across the country prohibit or restrict seaplane use. A search of Municode, the largest compiler of municipal codes in the country, found that the most common type of local regulation of seaplanes is a blanket prohibition on their landing and use either on specific water bodies or any waters within the jurisdiction. Jurisdictions that allow seaplanes may have ordinances that require approvals or permits, impose speed limits or safety buffers, and regulate mooring. Local ordinances are not always accessible to the public online and knowledge of such local regulations may not be wide-spread, especially among out-of-state seaplane pilots.

Recommendation: States should consider implementing efforts to increase the transparency and accessibility of local seaplane ordinances and restrictions. State Departments of Transportation could maintain websites that compile information on seaplane bases and local water body restrictions. The Wisconsin Department of Transportation's Seaplane Information webpage is a potential model for such a resource.

Regional case studies

Informing pilots about high-risk AIS species that may be present in different regions of the United States could serve as a helpful tool in raising awareness of different types of AIS that could be transported via the seaplane pathway. Regional case studies were developed to distribute to seaplane schools in FAA regions throughout the United States.

The methodology used to develop the case studies included identifying the most appropriate high-risk AIS per FAA region. To select the most appropriate species, the following information was compiled for each state:

- FAA region
- Regional AIS panels associated with the state
- Links to state ANS plans
- Links to worst AIS lists
- Links to noxious weed lists
- Regulations associated with "Worst" and "Noxious" AIS lists
- Links to prohibited wildlife lists and regulations associated with those lists
- Contact information for each state

From this information, AIS lists of prohibited, species of concern, and present were developed and individual species were selected to showcase for each FAA region. Others were identified in a call-out section of each case study to raise awareness about the different types of AIS that could be found in each region.

One case study was developed for each region (Figure 12, Appendix C). Information about the species and region are highlighted on the first page of each case study and best practices that prevent the spread of AIS by seaplane pilots (one for Alaska seaplane pilots and one for lower 48 pilots) is shared on the 2nd page (Figure 13).

Figure 12. Example of one of the FAA region case studies: Spiny waterflea.

SEAPLANE PILOT BEST PRACTICES
TO REDUCE THE SPREAD OF AQUATIC INVASIVE SPECIES

Follow these steps to improve your flying safety while preventing the spread of aquatic invasive species (AIS)
Why? AIS can take over waterbodies and crowd out native species, harming native fish and wildlife populations and potentially reducing seaplane access

Planning a Flight
Familiarize yourself with AIS at destination water bodies, but recognize that not all water bodies are monitored for AIS— always assume a waterbody has AIS.

If you are departing from a waterbody that has confirmed high-risk AIS, before landing at another water body, consider landing at an airport first to fully inspect and clean your aircraft.

Before Entering the Aircraft
Inspect and remove any visible vegetation or other debris from the aircraft. Remove any plant growth on mooring lines and dispose of any plants or identified AIS in the trash. Inspect the following for AIS:

- Floats
- Hulls
- Rudders
- Wires and Cables
- Mooring lines
- Wheel Wells
- Crossmembers
- Exterior paddle
- Your footwear and gear

Visually inspect submerged parts of the aircraft and run your hands, or use a brush, along the surfaces to check for any AIS that may be attached, especially if the aircraft has been moored on a waterbody for more than a few hours.

Pump as much water as possible out of bilge compartments using a pump with an invasive species filter (e.g., Turbo Pump) to limit the possibility of transporting microscopic AIS.

Before Takeoff
Just prior to takeoff, **raise and lower your water rudders several times to remove aquatic hitchhikers**, which can cause cable stretch and affect steering.

Avoid taxiing through aquatic plants. If you must taxi through aquatic plants, stop once in open water and manually clear vegetation from floats, hull, and rudders.

After Takeoff
After takeoff at a safe altitude, if conditions permit, **raise and lower your water rudders numerous times while flying over the water body you are departing** to clear aquatic plants from the water rudders and cables. If aquatic plants remain visible on the plane, return and remove them.

Storage and Mooring
Thoroughly *Clean, Drain, Dry* the aircraft prior to flying to another waterbody. If the aircraft floats take on water, completely drain and dry if possible. Allow to dry completely.

Report Invasive Species
Report any invasive species you see to your state AIS reporting system.

Spread the Word about Clean, Drain, Dry
Informed seaplane pilots can make a difference in preventing the spread of AIS. Talk with your colleagues and spread the word about the importance of *Clean, Drain, Dry* and steps pilots can take to minimize the spread of AIS.

Expand your understanding of the types of AIS you might encounter in local and regional waterbodies by visiting https//nas.er.usgs.gov.

Become a Certified AIS-Trained Seaplane Pilot!
Click on the QR code to watch a video created by the Washington Seaplane Pilot Association. After watching the video, take a short test, and earn your annual certificate to become an AIS-trained seaplane pilot. This certificate is recognized by all of the Pacific Northwest states.

ALASKA SEAPLANE PILOT BEST PRACTICES
TO REDUCE THE SPREAD OF AQUATIC INVASIVE SPECIES

Follow these steps to improve your flying safety while preventing the spread of aquatic invasive species (AIS)
Why? AIS can take over waterbodies and crowd out native species, harming native fish and wildlife populations

Planning a Flight
Familiarize yourself with AIS at destination water bodies, but recognize that not all water bodies are monitored for AIS— always assume a waterbody has AIS.

If you are departing from a waterbody that has confirmed high-risk AIS, thoroughly inspect your aircraft for AIS.

Before Entering the Aircraft
Inspect and remove any visible vegetation or other debris from the aircraft. Remove any plant growth on mooring lines and dispose of any plants properly (trash) upon returning to your base. Inspect the following for AIS:

- Floats
- Hulls
- Rudders
- Wires and Cables
- Mooring lines
- Wheel Wells
- Crossmembers
- Exterior paddle
- Your footwear and gear

Visually inspect submerged parts of the aircraft and run your hands, or use a brush, along the surfaces to check for and remove any AIS that may be attached. This is especially important if the aircraft has been moored on a lake for more than a few hours.

Pump as much water as possible out of bilge compartments using a pump with an invasive species filter (e.g., Turbo Pump). The removal of water from the float or bilge compartments prior to departure will limit the possibility of transporting microscopic AIS.

Before Takeoff
Just prior to takeoff, **raise and lower your water rudders several times to remove aquatic hitchhikers, which can cause cable stretch and affect steering.**

Avoid taxiing through aquatic plants. If you must taxi through aquatic plants, stop once in open water and manually clear vegetation from floats, hull, and rudders.

If you don't do anything else, cycle the water rudders several times before departing each water body.

After Takeoff
After takeoff at a safe altitude, if conditions permit, **raise and lower your water rudders numerous times while flying over the water body you are departing** to clear aquatic plants from the water rudders and cables. If aquatic plants remain visible on the plane, return and remove them.

Storage and Mooring
Thoroughly inspect your aircraft prior to flying to another waterbody. Dryland storage during an Alaskan winter will kill any AIS attached to your plane or in your float compartments. However, some AIS, such as Elodea spp., can survive overwintering in wet float compartments.

Report
Report any invasive species you see to the Alaska Invasive Species Hotline, 1-877-INVASIV (1-877-468-2748). You can also report online, or send an email.

Spread the Word and Protect Alaska's Natural Resources
Informed seaplane pilots can make a difference in preventing the spread of AIS. Talk with your colleagues and spread the word about the important steps seaplane pilots can take to minimize the spread of AIS and conserve Alaska's special places.

Expand your understanding of the types of AIS you might encounter in local and regional waterbodies by visiting the Alaska Department of Fish and Game Invasive Species website.

Become a Certified AIS-Trained Seaplane Pilot!
Click on the QR code to watch a video created by the Washington Seaplane Pilot Association. After watching the video, take a short test, and earn your annual certificate to become an AIS-trained seaplane pilot. This certificate is recognized by all of the Pacific Northwest states.

Figure 13. Seaplane pilot best practices for pilots in the lower 48 and Alaska.

Seaplane Pilot Engagement

Seaplane Pilot Survey

In June of 2024, a survey was made available to seaplane pilots throughout the United States. The goal of the online survey was to engage seaplane pilots to better understand their behaviors, perspectives, and awareness of AIS issues and the role pilots can play in lessening the spread of AIS via the seaplane pathway with the intent of hosting small focus groups following survey completion to further discuss and vet these issues.

Prior to development of the survey, the ANSTF Seaplane Committee was asked to provide input into the types of questions they would like to see asked. The draft survey was then developed and reviewed by an Alaskan seaplane pilot and instructor retired from the U.S. Fish and Wildlife Service as well as by a national human dimensions expert, Dr. Daniel Witter with D.J. Case.

The survey was announced via social media, direct email, and via the project website (see Appendix D). Although there was prolonged and repeated outreach occurred during the two-month period in which the survey was open, only 139 pilots from 28 states responded to the survey. The results of the survey are in Appendix E.

Of the 139 survey respondents, a total of 96% had FAA seaplane ratings (58% with Commercial Airplane Single Engine Sea (ASES) rating, 39% with Private Airplane Single Engine Sea (ASES) rating, and 3% with Airline Transport Pilot Single Engine Sea Rating (ATPSES). A total of 98% had current medical certificates required by the FAA to pilot an aircraft. Number of years flying varied (18% more than 30 years), 13% (16-20 years), 16% (6-10 years), 13% (3-5 years), 15% (less than 2 years) and 25% (other). A total of 43% are, or have been in the past, an FAA Certified Flight Instructor, and 78% own their own seaplane whereas 22% rent.

The FAA region where seaplane flying usually originates was Alaska (32%), followed by Northwest-Mountain (24%), Great Lakes (20%), Southern (11%), Other (9%), and Eastern (6%). A total of 52% identified as recreational pilots, 20% identified as commercial pilots, 20% identified as pilot school instructors, and 7% identified as government pilots – many of the pilots identified in more than one category.

Respondents indicated they are members of a variety of pilot organizations – Aircraft Owners and Pilots Association (36%), Seaplane Pilots Association (28%), Recreational Aviation Foundation (9%), National Association of Flight Instructors (7%), Other (16%), and None (7%).

A total of 39% fly an estimated 26-100 hours annually, followed by 24% that fly 101-500 hours annually,19% that fly less than 10 hours annually, 18% that fly 11-25 hours annually, and 3% that fly more than 500 hours annually. The estimate of average distance flown each time a seaplane is flown to a water destination is: 32% fly 26-50 miles, 24% fly less than 25 miles, 19% fly 51-75 miles, 17% fly 76-100 miles, and 8% fly more than 100 miles. The number of waterbodies visited during one trip (a single or multi-day event) is: 2-3 (65%), 1 (27%), 4-6 (7%), more than 7 (1%).

Most pilots use numerous resources and software for flight planning purposes, including ForeFlight Mobile (45%), the Seaplane Pilots Association Water Landing Directory App (19%), Other (13%), Garmin Pilot (8%), as well as six others that were used 7% or less (Avair, LiveATC, FlyQ, MyRadar, Sky Vector, FltPlan Go). Of these resources, the piece of software most used by pilots was ForeFlight (62%), None (12%), Garmin Pilot (8%), and six others that were used 6% or less (FlyQ, SPA Water Landing Directory App, SkyVector, FltPlan, FAA, Avair).

Survey respondents identified the location of their aircraft between uses as on water (40%), in a hangar (40%), on land or an out-of-water lift (17%), and other locations.

At least ¾ of all respondents were familiar or somewhat familiar with: how to inspect seaplanes for AIS before flying to another waterbody (89%); AIS (89%); where pilots can access information about AIS in their respective state or region (85%), specific AIS that have been detected in waterbodies where they fly (78%), and AIS that have been detected in their state (82%). However, there is room for improved awareness as the number of respondents that indicated they were not at all familiar with each of these categories ranged from 15 to 30.

Survey respondents expressed an awareness of the importance of preventing the spread of AIS (85%) and ensuring their seaplane does not have AIS prior to takeoff (82%). A total of 46% did not believe AIS pose a threat to seaplane flying in their state, and only 31% stated AIS were not common in their state (which likely was skewed because of the percentage of survey respondents represented by Alaska).

Although 82% of survey respondents stated they were likely to inspect their floats, rudders, tow line, and other parts of the seaplane, and remove any visible vegetation, mud, or organisms, 45% stated they were likely or somewhat likely to pump out floats using a filter capable of straining and capturing microscopic invasive species, and 60% stated they were not likely to use a pressure or hot water wash to clean their seaplane (likely due to lack of availability of this infrastructure). Pilots were asked about actions they take relative to AIS prevention activities. When asked about actions pilots have taken in the past 2 years, 80% stated they have never observed AIS on their plane, 47% always inspect and clean their seaplane, removing any visible signs of vegetation, mud, and organisms before landing in another waterbody, and 74% always pump all the water from

floats to the extent possible. A total of 68% said it was extremely difficult or difficult to put their seaplane in dry dock for at least 7–10 days after visiting a water body with AIS and before launching in other waters. A total of 89% stated it was very easy, easy, or not too difficult to drain as much water as possible from seaplane floats before leaving a water body.

Pilots were asked how strongly certain issues affect their ability to inspect and remove AIS prior to takeoff.

- A total of 19% said not knowing what they need to do either effects or strongly effects their ability to implement prevention efforts.
- A total of 44% stated that their home base does not have an easy way for them to dry dock their plane, which strongly affects or affects their ability to clean.
- A total of 59% stated not having access to a pressure washer or hot wash to clean their seaplane strongly affects or affects AIS prevention effort implementation.
- A total of 39% stated that the burden of inspecting and removing visible AIS between water bodies, when flying to numerous water bodies in a short time period, either strongly affects or affects AIS prevention effort implementation.

When asked about the level of agreement with numerous statements, 86% stated they agree or strongly disagree with feeling a personal obligation to help reduce the spread of AIS by seaplanes. A total of 84% stated they strongly agree or agree that as a seaplane pilot, "I should do whatever I can to stop the spread of AIS," and 85% stated they strongly agree or agree that they can help protect the seaplane industry and outdoor recreation by following protocols that prevent the spread of AIS.

A total of 65% stated they strongly agree or agree that the FAA should include AIS prevention protocols as part of seaplane pilot training and 74% strongly agree or agree that they would welcome instruction, as part of pilot training, on ways to inspect and clean their aircraft to ensure they do not transport AIS. A total of 82% stated they are concerned about the risk of damage to aquatic environments caused by AIS.

Results from the online survey were used to inform the structure and content of regional seaplane pilot focus groups.

Seaplane Pilot Focus Groups

A total of 25 seaplane pilots from across the United States gathered virtually from September through November 2024 as a follow-up to a seaplane pilot survey conducted months earlier. The purpose of the convenings was to explore in greater detail the risk associated with seaplanes transporting AIS, characterize seaplane pilot perspectives, and incorporate pilot feedback into project products as well as recommendations to the U.S. Fish and Wildlife Service.

The focus group questions included the following topics 1) pilot activities and flight preparation relative to AIS, 2) tools and methods of information dissemination most suitable for pilots, 3) best practices to prevent the spread of AIS, and 4) perceptions of seaplane design contributing to AIS spread. The intent was to encourage participants to provide feedback and impressions on a variety of topics and share personal experiences.

A total of five small focus groups were held (the number of pilots in each is listed in parentheses – in all cases, numerous pilots registered for the focus groups, but did not participate):

- Eastern FAA Region Focus Group - September 18, 2024 4pm-7pm Eastern Time (7)
- Southern and Southwest FAA Regions Focus Group - September 19, 2024 4pm-7pm Eastern Time (4)
- Great Lakes and Central FAA Regions Focus Group - October 8, 4pm-7pm Central Time (3)
- Western Pacific and NW Mountain FAA Regions Focus Group - October 9, 4pm-7pm Pacific Time (3)
- Alaska FAA Region Focus Group - November 21, 4pm-7pm Alaska Time (8)

Invitations to participate in the focus groups were shared on numerous social media platforms and directly via email with regional seaplane pilot interest groups. Advance registration was required to participate. Each of the focus groups were scheduled to accommodate local time zone participants (later in the day). However, if a pilot could not participate in their logical regional focus group, they were able to participate in a different regional focus group to meet that need. The focus groups were conducted over a period of eight weeks beginning in September 2024 and concluding in November 2024. Each focus group was scheduled for 3 hours of time. However, on average most focus groups were 2.5 hours long. It was not unusual for at least one field representative from the Seaplane Pilot Association to participate in every focus group. All the participants were engaged and contributory to each event.

- Geographic representation: Alaska, Florida, Idaho, Maine, Michigan, Minnesota, Missouri, Texas, Ohio, Oregon, Pennsylvania, and Washington.
- Gender representation: Primarily male, however multiple focus groups included participation from female pilots.
- Pilot Certification Experience representation: the pilots ranged from those with recent rating acquisition to multiple decades of experience. Participants were amateurs, agency enforcement, agency, commercial, and instructor pilots.

- Prior knowledge of AIS does not prevent pilots from going to a particular waterbody. The priority factor that was considered when deciding to fly to a specific waterbody was, "Can I land there, and is it safe?" One Alaskan pilot mentioned he flies into a general area and then determines which specific waterbody to land on depending on conditions, such as the size of the waterbody, weather conditions, wind direction, etc.
- Pilot to pilot, or pilot to local waterbody manager, communication is an important aspect of gaining information about waterbodies and conditions when pilots are preparing for a flight.

Tools and Methods

The following themes emerged when pilots were asked about what planning tools they use to help inform pre-flight planning:

- Pilots described using a variety of tools to plan flights, including National Weather Service forecast, FAA weather cameras, OnX, CalTopo, Google Earth, Boater's guides, windy.com, Foreflight, WingX, Garmin Pilot, recreation.gov, AquaMap, and SPA Landing Directory.
- Pilots welcome and appreciate concise information on AIS and basic information on species distribution. Pilots indicated that details and information about AIS occurrence in waterbodies is important but that too much detail could overwhelm their decisions and potential use of the tool. Pilots want to know where AIS are but want limited "resolution" of that information. Several pilots expressed concern about being shown data that indicates a water body is free from AIS simply because there hasn't been a reported sighting of AIS to a major AIS database.
- Pilots are interested in up-to-date, real-time information on AIS that can be accessed through their current flight planning platforms.

All participants were FAA-rated seaplane pilots with various levels of experience and background, including numerous participants that were seaplane pilot instructors. All participants were encouraged to use their camera to create a sense of sharing and community among participants and the facilitators. Participants were given a brief overview of the seaplane-AIS project, introduced themselves, and were asked a series of questions, including follow-up questions and discussion. Facilitators recorded each session, facilitated the conversation, and took detailed notes using screen sharing.

During the introductory phase of the focus group discussion, all pilots shared information about experience level, types of aircraft flown, memorable experiences and their inspiration to become a seaplane pilot. This was intended to foster an environment of open communication and sharing prior to addressing focal areas of discussion. Introductory icebreaker questions gave attendees an opportunity to share their perspectives about why they chose to earn a seaplane rating, and what they found unique and memorable about seaplane flying. Several pilots described the freedom associated with seaplane flying when compared to restrictions associated with public airport use. The diversity of seaplane pilots participating in the focus groups was broad, from self-professed weekend warriors, to people that fly seaplanes as an only means of transportation, to those that use seaplanes primarily for work purposes (e.g., wildlife surveys). Pilots shared stories about their most memorable flights, from flying with their grandchildren, to landing on and taking off from

waterbodies under difficult conditions, to meeting new friends and people that share their passion for flying seaplanes. Experience ranged from pilots that earned their seaplane ratings in the past 12 months to pilots that have been flying for 40–50 years. After the introductory phase, discussion focused on four themes:

- Pilot activities and flight preparation relative to AIS - to understand typical preparation methods used and typical flight behavior.
- Tools and methods of information most suitable for pilots - to understand typical processes or tools used to plan flights, willingness to incorporate other information into planning processes, tools that could potentially mitigate AIS issues, and methods by which pilots learn and are exposed to training information.
- Best practices and participation - to understand general awareness of best practices to minimize invasive species spread, such as inspection and cleaning and obtain feedback on recently produced regional seaplane-AIS case studies.
- Perceptions of seaplane design contributing to AIS spread - to obtain perspectives on aircraft or equipment that enhances vulnerability to AIS. In addition, suggestions were sought on ways to mitigate the possibility of these design features potentially spreading AIS.

Flight Preparation

The following themes emerged when discussing factors pilots consider when selecting destination water bodies:

- Selecting destination waterbodies is based primarily on purpose or mission (e.g., destination restaurant, guiding hunters or anglers, surveying wildlife, training new pilots, camping, traveling to stores for supplies and groceries), and subsequently determining safe locations to land. Pilots that do not own their own seaplanes generally are restricted in the distance they can fly from the rental plane base.
- Most of the pilots were aware of the SPA Landing Directory, but noted that there were incomplete records, and updates are needed but in general, the SPA app has the type of information they seek. Several suggested integration of the current SPA Landing Directory with real-time data would improve its utility.

Best Practices

These themes emerged when pilots asked to review the draft best practices to prevent AIS spread:

- Pilots do not know where to report suspect AIS and are not certain how to identify individual species.
- Suggestions to raise or lower gear to remove vegetation while taxiing through vegetation can pose safety issues as pilots may forget gear location. Raising and lowering rudders is considered introducing risk, as it is not a “normal” protocol. Pilots would not raise and lower rudders unless they could see from the cabin that vegetation was attached.
- Some pilots mentioned they follow protocols and not checklists whereas other pilots recommended a short pre-flight inspection checklist be developed for AIS. Many flight schools develop their own checklists – several pilots proposed adding a few bullet points to those checklists for AIS inspection.

- Check, recheck, and check again. All pilots stressed the sequence of determining readiness and safety, and how AIS could be integrated.
- Pilots want to understand when they should consider dropping the landing gear.
- A short process/acronym/steps that would help reinforce best practices would assist in adherence/compliance with BPs. Create a mnemonic for cycling the water rudders or focus on "one simple step".
- Clean Drain Dry, a procedure commonly used by the boating community, is not as relevant to seaplane pilots, particularly those in Alaska that keep their boats in water throughout the short summer season.
- Depending on the geographic region or particular location, capacity to clean or remove a seaplane from water is not as feasible compared to locations that have more seaplane base infrastructure.
- Incorporate QR codes into the best practices to allow pilots to quickly access AIS information, such as reporting invasive species.
- Ensure pilots inspect their paddle and their personal gear and equipment for AIS in addition to the parts of a seaplane.
- Work with industry to identify a product that can be added to floats to kill AIS while not affecting the integrity of the float material.
- Ask float manufacturers to add information about AIS to their operations manuals.
- Incorporate an AIS content pack into Foreflight.
- Keep mooring lines out of the water as much as possible.

Seaplane Design and Areas of Focus

These themes emerged when pilots were posed questions regarding seaplane design and areas of the seaplane that may be more vulnerable to AIS:

- The use of a float pump with an invasive species filter (e.g., Turbo Pump) to remove excess water was the most popular idea to address the potential for floats that may contain water with AIS, although several pilots commented the overall cost of the product would prevent them and other pilots from purchasing.
- Consider modifying the space between the cabling and the rudder with a rubber boot, or hood, that could prevent entanglement with AIS.
- The rudder shape could be redesigned to minimize catching vegetation while not affecting flight safety.
- Use anti-fouling paint to prevent AIS from attaching.
- Add UV light to electrically energize the inside of the floats (with the caution that there may not be adequate information on how UV light interacts with sealants and adhesives – more science is needed on copper-based paints and coatings)

Sharing Best Practices

The following themes emerged when pilots were posed questions regarding ways to share information about AIS with seaplane pilots:

- Initial certification is the most effective time to expose pilots to any AIS checklists or protocols to incorporate into their flight planning.

- Signage about AIS prevention or Clean, Drain, Dry at seaplane bases is lacking.
- Not all pilots are aware of the nexus between seaplanes and AIS. For example, a pilot that recently received a seaplane rating had never heard of the issue. Some pilots commented that limited AIS information was related to regions coincident with few watercraft inspection programs.
- Pilots are used to following rules and regulations. Disseminate the information broadly and pilots will follow the rules.
- Mandate AIS training as part of a requirement to receive a seaplane rating. Add AIS inspection and decontamination information to the FAA Handbook FAA-H-8083-23.
- Hands-on and simulations for AIS prevention practices during training are key to instilling positive pilot behaviors associated with AIS inspection and decontamination.
- FAA training materials, FAA Advisory Circulars, and high output seaplane training companies were all suggested as primary methods for reaching a high volume of pilots with AIS prevention information.
- Distribute AIS educational materials to seaplane base points of contact. Suggested examples of outreach examples to pilots included data layers, stories about a local waterbody, laminated pocket guides, monthly publications from local seaplane organizations (e.g., Alaska Airmen's Association), case studies, email communication, flight schools, YouTube videos, mandatory as part of seaplane pilot training, direct mailers to seaplane pilots, stickers, webinars, podcasts, social media, water shows, boat shows, and brochures.

Helping Pilots Address Challenges

The following themes emerged when pilots were asked what might help them address the challenges they face implementing best practices:

- Decontamination units – create a list of the most critical areas to place these units and then fund their placement.
- Educate seaplane pilots.
- Develop a spray or product that can pre-empt the attachment or transport of AIS by seaplanes.

Summary

Focus groups were instrumental in exploring seaplane pilot perspectives and recommendations relative to reducing the spread of AIS by seaplanes. The small size of the groups allowed for detailed interaction and discussion with individual pilots and achieved the goal of supplementing the information garnered from the broader pilot survey conducted months earlier. Recommendations to modify the best practices were reviewed and incorporated into the case studies and best practices one-pager after all of the focus groups convened. Other recommendations will be considered, compared to the results of the pilot survey, and incorporated into the overall list of recommendations to the U.S. Fish and Wildlife Service at the conclusion of the project.


Industry Think Tank

Eight representatives from the seaplane manufacturing industry and Seaplane Pilots Association as well as the American Boat and Yacht Council convened in November 2023 to discuss potential strategic and collaborative approaches industry could take to reduce the risk of transport of AIS via seaplanes (Appendix F - Think Tank agenda) as well as assess the level of interest in convening in the future to address some of the AIS-seaplane issues in greater detail.

Participants included the project team and the following industry representatives:
John Gowey, Director of Operations, Kenmore Air Harbor, LLC (Kenmore, WA)
Matt Sigfrinius, VP of OEM Sales, Aerocet, Inc. (Lake Wales, FL)
Brad Kutz, Vice President of Engineering, Wipaire (St. Paul, MN)
Steve Guetter, General Manager at Wipaire/Advanced Flight Training and Leasing (St. Paul, MN)
Paul Richards, Owner, Clamar Floats (Brunswick, ME)
Brian Goodwin, Director of Standards and Compliance, The American Boat and Yacht Council (Baltimore, MD)
Steve McCaughey, Executive Director, Seaplane Pilots Association (Lakeland, FL)
Bruce Hinds, Vice President and Aquatic Invasive Species Coordinator, Seaplane Pilots Association (WA)

Opportunities for next steps:

- Add AIS information in manufacturer's pamplets/instruction manuals.
- The U.S. Fish and Wildlife Service could suggest recognition of seaplane pilot training programs in each state.
- Provide clarification on chemical products or solutions they could add to float compartments to kill AIS but not degrade the integrity of the float.
- Host a more in-depth Think Tank with industry to produce a technical bulletin for the seaplane industry similar to what the watercraft industry produced: Design and Construction of Watercraft and Watercraft Accessories in Consideration of Aquatic Invasive Species (note: the Seaplane Pilots Association expressed interest in helping to sponsor such an event.

Summary and Recommendations

Seaplanes can contribute to the spread of AIS in the United States, however, enhanced prevention efforts can mitigate the risk of this pathway. The results of this project illustrate that seaplane pilots are receptive to learning about AIS and taking steps to mitigate risk. Providing them with the tools and information to be sound stewards of the resources they value will significantly enhance prevention efforts and help to reduce the spread of AIS via the seaplane pathway.

Recommendations are offered in six thematic areas: information on seaplane use, research, gaps in regulations, outreach, training, and AIS-related infrastructure.

A. Address Current Gaps in Seaplane Pilot Statistics

- Incorporate additional seaplane pilot-related questions into the annual FAA pilot survey and sort the results by straight and amphibious floats to inform estimates regarding the total number of seaplanes, how much use occurs on an annual basis, states in which the aircraft are flown and for what purpose, and number of water landings. Additionally, consider an annual FAA pilot survey focused specifically on pilots with seaplane ratings to obtain accurate, updated information about seaplane pilot statistics in the United States and seaplane pilot inspection and decontamination behaviors.

B. Conduct Research

- Invest in research that uses technology to inform seaplane pilots when AIS is detected on their rudders or in their floats.
- Work with industry and the Environmental Protection Agency to identify a product (e.g., chemical) or treatment (e.g., UV light) that kills AIS prior to pumping out a float. In the interim, provide seaplane pilots with guidance relative to chemical use.
- Explore modifications to rudder conformations to lessen attachment of aquatic plants.
- Explore the potential for the use of anti-fouling paints on floats.
- Investigate the efficacy of saltwater landings in killing freshwater AIS transported by seaplanes.
- Host a more in-depth Think Tank with industry to produce a technical bulletin for the seaplane industry similar to what the watercraft industry produced: Design and Construction of Watercraft and Watercraft Accessories in Consideration of Aquatic Invasive Species.

C. Address Gaps in Seaplane Regulations

- To address coverage gaps in state regulations, states should review their existing AIS laws and consider expanding their scope of current CDD obligations to include seaplanes. States without CDD requirements should consider adopting these requirements to further national alignment of state AIS policy.

D. Expand Outreach to Seaplane Pilots

- Implement efforts to increase the transparency and accessibility of local seaplane ordinances and restrictions. State Departments of Transportation could maintain websites that compile information on seaplane bases and local water body restrictions. The Wisconsin Department of Transportation's Seaplane Information webpage is a potential model for such a resource.
- Provide information to pilots on where they can report suspect AIS to the responsible state agency or entity to advance prevention efforts, particularly in places such as Alaska, where seaplanes are a common mode of transportation.
- Provide the seaplane industry with tools to raise awareness of AIS and the seaplane pathway, e.g., produce AIS inspection checklists on airplane struts, distribute regional case studies to all U.S. seaplane schools.
- Ensure float manufacturers provide information about AIS in the information and manuals they provide when they sell their products.
- Incorporate real-time AIS data layers to apps used by seaplane pilots to inform flight planning.
- Work with Transport Canada to share the results of the seaplane project, including case studies and education modules, and encourage enhanced engagement on AIS-seaplane issues with Canadian-licensed seaplane pilots.

E. Ensure AIS Training is a Mandatory Component of FAA Seaplane Rating Training

- Ensure AIS training is a mandatory component of FAA seaplane rating training by including information on the seaplane pathway-AIS nexus and seaplane pilot best practices in the FAAH808323, Seaplane, Skiplane, and Float/Ski Equipped Helicopter Operations Handbook.
- Produce and distribute an FAA Advisory Circular on the seaplane-AIS nexus and best practices.

F. Enhance AIS Decontamination Infrastructure

- Prioritize AIS outreach and cleaning infrastructure at FAA-recognized seaplane bases and high output seaplane schools to maximize strategic investments that facilitate reducing risk of AIS transport via the seaplane pathway. Infrastructure could include signage, cleaning stations, dry docks, and other tools to raise awareness and assist pilots with decontamination procedures.

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Appendices

Appendix A. U.S. Registered Pilots by Category as of 1 September 2023.

State	Region	Student Pilot*	Sport Pilot**	Recreational Pilot***	Private Pilot****	Commercial Pilot*****	ATP Pilot******	Total U.S. Pilot
AK	Alaska	2,999	59	0	2,642	1,746	2,401	9,847
	SUBTOTAL	**2,999**	**59**	**0**	**2,642**	**1,746**	**2,401**	**9,847**
IA	Central	2,466	106	1	1,951	986	836	6,346
KS	Central	3,162	96	3	2.464	1,335	1,418	8,478
KY	Central	3,234	75	2	1,777	1,092	2,270	8,450
MO	Central	4,982	181	0	3,107	1,856	2,146	12,272
NE	Central	1,865	42	0	1,246	712	693	4,558
TN	Central	6,905	129	2	3,876	2,729	5,027	18,668
	SUBTOTAL	**22,614**	**629**	**8**	**14,421**	**8,710**	**12,390**	**58,772**
CT	Eastern	1,998	30	1	1,443	771	1,329	5,572
Del.	Eastern	691	12	1	326	217	464	1,711
D.C.	Eastern	375	7	0	226	84	169	861
ME	Eastern	1,056	57	1	792	455	574	2,935
MD	Eastern	4,744	106	1	2,225	1,350	1,828	10,254
MA	Eastern	4,394	73	1	2,548	1,195	1,701	9,912
NH	Eastern	1,474	64	0	1,043	592	1,448	4,621
NJ	Eastern	4,749	45	3	2,648	1,481	2,436	11,362
NY	Eastern	9,352	137	8	4,755	2,789	3,301	20,342
NC	Eastern	7,357	183	2	4,835	3,016	5,254	20,647
PA	Eastern	7,541	222	6	4,566	2,554	4,509	19,398
RI	Eastern	572	7	0	293	162	237	1,271
VT	Eastern	645	10	1	466	277	244	1,643
VA	Eastern	7,120	173	2	4,098	2,676	4,569	18,638
WV	Eastern	1,047	43	0	557	316	339	2,302
	SUBTOTAL	**53,115**	**1,169**	**27**	**30,821**	**17,935**	**28,402**	**131,469**

1 An individual learning to fly under the tutelage of a flight instructor; permitted to fly alone under specific, limited conditions.
2 An individual authorized to fly only lightsport aircraft.
3 An individual who may fly aircraft of up to 180 horsepower and 4 seats in the daytime for pleasure only.
4 An individual who may fly for pleasure or personal business, generally without accepting compensation.
5 An individual who may, with some restrictions, fly for compensation or hire.
6 An individual authorized to act as pilot for a scheduled airline.

State	Region	Student Pilot*	Sport Pilot**	Recreational Pilot***	Private Pilot****	Commercial Pilot*****	ATP Pilot******	Total U.S. Pilot
IL	Great Lakes	7,851	322	5	4,788	2,635	4,762	20,363
IN	Great Lakes	5,738	226	3	3,544	1,800	2,701	14,012
MI	Great Lakes	6,455	237	2	4,636	2,410	3,726	17,466
MN	Great Lakes	5,169	123	0	4,123	2,398	3,901	15,714
ND	Great Lakes	1,767	30	0	1,002	914	322	4,035
OH	Great Lakes	7,549	299	4	5,007	2,612	4,052	19,523
SD	Great Lakes	1,029	64	1	784	560	516	2,954
WI	Great Lakes	4,613	305	2	3,322	1,496	2,336	12,074
	SUBTOTAL	**40,171**	**1,606**	**17**	**27,206**	**14,825**	**22,316**	**106,141**
CO	NW Mountain	8,124	178	1	5,200	3,473	7,252	24,228
ID	NW Mountain	2,753	102	0	2,041	1,259	1,545	7,700
MT	NW Mountain	1,924	48	2	1,444	968	837	5,223
OR	NW Mountain	4,441	123	3	3,399	2,261	1,673	11,900
UT	NW Mountain	4,759	94	1	2,903	2,243	3,253	13,253
WA	NW Mountain	9,928	248	0	6,063	3,491	6,836	26,566
WY	NW Mountain	1,017	22	0	704	379	355	2,477
	SUBTOTAL	**32,946**	**815**	**7**	**21,754**	**14,074**	**21,751**	**91,347**
AL	Southern	3,991	84	1	2,270	2,005	1,623	9,974
FL	Southern	31,746	651	1	15,323	13,139	22,839	83,699
GA	Southern	9,356	186	3	5,113	3,025	7,571	25,254
SC	Southern	3,878	99	1	2,562	1,436	2,647	10,623
	SUBTOTAL	**50,419**	**1,069**	**6**	**25,634**	**19,896**	**35,086**	**132,110**
AR	Southwest	3,159	101	0	1,734	1,166	1,026	7,186
LA	Southwest	2,868	72	0	1,566	1,126	1,155	6,787
MS	Southwest	2,390	37	2	1,175	841	1,031	5,476
NM	Southwest	2,020	83	3	1,409	980	649	5,144
OK	Southwest	4,772	66	2	2,545	1,626	1,717	10,728
TX	Southwest	27,468	452	4	14,521	9,733	19,014	71,192
	SUBTOTAL	**42,677**	**811**	**11**	**22,950**	**15,472**	**24,592**	**106,513**
AZ	Western Pacific	10,159	224	0	5,604	5,474	6,223	27,684
CA	Western Pacific	30,442	579	3	19,836	11,014	12,348	74,222
HI	Western Pacific	1,617	19	0	686	832	1,469	4,623
NV	Western Pacific	3,427	75	0	2,021	1,518	3,189	10,230
	SUBTOTAL	**45,717**	**897**	**3**	**28,178**	**18,859**	**23,327**	**116,981**
	TOTAL	**290,658**	**7,055**	**79**	**173,606**	**111,517**	**170,265**	**753,180**

Appendix B. Federal and State Regulations Governing Seaplanes

Federal Regulations Governing Seaplane Use

US Army Corps of Engineers (USACE)
The Chief of Engineers, under the supervision of the Secretary of the Army, is authorized to construct, maintain, and operate public park and recreational facilities at water resource development projects under the control of the Department of the Army, to permit the construction of such facilities by local interests(particularly those to be operated and maintained by such interests), and to permit the maintenance and operation of such facilities by local interests (16 U.S.C.A. § 460d).

Using this authority, the USACE has enacted the following regulations governing public use of water resource development projects administered by the agency (36 C.F.R. Part 327).

36 C.F.R. § 327.4 Aircraft
It is unlawful for any person to operate any aircraft on or above project waters or project lands in a careless, negligent, or reckless manner so as to endanger any person, property, or environmental feature. This prohibition "pertains to all aircraft including, but not limited to, airplanes, seaplanes, helicopters, ultralight aircraft, motorized hang gliders, hot air balloons, any nonpowered flight devices or any other such equipment."

All operations of seaplanes while upon project waters shall be in accordance with U.S. Coast Guard navigation rules for powerboats or vessels and § 327.3. Seaplane operations contrary to the prohibitions or restrictions established by the District Commander (pursuant to part 328 of this title) are prohibited. Seaplanes may not be operated at Corps projects between sunset and sunrise unless approved by the District Commander.

Seaplanes on project waters and lands in excess of 24 hours must be securely moored at mooring facilities and at locations permitted by the District Commander. Seaplanes may be temporarily moored on project waters and lands, except in areas prohibited by the District Commander, for periods less than 24 hours provided the (1) mooring is safe, secure and accomplished so as not to damage the rights of the Government or members of the public, and (2) the operator remains in the vicinity of the seaplane and reasonably available to relocate the seaplane if necessary.

Commercial operation of seaplanes from project waters is prohibited without written approval of the District Commander following consultation with and necessary clearance from the FAA and other appropriate public authorities and affected interests.

36 C.F.R. Part 328. Regulation of Seaplane Operations at Civil Works Water Resources Development Projects Administered by the Chief of Engineers

Part 328, published on November 15, 1977, provides uniform policies and criteria for designating Corps projects, or portions thereof, at which seaplane operations are prohibited or restricted. (36 C.F.R. § 328.1). The regulation is applicable to all Field Operating Agencies having Civil Works responsibilities. (36 C.F.R. § 328.2).

Seaplane operations may be prohibited or restricted at such water resource development projects, or portions thereof, for a variety of management reasons. 36 C.F.R. § 328.4(c).

36 C.F.R.§ 328.5 sets forth guidelines for seaplane use at project waters that are similar to those outlined in § 327.4. All operations of seaplanes while upon the water must be in accordance with marine rules of the road for powerboats or vessels. Seaplanes may not be operated at Corps projects between sunset and sunrise unless adequate lighting and supervision are available. Seaplanes on project waters or lands in excess of 24 hours shall be securely moored at mooring facilities and at locations permitted by the District Engineer.

Seaplanes may be temporarily moored on project waters and lands for periods of less than 24 hours, outside of areas prohibited by the District Engineer, provided that the mooring is safe/secure and the operator remains in the vicinity of the seaplane. Commercial operation is not permitted without written approval of the District Engineer. Appropriate signs must be employed to inform users of projects, or portions thereof, where seaplane operations are permitted.

The regulation directed District Engineers to examine, within one year (by 1978), each Corps project within their districts that a seaplane operator "could conceivably attempt to use for seaplane operations" and determine where seaplane operations should be prohibited (36 C.F.R. § 328.6(a)(1)). District Engineers are authorized to "establish such restrictions on sea plane operations as deemed necessary or desirable in accordance with these regulations for other areas. Seaplane takeoff and landing maneuvers within specified distances of the shoreline, bridges, causeways, water utility crossings, dams, and similar structures should be prohibited." (36 C.F.R. § 328.6(a)(2)). USACE maps, brochures, or similar documents should clearly identify where seaplane operations are prohibited or restricted. (36 C.F.R. § 328.6(a)(5)). District Engineers are required to notify the FAA of projects, or portions thereof, where seaplane operations are prohibited or restricted. (36 C.F.R. § 328.6(a)(6)). District Engineers should periodically reevaluate determinations and may modify, delete, or add projects, or portions thereof, where seaplane operations are prohibited or restricted. (36 C.F.R. § 328.6(c)).

Part 322. Permits for Structures or Work in or Affecting Navigable Waters of the United States Section 10 of the Rivers and Harbors Act of 1899 requires authorization from the Secretary of the Army, acting through the USACE, for the construction of any structure in or over any navigable water of the United States. Structures in navigable waters associated with sea plane operations require a Section 10 permit. (33 C.F.R. § 322.5(j)(1)). The USACE coordinates with the Federal Aviation Administration and U.S. Department of Transportation on such applications. (33 C.F.R. § 322.5(j)(2)).

U.S. Department of Interior
U.S. Fish and Wildlife Service

The Department of Interior is authorized to issue regulations as necessary to administer the National Wildlife Refuge System. (16 U.S.C. § 668dd(b)(5). The U.S. Fish and Wildlife Service (FWS) manages the National Wildlife Refuge System.

50 C.F.R. § 27.34 Aircraft.
The unauthorized landing or takeoff of an aircraft on a national wildlife refuge is prohibited, except in an emergency.

50 C.F.R. § 36.39. Alaska National Wildlife Refuges – Public Use
The FWS has issued refuge-specific regulations governing the operation of aircraft on the Kenai National Wildlife Refuge. Operation of aircraft is authorized only in designated areas as described in the regulation and subject to certain restrictions. For example, FWS prohibits the operation of aircraft from May 1 through September 10 on any lake within the Kenai NWR where nesting trumpeter swans or their broods or both are present.

Bureau of Reclamation
The Department of the Interior is authorized by Congress to "issue regulations necessary to maintain law and order and protect persons and property within Reclamation projects and on Reclamation lands." 43 U.S.C.A. § 373b. Under Bureau of Reclamation (BOR) regulations, a seaplane may be considered either an aircraft or a vessel, because it can be used both for flight in the air or as a means of transportation on the water. (43 C.F.R. § 423.2).

43 C.F.R. § 423.38. Operating vessels on Reclamation waters
Operators must comply with Federal, State, and local laws applicable to the operation of a vessel, other watercraft, or seaplane on Reclamation waters. Seaplanes must not operate in an area closed to the public, and restrictions established by signs, buoys, and other regulatory markers must be observed. Vessels must be removed from Reclamation lands and waters when not in actual use for a period of more than 24 hours, unless they are securely moored or stored at special use areas so designated by an authorized official.

43 C.F.R. § 423.41. Aircraft
Aircraft operators must comply with any applicable Federal, State, and local laws, and with any additional requirements or restrictions established by an authorized official in a special use area with respect to aircraft landings, takeoffs, and operation on or in the proximity of Reclamation facilities, lands, and waterbodies. Operators must comply with all applicable U.S. Coast Guard rules when operating a seaplane on Reclamation waterbodies. Seaplanes must be securely moored if remaining on Reclamation waterbodies in excess of 24 hours at mooring facilities and locations designated by an authorized official. Seaplanes may be moored for periods of less than 24 hours on Reclamation waterbodies, except in special use areas otherwise designated by an authorized official, provided the mooring is safe/secure and the operator remains in the vicinity of the seaplane.

National Park Service

The Department of the Interior is authorized to prescribe such regulations as are necessary or proper for the use and management of National Park System units. 54 U.S.C.A. § 100751(a). The grant of authority includes regulations concerning boating and other activities on or relating to water located within System units. Such regulations are complementary to the authority of the U.S. Coast Guard to regulate the use of water. 54 U.S.C.A. § 100751(b).

Operating or using aircraft on National Park System lands and waters other than at locations designated pursuant to special regulations is prohibited. 36 C.F.R. § 2.17. Where special regulations allow the use of a water surface for aircraft, it is unlawful to operate or use aircraft under power on the water within 500 feet of locations designated as swimming beaches, boat docks, piers, or ramps, except as otherwise designated.

Congress granted the Department of Interior authority to regulate use by seaplanes in Voyageurs National Park (16 U.S.C.A. § 160h). The National Park Service has not published special regulations for Voyageurs that address seaplane use. Voyageurs National Park is subject to State of Minnesota boating laws. (https://www.nps.gov/voya/planyourvisit/lake navigation.htm).

36 C.F.R. § 7.9 St. Croix National Scenic Riverway

If a vessel or its trailer has been in water infested or contaminated with aquatic nuisance species, it is unlawful for a person to enter St. Croix National Scenic Riverway by such vessel or launch or operate such vessel within the Riverway unless such vessels and trailers are inspected and cleaned using appropriate techniques and processes. The regulation defines aquatic nuisance species to include zebra mussel, purple loosestrife, and Eurasian water milfoil. The term vessel includes seaplanes when on the water.

36 C.F.R. § 7.20 Fire Island National Seashore

Aircraft may be operated on the waters of the Great South Bay and the Atlantic Ocean within the boundaries of Fire Island National Seashore, except as restricted in 36 C.F.R. § 2.17 and the following provisions:

- The waters of the Great South Bay and the Atlantic Ocean within the boundaries of Fire Island National Seashore are closed to takeoffs, landings, beachings, approaches or other aircraft operations within 1000 feet of any shoreline, including islands, and within 1000 feet of lands within the boundaries of the incorporated villages of Ocean Beach and Saltaire and the village of Seaview.
- Aircraft may taxi on routes perpendicular to the shoreline to and from docking facilities at the following locations:
- Kismet—located at approximate longitude 73° 12 ½ ′ and approximate latitude 40° 38 ½ ′.
- Lonelyville—located at approximate longitude 73° 11′ and approximate latitude 40° 38 ½ ′.
- Atlantique—located at approximate longitude 73° 10 ½ ′ and approximate latitude 40° 38 ½ ′.
- Fire Island Pines—located at approximate longitude 73° 04 ½ ′ and approximate latitude 40°40′.
- Water Island—located at approximate longitude73° 02′ and approximate latitude 40° 40 ½ ′.
- Davis Park—located at approximate longitude 73° 00 ½ ′ and approximate latitude 40° 41′.

- Aircraft operation in the vicinity of marinas, boats, boat docks, floats, piers, ramps, bird nesting areas, or bathing beaches must be performed with due caution and regard for persons and property and in accordance with any posted signs or uniform waterway markers.
- Aircraft are prohibited from landing or taking off from any land surfaces, any estuary, lagoon, marsh, pond, tidal flat, paved surface, or any waters temporarily covering a beach; except with prior authorization of the Superintendent. Permission shall be based on the need for emergency service, resource protection, resource management, or law enforcement.
- Aircraft operations shall comply with all Federal, State and county ordinances and rules for operations as may be indicated in available navigation charts or other aids to aviation which are available for the Fire Island area.

36 CFR § 7.27 Dry Tortugas National Park
Landing an aircraft in Dry Tortugas National Park may occur only in accordance with a permit issued by the Park Superintendent. When a landing is authorized by permit, aircraft may be landed on the waters within a radius of 1 mile of Garden Key, but a landing or take off may not be made within 500 feet of Garden Key, or within 500 feet of any closed area.

Operation of aircraft is subject to 36 C.F.R. § 2.17, except that seaplanes may be taxied closer than 500 feet to the Garden Dock while en route to or from the designated ramp, north of the dock. Seaplanes may be moored or brought up on land only on the designated beach, north of the Garden Key dock.

36 CFR Part 13, Subpart N – Special Regulations – Glacier Bay National Park and Pre serve
The special regulations for Glacier Bay National Park and Preserve define vessel to include a seaplane while operating on the water. (36 C.F.R. § 13.1102).
It is unlawful to operate a vessel or a seaplane on Johns Hopkins Inlet waters south of 58°54.2′ N latitude (an imaginary line running approximately due west from Jaw Point)
from May 1 through June 30. From July 1 through August 31, no one may operate a vessel or a seaplane on Johns Hopkins Inlet waters south of 58°54.2′ N latitude (an imaginary line running approximately due west from Jaw Point), within 1/4 nautical mile of a seal hauled out on ice; except when safe navigation requires, and then with due care to maintain the 1/4 nautical mile distance from concentrations of seals.

36 C.F.R. § 13.1178
Operating a vessel within 1/4 nautical mile of a whale is prohibited. The operator of a vessel inadvertently positioned within 1/4 nautical mile of a whale must immediately slow the vessel to 10 knots or less, without shifting into reverse unless impact is likely. The operator must direct or maintain the vessel on as steady a course as possible away from the whale until at least 1/4 nautical mile of separation is established. The operator of a vessel or sea plane positioned within 1/2 nautical mile of a whale is prohibited from altering course or speed in a manner that results in decreasing the distance between the whale and the vessel or seaplane.

36 CFR § 13.1170.
Operating a vessel or seaplane on the following water within Glacier Bay is prohibited under 36 C.F.R. § 13.1180:

- From May 1 through September 15.
  - Adams Inlet, east of 135°59.2′ W longitude (an imaginary line running approximately due north and south through the charted (5) obstruction located approximately 2 ¼ nautical miles east of Pt. George).
  - Rendu Inlet, north of the wilderness boundary at the mouth of the inlet.
  - Hugh Miller complex, including Scidmore Bay and Charpentier Inlet, west of the wilderness boundary at the mouth of the Hugh Miller Inlet.
  - Waters within the Beardslee Island group (except the Beardslee Entrance), that is defined by an imaginary line running due west from shore to the easternmost point of Lester Island, then along the south shore of Lester Island to its western end, then to the southernmost point of Young Island, then north along the west shore and east along the north shore of Young Island to its northernmost point, then at a bearing of 15 true to an imaginary point located one nautical mile due east of the easternmost point of Strawberry Island, then at a bearing of 345 true to the northernmost point of Flapjack Island, then at a bearing of 81 true to the northernmost point of the unnamed island immediately to the east of Flapjack Island, then southeasterly to the northernmost point of the next unnamed is land, then southeasterly along the (Beartrack Cove) shore of that island to its easternmost point, then due east to shore.
- From June 1 through July 15, operating a motor vessel or a seaplane on the waters of Muir Inlet north of 59°02.7′ N latitude (an imaginary line running approximately due west from the point of land on the east shore approximately 1 nautical mile north of the McBride Glacier) is prohibited.
- From July 16 through August 31, operating a motor vessel or a seaplane on the waters of Wachusett Inlet west of 136°12.0′ W longitude (an imaginary line running approximately due north from the point of land on the south shore of Wachusett Inlet approximately 2¼ nautical miles west of Rowlee Point) is prohibited.

U.S. Department of Homeland Security – U.S. Coast Guard

The U.S. Coast Guard regulates the safety of navigation on inland and marine waters. The Coast Guard's inland navigation rules define vessel to include seaplanes. (33 C.F.R. § 83.03). The navigation rules set forth safety requirements for, among other things, steering, equipment, lights, and sounds. For example, Coast Guard rules state that "a seaplane on the water shall, in general, keep well clear of all vessels and avoid impeding their navigation." (33 C.F.R. § 83.18(e)). The Coast Guard may also establish security zones and restricted areas. (See, e.g., 33 C.F.R. § 162.15).

U.S. Department of Transportation – Federal Aviation Administration

The Federal Aviation Administration oversees design, production, and airworthiness certification processes for aviation products. With respect to seaplanes, FAA regulations state that they "must be designed for the water loads developed during takeoff and landing, with the seaplane in any attitude likely to occur in normal operation, and at the appropriate forward and sinking velocities under the most severe sea conditions likely to be encountered." (14 C.F.R. § 25.521). Specific airworthiness design standards are set forth in other sections of Part 25.

The FAA is also responsible for issuing pilot licenses and establishing training requirements. FAA regulations require seaplane pilots to know and follow the rules for seaplane base operations. (See, e.g., 14 C.F.R. § 61.107, 14 C.F.R. § 61.311). Individuals seeking commercial multiengine seaplane rating must log at least "10 hours of training in a multiengine seaplane that has flaps and a controllable pitch propeller, including seaplanes equipped with an engine control system consisting of a digital computer and associated accessories for controlling the engine and propeller, such as a full authority digital engine control." (14 C.F.R. § 61.129).

State Laws Governing Seaplane Use

The Federal Aviation Administration has exclusive authority in regulating the airspace over the U.S. (49 U.S.C. § 40103(a)). The Federal Aviation Administration also oversees the design, production, and airworthiness of aviation products, the training and certification of pilots, and the certification and operation of airports. The regulation of aircraft in flight, however, does not preempt state and local regulation of aircraft landing sites. (Gustafson v. City of Lake Angelus, 76 F.3d 778, 783 (6th Cir. 1996)). States may enact a variety of statutes and regulations governing on-the-ground airport operations if they do not conflict with federal law.

Thirty states have at least one statute or regulation referring to seaplanes (Appendix A). These laws fall into several broad categories: grants of state agency or municipal authority, pilot or seaplane base license requirements, safety requirements, specific geographic restrictions, and aquatic invasive species regulation. This section provides brief summaries of state approaches to seaplane regulations. Details and citations to the state laws and regulations are provided in the attached spreadsheet.

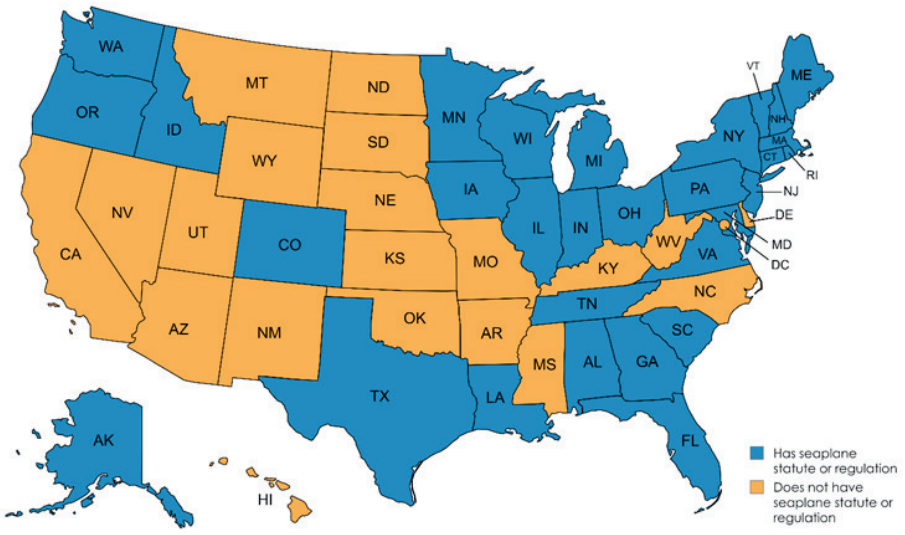


Figure 12. States with at least one statute or regulation referring to seaplanes.

State Agency Authorization
Eight states (Alaska, Iowa, Maine, New Hampshire, Oregon, South Carolina, Vermont, and Virginia) grant express authority to a state agency or other entity to regulate the takeoff/ landing or operation of seaplanes. The scope of the authorization varies by state. The lack of express authorization in other states does not mean that jurisdiction is lacking, however. Seaplanes are aircraft and fall under the jurisdiction of the state agency responsible for aviation, often the department of transportation. States laws governing the takeoff and landing of aircraft more generally may also apply to seaplanes.

General Seaplane Regulation or Restriction
Thirteen states have laws imposing broad regulations or restrictions on seaplanes. The majority of these provisions simply state that seaplanes must comply with state boating laws and navigational rules when they are operating on the water. Several states have more de tailed laws regarding seaplane operation.

Some states authorize the use of seaplanes unless otherwise prohibited. For example, in Oregon, seaplanes may land, takeoff, or operate on state waters open to motorboats, unless specifically prohibited by the Oregon Department of Aviation or inconsistent with federal law. In Michigan, waterways may be used for the landing, docking, and takeoff of seaplanes in accordance with Michigan Department of Transportation rules. In South Carolina, navigable waters available for public use may be used for the landing, docking, and takeoff of seaplanes.

Some states prohibit the use of seaplanes in certain areas or classes of waters. In Iowa, it is unlawful for any aircraft to make use of the inland lakes of the state, except for the transportation of people or property over distances greater than 30 miles (Iowa Code Ann. § 462A.30).

Massachusetts prohibits the operation of a seaplane in or on a public access facility. Public access facilities include any public facility posted by the Department of Fish and Game to provide access by the public to state land or water resources including, but not limited to, boat launching ramps, cartop boat access areas, parking areas, sportfishing piers, and shore fishing areas. Additionally, seaplanes are not permitted in any public water source unless authorized by a permit from the Board of Water Commissioners or similar entity having jurisdiction over the water.

Vermont restricts the operation of seaplanes within 200 feet of the shoreline; an individual in the water; a canoe, rowboat, or other vessel; an anchored or moored vessel containing any individual; or anchorages or docks, except at a speed of less than five miles per hour that does not create a wake. An individual cannot operate any seaplane within 200 feet of a divers-down flag.

Specific Geographic Restrictions
States have also enacted laws and regulations prohibiting or restricting seaplane use at certain protected waters, such as state parks, wilderness areas, recreational lakes, and drinking water reservoirs. The prohibitions and restrictions vary in detail and scope among states. New Hampshire, for example, prohibits seaplane use on more than a dozen lakes and reservoirs that are

principal drinking water supplies for various cities and towns. Alabama prohibits the use of seaplanes on lakes within Gulf State Park. Minnesota prohibits all seaplane operations, except by the holder of a private seaplane base license, on Lake Minnetonka, White Bear Lake, and Lake Owasso from 11 a.m. to 6 p.m. on Saturdays, Sundays, and national legal holidays between June 1 and September 15. Commercial use of seaplanes is prohibited on Lake George, NY, and a permit is needed from the Lake George Park Commission to berth a seaplane.

It is important to note that this inventory of specific geographic restrictions is not comprehensive, as seaplane use may be restricted on the local level by municipalities (see below) or the governing entities of individual water bodies. In addition, state laws or regulations of ten exclude seaplanes from the definition of "vessel" or "watercraft." If a water is open only to use by vessels, and seaplanes are not classified as vessels in that state, their use on that particular water might be prohibited (See, e.g., 2 Colo. Code Regs. 4051:105).

Seaplane Base Licensing, Design, and Operational Standards

Fifteen states set forth licensing, design, or operational standards for seaplane bases. For example, in Ohio, all public and private seaplane landing sites, landing fields, landing areas, and bodies of water shall first be approved and issued an operating certificate by the Ohio Department of Transportation Office of Aviation before being used for commercial purposes. In Virginia, a person establishing or owning a private seaplane base must register the facility if it is more than five nautical miles from a licensed public use airport. In Vermont, a municipality or person proposing to establish a seaplane landing area must apply to the Transportation Board for a certificate of approval of the site selected.

In Maryland, every licensed airport specifically adapted for the landing and taking off of seaplanes must meet or exceed the designated standards regarding size, boundary markers, hazards, wind indicator, and minimum facilities and equipment. In Illinois, water landing and departure surfaces for seaplanes must be a minimum of 400 feet in width, and all approaches to and departures from the water area shall be sufficient to clear all structures on the land or in the water by at least 100 feet.

Georgia requires seaplane bases to conform to standards established by the controlling jurisdiction's rules and regulations for operations on the body of water. If no specific standards have been established, the Seaplane Base must conform to standard design guidance of the Federal Aviation Administration AC 150/53951, Seaplane Bases. Virginia and Ohio also incorporate the FAA's design guidance by reference.

Seaplane Owner/Operator Licensing/Registration Requirements

Connecticut requires the owner of any aircraft that is based or primarily used at any airport facility or seaplane base in a municipality to register with the municipality and pay an annual renewal fee. Alaska's regulations state that to qualify for a float space at Ted Stevens Anchorage International Airport in Alaska, an individual's pilot certificate must demonstrate that the applicant holds a current seaplane rating.

Municipal Authority
Five states (Florida, Michigan, Oregon, Texas, and Wisconsin) grant express authority to municipalities to regulate seaplane use. Upon adoption of zoning requirements, a Florida municipality may prohibit or regulate for specified public health and safety purposes, the landing of seaplanes in and upon any public waters of the state within their jurisdiction. Michigan municipalities may restrict the use of seaplanes by ordinance, upon approval by the Michigan Department of Transportation.

In Oregon, municipalities may apply to the State Aviation Board for special regulations relating to the operations of seaplanes on waters within the territorial limits of the political subdivision. These regulations may include, but need not be limited to, the establishment of limits on the areas of operations, hours and time of operations, and the prohibition of seaplane landings and takeoffs.

In Texas, a government entity that owns, controls, or has jurisdiction over a navigable body of water may prohibit the takeoff, landing, or operation of an aquatic aircraft in an area in which motorized boating is permitted with the approval of the Texas Department of Transportation. The government entity may also impose a permit requirement or fee for the operation of aquatic aircraft with the approval of the Texas Department of Transportation.

Wisconsin municipalities adjoining or surrounding any waters are authorized to adopt ordinances that impose reasonable safety regulations relating to the operation on the surface of such waters of any aircraft capable of landing on water. Such ordinances may also pre scribe the areas which may be used as a landing and takeoff strip for the aircraft or prohibit the use of the waters altogether.

Aquatic Invasive Species Regulation
Four states (Illinois, Maine, Washington, and Wisconsin) expressly subject seaplane opera tors to state AIS requirements. In Illinois, it is unlawful for any person to place, takeoff, or operate a seaplane in waters of the State if it has any aquatic plants or aquatic animals attached to the exterior. In Wisconsin, it is unlawful to place or operate a seaplane in a navigable water if it has any aquatic plants or aquatic animals attached to the exterior of the seaplane. Taking off with a seaplane with aquatic plants or aquatic animals attached to the exterior is prohibited, with the exception of a seaplane with duckweed that is incidentally attached.

In Washington, a person in possession of an aquatic conveyance, which includes seaplanes, must meet clean and drain requirements after the conveyance's use in or on a water body or property. Washington state law requires owners of seaplanes to purchase an AIS prevention permit before placing or operating the seaplane in any waterbody in the state. An AIS prevention permit is also required before commercially transporting a seaplane into or through the state that has previously been placed or operated in the waters of any state or country. Similarly, seaplane operators in Maine must have a valid lake and river protection sticker, issued annually, permanently affixed to the seaplane to operate in inland waters.

State	Seaplane Regulation (Y/N)	Citation	Type of Regulation	Regulatory Details
AL	Y	Ala. Admin. Code 2205.18	Specific Geographic Restriction	It shall be unlawful to operate any aircraft or seaplane of any type on any Lake within Gulf State Park, including, but not limited to, lake Shelby, Middle Lake, and Little Lake, provided, however, that this prohibition shall not apply to official emergency, governmental, or military aircraft conducting official operations.
AK	Y	Alaska Stat. Ann. § 02.15.160	Agency Authorization	The Department of Transportation and Public Facilities may construct, maintain, or operate floats and seaplane ramp landing facilities, subject to the provisions of AS 02.15.060, 02.15.070, and 02.15.120. The department may construct, maintain, or operate emergency landing fields, or rural airstrips adequate to meet rural needs with or without financial contribution by local interests.
		17 AAC 42.510	Pilot License Requirement	To qualify for a float space at Ted Stevens Anchorage International Airport an individual's pilot certificate must show that the applicant holds a current seaplane rating.
		5 AAC 92.066	Specific Geographic Restriction	All aircraft access to Round Island in Walrus Islands State Game Sanctuary (Bristol Bay Unit 17) is prohibited, except with permission of the department; access to Round Island is allowed only through an access corridor designated by the department; helicopter landings are restricted to the area directly behind the cabin; seaplane landings must be made at least one-half mile offshore within the access corridor.
AZ	N			
AR	N			
CA	N			
CO	Y	2 CCR 405 2:219	Safety Regulation	A seaplane on the water shall, in general, keep well clear of all vessels and avoid impeding their navigation. In circumstances, however, where risk of collision exists, seaplanes shall comply with these Navigation and Rules of the Road regulations.
CT	Y	C.G.S.A. § 13b 39a	Registration Requirement	The owner of any aircraft which is based or primarily used at any airport facility, heliport, air navigation facility, restricted landing area or seaplane base in a municipality must register with the municipality and pay an annual renewal fee.
		Regs. Conn. State Agencies § 154126	Seaplane Base Design/ Licensing/ Operation	A license for the operation of a seaplane base on any body of water in this state may be granted when all the conditions required for the establishment of an airport have been complied with and, in addition thereto, the following requirement has been met: When the body of water to be used for landings and takeoffs is under the jurisdiction of any federal, state, municipal, port or other authority, the flight operations on such body of water shall be in conformity with the marine traffic rules and regulations of such authority.
		Regs. Conn. State Agencies § 154130	Safety Regulation	Each commercial seaplane base shall have, in addition to the facilities required for a commercial airport, the following service facilities: (1) At least one life preserver of the ring or throwing type with sufficient line attached, kept available on the ramp, dock or float; (2) a boat, approved by the department, immediately available at all times that flights are in progress; (3) a dock, or float, suitable for the type of seaplane using the base, so located as to afford the maximum degree of safety in taxiing; (4) suitable beaching facilities for the type of aircraft using the base. Where an adequate ramp is maintained, the dock or float may be omitted; (5) an adequate supply of lines for heaving, towing, securing or rescue operations.
DE	N			

State	Seaplane Regulation (Y/N)	Citation	Type of Regulation	Regulatory Details
FL	Y	F.S.A. § 330.36	Municipal Authority	No county or municipality of this state shall license airports or control their location except by zoning requirements. Upon adoption of zoning requirements, a municipality may prohibit or otherwise regulate, for specified public health and safety purposes, the landing of seaplanes in and upon any public waters of the state which are located within the limits or jurisdiction of, or bordering on, the municipality.
GA	Y	Ga Comp. R. & Regs. 6729.03	Seaplane Base Design/ Licensing/ Operation	Seaplane Bases shall conform to the standards established by the controlling jurisdiction's rules and regulations for operations on the body of water. If no specific standards have been established, the Seaplane Base shall conform to standard design guidance of FAA AC 150/53951, Seaplane Bases.
HI	N			
ID	Y	IDAPA 26.01.20.203	Safety Regulation	Vessels operating on public waters administered by the Department of Parks and Recreation must fully comply with the Idaho Safe Boating Act and the Marine Sewage Disposal Act. Vessel is defined by department regulations to include seaplanes.
IL	Y	625 Ill. Comp. Stat. Ann. 45/5 23	AIS Regulation	No person may place or operate a vehicle, seaplane, watercraft, or other object of any kind in waters of this State if it has any aquatic plants or aquatic animals attached to the exterior of the vehicle, seaplane, watercraft, or other object. No person may take off with a seaplane, or transport or operate a vehicle, watercraft, or other object of any kind on a highway with aquatic plants or aquatic animals attached to the exterior of the seaplane, vehicle, watercraft, or other object.
		92 Ill. Adm. Code 14.630	Seaplane Base Design/ Licensing/ Operation	Water landing and departure surfaces must be a minimum of 400 feet in width. All approaches to and departures from the water area shall be sufficient to clear all structures on the land or in the water by at least 100 feet. Every seaplane base shall provide a wind direction/velocity indicator (must be lighted for night use).
		92 Ill. Adm. Code 14.630	Seaplane Base Design/ Licensing/ Operation	Private Use Seaplane Base Certificate Holder must, among other things, supervise all operations, prescribe local seaplane base rules, and develop and follow operational maintenance and repair practices that will ensure that the landing area and approaches are free from hazards to the operation of aircraft.
		92 Ill. Adm. Code 14.620	Seaplane Base Design/ Licensing/ Operation	Parallel design requirements & operator responsibilities for Public Use seaplane base.
IN	Y	105 IAC 3322	Seaplane Base Design/ Licensing/ Operation	A certificate of site approval for a private use seaplane base shall not be issued by the department unless any governmental body, authority or person having jurisdiction over the body of water has given approval for use of the site as a private use seaplane base.
		105 IAC 339	Seaplane Base Design/ Licensing/ Operation	A certificate of site approval for a public use seaplane base shall not be issued by the department unless any governmental body or authority having jurisdiction over the body of water has given approval for use of the site as a public use seaplane base.
		105 IAC 3312	Safety Regulation	All public use seaplane bases shall be inspected at least once a year by the department and shall maintain compliance with the certain minimum safety requirements

State	Seaplane Regulation (Y/N)	Citation	Type of Regulation	Regulatory Details
IA	Y	Iowa Code Ann. § 462A.30	General Seaplane Regulation	It is unlawful for any aircraft to make use of the inland lakes of the state, except in the transportation of persons or property between points separated by a distance of thirty miles or more. However, this section does not prohibit the use of such waters by any aircraft in danger or distress or the use of such waters by the operators of private aircraft, not operated for hire.
		Iowa Code Ann. § 462A.30	Agency Authorization	In addition, the commission may, on the recommendation of the state department of transportation, designate certain areas on inland lakes of the state where seaplane flight instruction may be conducted under such conditions as may be adopted by the commission and the state department of transportation.
KS	N			
KY	N			
LA	Y	LSAR.S. 34:851.4(A)(15)	Safety Regulation	Careless operation of a watercraft is the operation of a watercraft in a careless manner so as to endanger the life, limb, or property of any person, when such operation constitutes a violation of any of the following requirements: A seaplane on the water shall in general keep clear of all vessels and avoid impeding the navigation of all vessels.
ME	Y	12 M.R.S.A. § 13058	AIS Regulation	It is unlawful to operate a seaplane on the inland waters of the state unless a valid lake and river protection sticker is permanently affixed to the seaplane. A new lake and river protection sticker must be purchased every year and is required to be permanently affixed to each outside edge of a seaplane's pontoons so that the entire sticker is visible above the water line when the seaplane is resting on the water. Beginning January 1, 2022, the fee for a sticker is $45. A seaplane operating on interstate waters shared with the State of New Hampshire is exempt if it is displaying a lake and river protection sticker issued by the State of New Hampshire that is equivalent to Maine's lake and river protection sticker and NH enacts similar reciprocity provisions.
		6 M.R.S.A. § 103	Agency Authorization	The Commissioner of Transportation may make rules and regulations pertaining to the use and operation of commercial seaplane landing areas. In case the body of water to be used for landing and taking off is under the jurisdiction of any federal, state, municipal port or other authority, the operations on that body of water shall also be in conformity with the marine traffic rules and regulations of the authority, if those rules and regulations do not interfere with the safe operation of aircraft.
		01670 CMR Ch. 3, § III	AIS Regulation	Seaplane landing areas or milfoil areas. When marked shall be marked with SOLID YELLOW buoys. These markings have no significance as regards safe waters for the operation of watercraft, other than to inform the watercraft operator that seaplanes may be operating in the area or the existence of other special features.
MD	Y	COMAR 11.03.04.04	Specific Geographic Restriction	Public waters controlled by the State are available for non-commercial seaplane use unless otherwise restricted by regulation. Seaplanes may not take off and land on the designated portions of the following bodies of water: Chester River, Deal (Herring Bay), Choptank River, Tred Avon River, Wicomico River, Crisfield River, Patuxent River, and Potomac River. Unless prior written permission is obtained from the Secretary of Natural Resources and the Pennsylvania Power and Electric Co., seaplane operations may not be conducted on Deep Creek Lake in Garrett County. Seaplanes may not operate from bodies of water controlled by political subdivisions without the prior approval of the appropriate political subdivision. These bodies of water are Loch Raven Reservoir; Pretty Boy

State	Seaplane Regulation (Y/N)	Citation	Type of Regulation	Regulatory Details
				Reservoir; Liberty Reservoir; Triadelphia Reservoir; Rocky Gorge Reservoir; Rocky Gap Reservoir Cumberland; Sav age River Reservoir Bloomington; and Youghiogheny Lake Selbyport/Friendsville Maryland/Pennsylvania.
		COMAR 11.03.04.07	Seaplane Base Design/ Licensing/ Operation	Every licensed airport specifically adapted for the landing and taking off of seaplanes shall meet or exceed the designated standards regarding size, boundary markers, hazards, wind indicator, and minimum facilities and equipment.
MA	Y	320 CMR 2.02	General Seaplane Restriction	It is unlawful to operate any seaplane in or on a public access facility. Public Access Facility means any public facility that is posted by the Department of Fish and Game to provide access by the public to a land and/or water resource within Massachusetts including, but not limited to, boat launching ramps, cartop boat access areas, parking areas, sportfishing piers and shore fishing areas.
		310 CMR 22.20B	General Seaplane Restriction	Seaplanes are not permitted in any public water source unless permitted by written permit by the Board of Water Commissioners or like body having jurisdiction over such source.
MI	Y	Mich. Admin. Code R 259.401	General Seaplane Restrictions; Municipal Authority	Waterways may be used for the landing, docking, and takeoff of seaplanes in accordance with Department of Transportation rules. In the landing, docking, and takeoff of a seaplane the pilot of a seaplane shall comply with all applicable federal and state laws and rules. A seaplane shall not land, dock, or takeoff on a water way in such a manner as would violate applicable laws, ordinances, and rules if done by a motorized watercraft. Municipalities may restrict the use of seaplanes by ordinance, upon approval by the department.
		Mich. Comp. Laws Ann. § 259.80h	Safety Regulation	A seaplane operator conducting commercial operations shall assure that the seaplane base used for takeoff or landing has sufficient takeoff and landing distance for the operation being con ducted as specified by the manufacturer's operating limitations for the aircraft being operated.
MI	Y	Minnesota Rules, part 8800.1700	Seaplane Base Design/ Licensing/ Operation	Provisions set forth the licensing and design requirements for a public seaplane base, including size, boundary markers, docks, and other safety elements.
		Minnesota Rules, part 8800.2000	Seaplane Base Design/ Licensing/ Operation	Parallel provisions for private seaplane base licensing and design requirements.
		Minnesota Rules, part 8800.2200	Seaplane Base Design/ Licensing/ Operation	Provisions for the licensing of personal use airports, including seaplane bases. A personal use seaplane base license applies to the land area from which operations are conducted. When two or more bases located on the same body of water are under different ownership or control, each base must obtain a separate personal use seaplane base license. The commissioner may not grant a personal use seaplane base license for those lakes upon which seaplane operations are prohibited.
		Minnesota Rules, part 8800.2600	Safety Regulation	All seaplanes must comply with marine traffic rules to the extent that such rules do not interfere with the safe operations of aircraft.
		Minnesota Rules, part 8800.2700	Safety Regulation	All approaches to and takeoffs from the water area shall be made in such a manner as to clear all structures on the land by at least 100 feet, and wherever the area of the body of water will permit, such landing and takeoffs shall be made

State	Seaplane Regulation (Y/N)	Citation	Type of Regulation	Regulatory Details
				at a distance of not less than 300 feet, both laterally and vertically, from any boat or person on the surface of the water, or as near to 300 feet as the area of the water will permit.
		Minnesota Rules, part 8800.2800	Specific Geographic Restriction	Regulation sets forth the geographic coordinators of public waters within the seven-county metropolitan area where seaplane use is permitted. Covers only seaplane operations on all public waters within the following counties: Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington. All seaplane operations are prohibited from 11 a.m. (CDST) to 6 p.m. (CDST) on Saturdays, Sundays, and national legal holidays between June 1 and September 15 on the following public waters: Lake Minnetonka and all bays and lakes therein; White Bear Lake and all bays and lakes therein; and Lake Owasso and all bays and lakes therein. However, this restriction does not apply to the holder of a private or personal use seaplane base license while operating to and from the holder's licensed base.
MS	N			
MO	N			
MT	N			
NE	N			
NV	N			
NH	Y	N.H. Rev. Stat. § 422:27	Safety Regulation	All seaplanes shall be considered boats while in operation on the waters of the state and shall be subject to the marine rules of navigation, except that they shall be exempt from all laws and rules concerning the operation of boats for the purpose of landing and taking off from such public waters. The operation of seaplanes shall be subject to any restrictions placed upon the use of public waters by rules adopted by the department of safety or the department of environmental services.
		N.H. Rev. Stat. Ann. § 270:13a	Safety Regulation	Any seaplane or any helicopter on floats which lands on public waters shall be exempt from all laws and rules concerning the operation of boats for the purpose of landing and taking off from such public waters. Any seaplane or any helicopter on floats shall exercise due caution and respect for the rights and safety of any person or boat using the public waters.
		N.H. Code Admin. R. SafC 5102.94	Specific Geographic Restriction	Seaplanes and helicopters on floats shall be prohibited from operating on White Oak Pond in the town of Holderness, except for the purpose of landing and taking off.
		N.H. Code Admin. R. SafC 5102.68	Specific Geographic Restriction	No person shall operate a seaplane on the Pemigewasset River from the Route 104 bridge north to Sawhegenet Falls in New Hampton.
		N.H. Code Ad min. R. EnvDw 902.32; N.H. Code Admin. R. EnvDw 902.29	Specific Geographic Restriction	Seaplanes are not permitted to be used on Berry River, which is the principal drinking water supply for the City of Rochester and Pittsfield.
		N.H. Code Ad min. R. EnvDw 902.17	Specific Geographic Restriction	Seaplanes are not permitted on Bear Pond, which is the principal drinking water supply for the Contoocook Village Precinct in the town of Hopkinton.
		N.H. Code Ad min. R. EnvDw 902.14	Specific Geographic Restriction	A person shall not use a seaplane on any portion of the Tobey Reservoir, which is the principal drinking water supply for the town of Greenville.
		N.H. Code Ad min. R. EnvDw 902.31	Specific Geographic Restriction	A person shall not use any seaplane on Round Pond and the Rochester Reservoir, which are principal drinking water supplies for the city of Rochester.

State	Seaplane Regulation (Y/N)	Citation	Type of Regulation	Regulatory Details
NH	Y	N.H. Code Ad min. R. EnvDw 902.34	Specific Geographic Restriction	A person shall not use a seaplane in Sunapee Harbor north and west of a line from Russell Point bearing south 45 degrees west to the opposite shore. Restriction is to protect the purity of the water of Lake Sunapee, which is the principal drinking water supply for the town of Sunapee.
		N.H. Code Ad min. R. EnvDw 902.33	Specific Geographic Restriction	A person may not use a seaplane on Canobie Lake, which is the principal drinking water supply for the town of Salem.
		N.H. Code Ad min. R. EnvDw 902.09	Specific Geographic Restriction	A person may not use a seaplane within the Ammonoosuc River watershed above the Godfrey Dam, which is located at approximate latitude 44° 29′ 03″, longitude 71° 19′ 14″ to protect the water supply of the city of Berlin.
		N.H. Code Ad min. R. EnvDw 902.20	Specific Geographic Restriction	A person shall not use any seaplanes on the Garland Brook watershed to protect the drinking water supply for the town of Lancaster.
		N.H. Code Ad min. R. EnvDw 902.07	Specific Geographic Restriction	A person may not use a seaplane on Bradley Lake, which is the principal public drinking water supply for the town of Andover.
		N.H. Code Ad min. R. EnvDw 902.27	Specific Geographic Restriction	A person may not use a seaplane on Follett Brook, which is a principal drinking water supply for the town of Newmarket.
		N.H. Code Ad min. R. EnvDw 902.30	Specific Geographic Restriction	A person may not use a seaplane on Bellamy Reservoir, which is the principal drinking water supply for the city of Portsmouth.
		N.H. Code Ad min. R. EnvDw 902.13	Specific Geographic Restriction	A person may not operate a seaplane on Whittle Brook and Goffstown Reservoir, which constitute the principal drinking water supply for the Goffstown Village Precinct.
		N.H. Code Ad min. R. EnvDw 902.16	Specific Geographic Restriction	A person may not operate a seaplane on Loon Lake, which is the principal drinking water supply for the town of Hillsborough.
NJ	Y	N.J.A.C. 16:54–1.3	Seaplane Base Design/ Licensing/ Operation	Seaplane base are the type of aeronautical facilities required to be licensed by the State of New Jersey.
NM	N			
NY	Y	McKinney's General Business Law § 248	Specific Geographic Restriction	The taking off from or landing upon the surface of Lake Mahopac in the town of Carmel and county of Putnam, or upon the surface of Lake Moraine, also known as Madison reservoir, in the town of Madison and county of Madison, except when a landing and subsequent take off is necessary under actual distress conditions, and the operation of aircraft on or over the waters of Lake George, and on or over the waters of Lake Oscawana in the town of Putnam Valley, county of Putnam, or of Owasco Lake in the county of Cayuga or of Greenwood Lake in the town of Warwick, county of Orange for the carriage of passengers for hire, from and to points on such lakes or on the shores thereof, is a misdemeanor.
		N.Y. Comp. Codes R. & Regs. tit. 6, § 6461.4	Specific Geographic Restriction	No person, except for a gratuitous guest, shall berth a seaplane or use any dock, wharf, mooring or ramp, or any other facility for the berthing of a seaplane without having first obtained a special permit from the Lake George Park Commission. Commercial use of a seaplane to or from the waters of Lake George is prohibited.
NC	N			
ND	N			

State	Seaplane Regulation (Y/N)	Citation	Type of Regulation	Regulatory Details
OH	Y		Seaplane Base Design/ Licensing/ Operation	All public and private seaplane landing sites, landing fields, landing areas and bodies of water shall first be approved and issued an operating certificate by the DOT office of aviation before being used for commercial purposes.
		OAC 1501:47 906	Specific Geographic Restriction	The operation of seaplanes is prohibited on any waters of the Muskingum Watershed Conservancy District.
		OAC 1501:47 718	Specific Geographic Restriction	The operation of seaplanes on Lake Buckhorn, Holmes County is prohibited.
		OAC 1501:47 717	Specific Geographic Restriction	The operation of seaplanes on Lakengren lakes, Preble County is prohibited.
		OAC 1501:47 721	Specific Geographic Restriction	The operation of seaplanes is prohibited within all waters of the Medina County Parks District.
		OAC 1501:47 218	Safety Regulation	A seaplane on the water shall, in general, keep well clear of all vessels and avoid impeding their navigation.
		OAC 5501:1 401	Safety Regulation	Any seaplane landing site at which commercial operations are conducted, as defined in rule 5501:1101 of the Administrative Code, shall conform to all FAA requirements found in the current edition of "Advisory Circular (AC) No. 150/53951." The office of aviation can waive the requirement of any buoys.
OK	N			
OR	Y	O.R.S. § 835.200	Agency Authorization	The State Aviation Board shall adopt rules governing seaplane safety and operations on state waters in consultation with the State Marine Board and the State Parks and Recreation Department. The rules shall include identification of zones and bodies of water on which seaplanes may not land, take off or operate.
		O.R.S. § 835.210; OAR 7380400040	Municipal Authority	The governing body of a political subdivision of this state may apply to the State Aviation Board for special regulations relating to the operations of seaplanes on waters within the territorial limits of the political subdivision. These regulations may include, but need not be limited to, the establishment of limits on the areas of operations, hours and time of operations, and the prohibition of seaplane landings and takeoffs.
		O.R.S. § 830.187	Specific Geographic Restriction	A person may not use a seaplane to land on or take off from Waldo Lake.
		O.R.S. § 835.205	Agency Authorization	For purposes of ORS 830.175, 830.180, 830.185, 830.187 and 830.195, the Oregon Department of Aviation, in cooperation with the State Marine Board, shall regulate boats that are seaplanes as provided in ORS 830.605 and 835.200.
		OAR 738040 0016	General Seaplane Regulation	Given due regard for the suitability of any area for takeoff and landing in accordance with Federal Aviation Regulation 91.103, Seaplanes may land, take off or operate on waters of this state open to motorboats, unless specifically prohibited by Division 40 rules or unless inconsistent with any applicable laws or regulations of an agency of the United States. These rules establish no priority or precedence for seaplane operations. All seaplane operators must exercise due caution and consideration for the other users of the water. A seaplane, operating on the water and not in flight, is subject to, and must comply with all boating restrictions and regulations established for the particular body of water on which it is operating.

State	Seaplane Regulation (Y/N)	Citation	Type of Regulation	Regulatory Details
OR		OAR 738040 0018	Specific Geographic Restriction	Except in an emergency, seaplanes shall not land, takeoff or operate on the following waters: (1) Any body of water designated as a state or federal Wilderness or Primitive area or Wildlife refuge. (2) Those waters listed in ORS 830.180 and in State Marine Board rules, OAR Chapter 250, Division 20, where motors are prohibited or that allow electric motors only. These restrictions are summarized and published in the "Oregon Boating Regulations" booklet available from the State Marine Board. (3) Other bodies of water as designated by special regulations and adopted in OAR Chapter 738, Division 40. (4) Those waters under federal jurisdiction that are closed to seaplane operations by federal regulations. (5) Privately owned bodies of water without the permission of the owner.
		OAR 738040 0025	Safety Regulation	All seaplanes must be equipped as required by the regulations of the Federal Aviation Administration specifically for seaplanes that are in effect on November 1, 1996.
		OAR 738040 0030	General Seaplane Regulation	Each person operating an aircraft on the waters shall, insofar as possible, keep clear of all vessels and avoid impeding their navigation and follow a number of operational restrictions related to mooring, anchoring, towing, and other activities.
PA	Y	17 Pa. Code § 11.219	Specific Geographic Restriction	Seaplanes may be taxied at a slow minimum height swell speed in the waters of Presque Isle State Park for the purpose of access to and egress from the park.
RI	Y	Gen. Laws 1956, § 46229	Safety Regulation	No person shall operate any motorboat, vessel, or seaplane in a manner which shall unreasonably or unnecessarily interfere with any other motorboat, vessel, or seaplane, or with the free and proper navigation of the waterways of the state. No motor boat, vessel, or seaplane shall be docked or made fast to any pier, wharf, or other shore structure without the consent of the owner thereof, except in the case of an emergency.
SC	Y	Code 1976 § 55390	General Seaplane Regulation	Navigable waterways, which are available for use under the public trust doctrine, may be used for the landing, docking, and takeoff of seaplanes in accordance with state law. During the landing, docking, and takeoff of a seaplane, its pilot shall comply with all applicable federal and state laws and aeronautical rules. A sea plane shall not land, dock, or take off on a waterway in a manner that would violate applicable laws, ordinances, and rules if done by a motorized watercraft, except that a seaplane is not required to comply with a statewide speed limit for watercraft while landing and taking off, if a higher speed is necessary for safe operation and is not in conflict with any other restrictions applicable to watercraft.
		Code 1976 § 553100	Agency Authorization	If the division determines that use of a waterway by a seaplane poses an unreasonable risk to public health, safety, or property, the South Carolina Aeronautics Commission may withdraw approval or limit use of the waterway or make the use of the water way subject to conditions, after following certain criteria.
SD	N			
TN	Y	Tenn. Comp. R. & Regs. 1680 0102.05	Seaplane Base Design/ Licensing/ Operation	Provision sets forth the minimum airport design standards for seaplanes.

State	Seaplane Regulation (Y/N)	Citation	Type of Regulation	Regulatory Details
TX	Y	43 TAC § 30.401	Municipal Authority	A governmental entity that owns, controls, or has jurisdiction over a navigable body of water may not, in an area in which motorized boats are permitted, prohibit the takeoff, landing, or operation of an aquatic aircraft, or regulate or require a permit or fee for the operation of an aquatic aircraft without the approval of the Texas Department of Transportation.
UT	N			
VT	Y	Vt. Stat. Ann. tit. 5, § 207	Seaplane Base Design/ Licensing/ Operation	A municipality or person proposing to establish an airport, restricted landing area, or a seaplane landing area shall make application to the Board for a certificate of approval of the site selected and the general purpose or purposes for which the airport, restricted landing area, or seaplane landing area is to be established to ensure that it shall conform to minimum standards of safety and shall serve public interest.
		23 V.S.A. § 3310	Safety Regulation	The Commissioner of Forests, Parks and Recreation or a municipality in administering a swimming beach or waterfront program may designate a swimming area in front of the beach or land that the State or a municipality owns or controls and may make rules pertaining to the area. The rules may provide that no individual, except a lifeguard on duty and other authorized personnel, may operate a seaplane within the designated swimming area.
VA	Y	VA Code Ann. § 29.1735.1	Agency Authorization	The Department of Game and Inland Fisheries may promulgate regulations governing the takeoff, landing and taxi of seaplanes on impoundments located in the inland waters of the Common wealth, so as to reduce the risks of collision, personal injury, and property damage as a result of such operation. Such regulations shall not be inconsistent with regulations of the Federal Aviation Administration.
		24 VAC 520 160	Seaplane Base Design/ Licensing/ Operation	Seaplane bases may be established in, over, and upon any waters of this Commonwealth or any submerged land under such waters. There are different licensing provisions for public use bases and bases not intended for public use.
		24 VAC 520 170	Seaplane Base Design/ Licensing/ Operation	A person establishing or owning a private seaplane base must register the facility if it is more than five nautical miles from a licensed public use airport. Aircraft landing at private landing areas shall have prior approval of the landowners or controlling agency when reasonably practical.
		24 VAC 520 140	Seaplane Base Design/ Licensing/ Operation	The minimum requirements for the initial and continued licensing of a seaplane base open for public use under § 5.17 of the Code of Virginia shall provide for minimum standard dimensions as provided in the Federal Aviation Administration Advisory Circular 150/5395 Seaplane Bases, effective June 29, 1994.
WA	Y	RCWA 77.135.210; RCWA 77.135.230	AIS Regulation	The department may issue aquatic invasive species prevention permits to operators of vessels and aquatic conveyances. A person must obtain a Washington state aquatic invasive species prevention permit for each seaplane registered in another state, before placing or operating such seaplane on any water body in the state. Seaplanes having a valid Idaho or Oregon aquatic invasive species prevention or similar permit are exempt.
		RCWA 77.135.110	AIS Regulation	A person in possession of an aquatic conveyance must meet clean and drain requirements after the conveyance's use in or on a water body or property. Seaplanes are included in the definition of aquatic conveyance.

State	Seaplane Regulation (Y/N)	Citation	Type of Regulation	Regulatory Details
		RCWA 77.135.220	AIS Regulation	A person must obtain a Washington state aquatic invasive species prevention permit before commercially transporting a seaplane into or through the state that has previously been placed or operated in the waters of any state or country.
		WAC 35260 070	Safety Regulation	A seaplane on the water shall, in general, keep well clear of all vessels and avoid impeding their navigation. In circumstances, however, where risk of collision exists, she shall comply with the requirements of this section.
WV	N			
WI	Y	W.S.A. 30.78	Municipal Authority	Any city, village or town adjoining or surrounding any waters may, after public hearing, by ordinance: (a) Prescribe reasonable safety regulations relating to the operation on the surface of such waters of any aircraft capable of landing on water. (b) Prescribe the areas which may be used as a landing and takeoff strip for the aircraft or prohibit the use of the waters altogether. (c) Provide proper and reasonable penalties for the violation of any such ordinance.
		W.S.A. 30.07	AIS Regulation	No person may place or operate a seaplane in a navigable water if it has any aquatic plants or aquatic animals attached to the exterior of the seaplane. No person may take off with a seaplane with aquatic plants or aquatic animals attached to the exterior of the seaplane. Except transporting or operating a seaplane with duckweed that is incidentally attached to the exterior of the seaplane is permitted. A law enforcement officer who has reason to believe that a person is in violation this provision may order the person to: (a) Remove aquatic plants or aquatic animals from the seaplane before placing it in a navigable water; (b) Remove aquatic plants or aquatic animals from a seaplane before taking off with the seaplane, (c) Remove from, or not place in, a navigable water a seaplane, or (d) not take off with a seaplane.
WY	N			

Appendix C. FAA Regional AIS Case Studies

- Elodea spp. – Canadian Waterweed (*Elodea canadensis*, *E. nuttallii*)
- Waterfleas – FishHook Waterflea and Spiny Waterflea (*Bythotrephes longimanus*, *Cercopagis pengoi*)
- Feathered Mosquitofern (*Azolla pinnata*)
- Golden Algae (*Prymnesium parvum*)
- Hydrilla (*Hydrilla verticillata*)
- New Zealand Mudsnails (*Potamopyrgus antipodarum*)
- Giant Salvinia (*Salvinia molesta*)
- Dreissenid Mussels – Zebra and Quagga Mussels (*Dreissena polymorpha*, *D. rostriformis bugensis*)

Note: The 2nd page of each case study is a graphic and information about seaplane pilot best practices (see page 34 of this document).

Source: Kristine Dunker, Alaska Department of Fish and Game.

CASE STUDY: *ELODEA* SPP.—CANADIAN WATERWEED AND NUTTALL'S WATERWEED (*Elodea canadensis, E. nuttallii*)

The introduction and spread of aquatic invasive species (AIS) poses a threat to lakes, rivers, and other water bodies throughout North America. One pathway that has been shown to contribute to AIS spread is seaplanes. This case study illustrates the role seaplanes can play in the spread of AIS and the negative impacts AIS establishment can have on the environment as well as seaplane safety and operations. These case studies also illustrate the important role seaplane pilots can play to prevent the spread of AIS.

FAA Geographic Region: Alaska

Elodea spp. were the first freshwater AIS reported from the State of Alaska. First reported in 1982 from Eyak Lake, a large lake in Cordova, nearly half of the known infestations in Alaska have been in seaplane-accessible water bodies. In 2015, Lake Hood, home to the world's busiest seaplane base, was the site of a successful extensive and costly *Elodea* spp. eradication project by the State of Alaska.

What are *Elodea* spp.?

Canadian waterweed and Nuttall's waterweed, also known as *Elodea* spp., are closely related freshwater aquatic plants native to much of the contiguous United States and southern Canada. *Elodea* spp. are submerged aquatic plants that grow in lakes and streams and can form large, dense beds that grow from the bottom of a water body to the surface and then spread horizontally. Aggressive, weedy growth occurs in many types of water bodies, including nutrient-rich as well as clear, cold waters. This plant continues to grow under ice during the winter season when native plants cease to grow.

Why are *Elodea* spp. a problem?

Once established, *Elodea* spp. grow rapidly, compete with native plants for light and nutrients, and create a dense mat. These dense mats impair water bodies and reduce the quality of spawning and rearing habitat for salmon, whitefish, and grayling. The explosive growth and dense mats of *Elodea* spp. pose safety hazards for seaplanes, boats, and people. When *Elodea* spp. dieback, oxygen levels for fish and other organisms are reduced as the plants decompose. The relentless boom and bust of *Elodea* spp. may decrease property values while increasing management costs.

How can *Elodea* spp. be spread by seaplanes?

Known as oxygen weed in the aquarium trade, uninformed aquarium owners that dump their tank vegetation into water bodies contribute to the spread of *Elodea* spp. Once established, *Elodea* spp. spread easily. Fragments of *Elodea* spp. as small as two inches can root and establish a new population. These fragments, which can withstand both periods of freezing temperatures and drying, can easily be transported on seaplane floats, mooring lines, wires and cables, and rudders.

Seaplane pilots can help prevent the spread of aquatic invasive species.

Examples of other aquatic invasive species you may encounter in your region:

- Didymo (*Didymosphenia geminata*)
- Purple Loosestrife (*Lythrum salicaria*)
- Big-Eared Radix (*Radix auricularia*)

CASE STUDY: WATERFLEAS—FISHHOOK WATERFLEA AND SPINY WATERFLEA (*Bythotrephes longimanus, Cercopagis pengoi*)

The introduction and spread of aquatic invasive species (AIS) poses a threat to lakes, rivers, and other water bodies throughout North America. One pathway that has been shown to contribute to AIS spread is seaplanes. This case study illustrates the role seaplanes can play in the spread of AIS and the negative impacts AIS establishment can have on the environment as well as seaplane safety and operations. These case studies also illustrate the important role seaplane pilots can play to prevent the spread of AIS.

FAA Geographic Region: Great Lakes

Waterfleas are widespread and well-established in the Great Lakes. Likely introduced in the ballast water of large ships in the 1980s and 1990s, fishhook and spiny waterfleas are a concern to the region. Efforts to reduce their spread are focused on preventing their unintentional movement into and between inland lakes by human activities. Of particular concern are lake-hopping excursions that include visits to one or more lakes containing waterfleas.

What are Waterfleas?

Misleadingly named, waterfleas are not aquatic insects, but rather tiny crustaceans that swim in the water columns of lakes with other organisms (collectively called zooplankton). Nearly invisible to the human eye, these tiny translucent animals can dominate native zooplankton communities. The spiny tails of waterfleas, making up more than 2/3 of their total length, can have one to four pairs of thorn-shaped barbs, often making them inedible. Female waterfleas produce offspring rapidly during the summer months but, in early fall, switch to producing eggs that can remain dormant, surviving the colder winter months on lake bottoms or being transported long distances on damp equipment.

Why are Waterfleas a problem?

Although small, waterfleas can have a profound effect on waterbodies, out-competing native zooplankton species, disrupting food chains, and negatively impacting recreational fishing. Waterfleas cause a significant decline in zooplankton, leading to less food for small native fish, including young sport fish, such as bass, walleye, and yellow perch. Because waterfleas are largely inedible, reproduce rapidly, and consume native zooplankton, the more abundant waterfleas become in a waterbody, the less food there is for fish. In addition, the presence of waterfleas impacts both recreational angling and commercial fishing (including fish farms). Their tail spines get snagged on fishing equipment, such as lines, nets, and cables. The value of lakes known for recreational fishing can decline sharply with the establishment of waterfleas. Once introduced, there are no known techniques for controlling or eliminating them from an infested lake.

How can Waterfleas be spread by seaplanes?

Waterfleas, snagged by their barbed tails, can easily be transported on seaplane floats, mooring lines, wires and cables, and rudders. Although adult waterfleas may not survive for long out of water, their dormant eggs are resilient, particularly if they remain in the female waterflea's body (the barbed tail spine staying attached to ropes, lines, vegetation, and mud), and can hatch whether or not the carrier waterflea is alive. If introduced to a new water body, the eggs can hatch and quickly multiply into a large population. Both live waterfleas and dormant eggs may also be successfully transported in trapped standing water.

Seaplane pilots that lake-hop can unintentionally spread both entrained live waterfleas or dormant eggs from lake to lake and facilitate the rapid expansion of these species.

Seaplane pilots can help prevent the spread of aquatic invasive species.

Examples of other aquatic invasive species you may encounter in your region:

- a microsporidian parasite (*Heterosporis sutherlandae*)
- Brittle Waternymph (*Najas minor*)
- Curly-leaf Pondweed (*Potamogeton crispus*)
- Largemouth Bass Virus (LMBV) (*Ranavirus* [*LMBV*])
- Lyngbya (*Lyngbya wollei*)
- New Zealand Mudsnail (*Potamopyrgus antipodarum*)
- Red-rim Melania (*Melanoides tuberculata*)
- Water Lettuce (*Pistia stratiotes*)
- Whirling Disease (*Myxobolus cerebralis*)
- Yellow Floating-heart (*Nymphoides peltata*)

CASE STUDY: FEATHERED MOSQUITOFERN (*Azolla pinnata*)

The introduction and spread of aquatic invasive species (AIS) poses a threat to lakes, rivers, and other water bodies throughout North America. One pathway that has been shown to contribute to AIS spread is seaplanes. This case study illustrates the role seaplanes can play in the spread of AIS and the negative impacts AIS establishment can have on the environment as well as seaplane safety and operations. These case studies also illustrate the important role seaplane pilots can play to prevent the spread of AIS.

FAA Geographic Region: Southern

Feathered mosquitofern has been found in (and removed from) numerous plant nurseries in the United States. It has a limited distribution to water bodies in Florida and Hawaii. Because of its limited distribution, seaplane pilots can prevent further spread of this plant to new water bodies.

What is Feathered Mosquitofern?

Feathered mosquitofern is a small free-floating aquatic fern with roots that are suspended in the water column. Individual plants often clump together to form dense floating mats. Native to Australia, feathered mosquitofern grows in habitats of slow-moving freshwater ponds, swamps, and drainage canals, and thrives in temperate humid climates. The few populations that exist in the United States were spread by hitchhiking on other aquarium plants, and subsequently dumped into waterbodies. Both plant fragments and spores can produce new plants.

Why is Feathered Mosquitofern a problem?

Feathered mosquitofern can grow rapidly and cover the surface of a waterbody. The species can grow very quickly and can double its population size every two to five days. Their dense mats can reduce water oxygen levels and deplete nutrients in the water column resulting in impeded native plant growth. Dense mats can also limit access to boating, fishing, and other activities. Feathered mosquitofern can spread on currents between connected waterbodies, and can attach to watercraft and equipment. Dense mats may also clog irrigation and flood control structures.

How can Feathered Mosquitofern be spread by seaplanes?

Seaplanes that take on water in their floats may contain fragments or spores of feathered mosquitofern. Feathered mosquitofern can survive for days on moist soil out of water. Fragments can easily be transported on seaplane floats, mooring lines, wires and cables, and rudders.

Seaplane pilots can help prevent the spread of aquatic invasive species.

Examples of other aquatic invasive species you may encounter in your region:

- Alligatorweed (*Alternanthera philoxeroides*)
- Common Salvinia (*Salvinia minima*)
- Feathered Mosquitofern (*Azolla pinnata*)
- Giant Salvinia (*Salvinia molesta*)
- Indian Swampweed (*Hygrophila polysperma*)
- Parrotfeather (*Myriophyllum aquaticum*)
- Water Hyacinth (*Eichhornia crassipes*)
- Water Lettuce (*Pistia stratiotes*)
- Waterflea (*Daphnia lumholtzi*)
- Yellow Floating-heart (*Nymphoides peltata*)

CASE STUDY: GOLDEN ALGAE (*Prymnesium parvum*)

The introduction and spread of aquatic invasive species (AIS) poses a threat to lakes, rivers, and other water bodies throughout North America. One pathway that has been shown to contribute to AIS spread is seaplanes. This case study illustrates the role seaplanes can play in the spread of AIS and the negative impacts AIS establishment can have on the environment as well as seaplane safety and operations. These case studies also illustrate the important role seaplane pilots can play to prevent the spread of AIS.

FAA Geographic Region: Southwest

Golden algae have been found in more than 20 states, and blooms were first noted in Texas in the 1980s. During the early 2000s, algae blooms in reservoirs and rivers occurred across the southern United States. The alga occurs in brackish inland waters and coastal freshwater rivers, lakes, and estuaries. Seaplane-accessible water bodies across the Southwest may be at risk from golden algae introductions.

What is Golden Algae?

Golden alga that can be found suspended in the water column. The algae, suspected to originate from Europe, uses energy from the sun to grow. The algae produces chemicals toxic to other plankton and microscopic life. As other organisms die from these toxic chemicals, golden algae grow excessively, or bloom, creating a golden color in the water. Evidence suggests that the toxin production by golden algae can be triggered by increased salinity linked to periods of drought.

Why is Golden Algae a problem?

The chemicals produced by golden algae are toxic to gill-breathing animals, such as fish and shellfish as well as plankton. The first observation of the algae in North America was linked to a massive fish kill of nearly 150,000 individual fish in Texas. A conservative estimate of more than 30 million fish deaths in Texas are directly linked to golden algae toxic blooms. Native mussel beds have also succumbed to toxins from algal blooms. Harmful algal blooms that cover the surface of the water block sunlight from reaching other organisms in deeper water, hindering their growth. To minimize their negative impacts and spread, algal blooms can trigger waterbody closures to all activities.

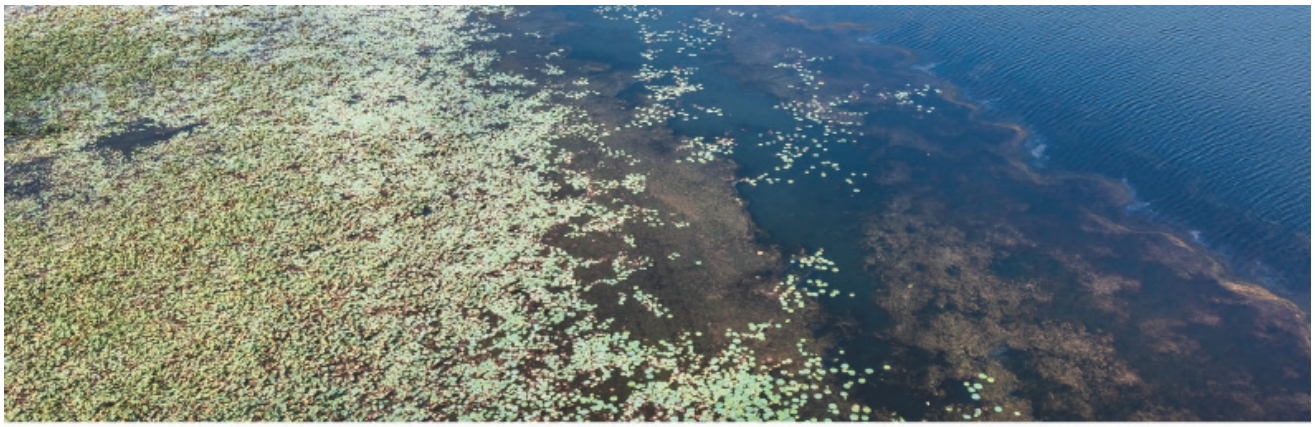
How can Golden Algae be spread by seaplanes?

Algae may be transported within or on the floats of seaplanes. It is also possible that algae may hitchhike on other aquatic plants that attach to seaplane floats, mooring lines, wires and cables, and rudders. The resting, or dormant, stage of the algae may be one way that this species can survive and facilitate spread to new waters.

Seaplane pilots can help prevent the spread of aquatic invasive species.

Examples of other aquatic invasive species you may encounter in your region:

- Alligatorweed (*Alternanthera philoxeroides*)
- Brittle Waternymph (*Najas minor*)
- Common Salvinia (*Salvinia minima*)
- Feathered Mosquitofern (*Azolla pinnata*)
- Giant (or Island) Apple Snail (*Pomacea maculata*)
- Giant Salvinia (*Salvinia molesta*)
- Indian Swampweed (*Hygrophila polysperma*)
- Water Hyacinth (*Eichhornia crassipes*)
- Water Lettuce (*Pistia stratiotes*)
- Waterflea (*Daphnia lumholtzi*)



CASE STUDY: HYDRILLA (*Hydrilla verticillata*)

The introduction and spread of aquatic invasive species (AIS) poses a threat to lakes, rivers, and other water bodies throughout North America. One pathway that has been shown to contribute to AIS spread is seaplanes. This case study illustrates the role seaplanes can play in the spread of AIS and the negative impacts AIS establishment can have on the environment as well as seaplane safety and operations. These case studies also illustrate the important role seaplane pilots can play to prevent the spread of AIS.

FAA Geographic Region: Central

Hydrilla was first found in the United States in Florida in 1952 and has since spread to 27 states primarily in the South and East. In the Central Region, infestations of hydrilla are concentrated in Missouri and Oklahoma. Because of its limited distribution in the Central Region, it is possible that informed seaplane pilots can prevent further spread to other waterbodies.

What is Hydrilla?

Hydrilla verticillata, and its numerous subspecies, is a rooted aquatic plant that grows long stems to reach the surface to form dense mats. It can be found in freshwater lakes, rivers, ponds, and canals. Native to the Indian subcontinent, it is a popular aquarium plant that was initially introduced to waters of the United States as discards from aquarium dumping. Hydrilla fragments, root stem pieces, and its tubers can generate new plants. The tubers can survive multiple days out of water.

Why is Hydrilla a problem?

Once established, hydrilla can grow aggressively and spread in shallow areas forming thick mats. The thick growth can displace beneficial native plants and create anoxic conditions harming other species. Dense beds of hydrilla can also restrict boating, swimming, and general access to water. Recently, cyanobacteria—blue-green algae that can affect water quality and function—have been associated with hydrilla infestations, which has been linked to bald eagle, waterbird, and fish deaths.

How can Hydrilla be spread by seaplanes?

Hydrilla can be moved to new waterbodies as fragments clinging to floats and other seaplane surfaces. Plant fragments or tubers can become entrained and easily be transported on seaplane floats, mooring lines, wires and cables, and rudders. Seaplanes that take on water in their floats may contain plant fragments and can be transported to new waters.

Seaplane pilots can help prevent the spread of aquatic invasive species.

Examples of other aquatic invasive species you may encounter in your region:

- Brazillian Waterweed (*Egeria densa*)
- Brittle Waternymph (*Najas minor*)
- Common Salvinia (*Salvinia minima*)
- Curly-leaf Pondweed (*Salvinia minima*)
- Eurasian Watermilfoil (*Myriophyllum spicatum*)
- Flowering Rush (*Butomus umbellatus*)
- Purple Loosestrife (*Lythrum salicaria*)
- Water Hyacinth (*Eichhornia crassipes*)
- Water Primrose (*Ludwigia spp.*)
- Whirling Disease (*Myxobolus cerebralis*)

CASE STUDY: NEW ZEALAND MUD SNAILS (*Potamopyrgus antipodarum*)

The introduction and spread of aquatic invasive species (AIS) poses a threat to lakes, rivers, and other water bodies throughout North America. One pathway that has been shown to contribute to AIS spread is seaplanes. This case study illustrates the role seaplanes can play in the spread of AIS and the negative impacts AIS establishment can have on the environment as well as seaplane safety and operations. These case studies also illustrate the important role seaplane pilots can play to prevent the spread of AIS.

FAA Geographic Region: Eastern

First reported in the United States near the Snake River in Idaho, New Zealand mudsnails have spread rapidly throughout the western states, in the Great Lakes, and in lakes and streams in parts of the East Coast, including Pennsylvania and New York. The physiology and biology of mudsnails make them well-suited for human-aided introduction and spread.

What are New Zealand Mudsnails?

New Zealand mudsnails are tiny, brownish freshwater snails about ¼ inch long. These small snails are remarkably adaptable to a wide range of conditions and habitats ranging from cold flowing streams to warm water lakes and brackish water. Their broad tolerances for water temperature, flow rates, and salinity create significant potential for widespread establishment across much of the United States. Mudsnails have a flap (also known as an operculum) that allows them to withdraw into their shells, making it possible for them to survive out of water for days. Populations within the United States are almost exclusively female and produce live young through cloning—the introduction of a single snail can start a new population.

Why are New Zealand Mudsnails a problem?

Once established, mudsnail densities can increase rapidly, sometimes carpeting the shallow portions of water bodies, crowding out native insects and invertebrates essential in the food webs of lakes and streams. Because of their small size and hard shell, mudsnails are not a good food source for fish, often remaining undigested and alive after a trip through a fish's digestive system. Once established, mudsnails are unlikely to be eradicated from natural systems even with targeted pesticides or water drawdowns.

How can New Zealand Mudsnails be spread by seaplanes?

These tiny snails, easily mistaken for bits of gravel or mud, are natural hitchhikers. Because of their small size, they can wedge themselves into cracks and crevices. Mudsnails can also be transported on any entangled aquatic plants or standing water. In addition, any equipment, including anchors, lines, and cables, that come in contact with the sediment at the bottom of a lake can transport mudsnails.

Seaplane pilots can help prevent the spread of aquatic invasive species.

Examples of other aquatic invasive species you may encounter in your region:

- Didymo (*Didymosphenia geminata*)
- European Frogbit (*Hydrocharis morsus-ranae*)
- Faucet Snail (*Bithynia tentaculata*)
- Fishhook Waterflea (*Cercopagis pengoi*)
- Mystery snails (*Cipangopaludina spp.*)
- Spiny Waterflea (*Bythotrephes longimanus*)
- Variable-leaf Watermilfoil (*Myriophyllum heterophyllum*)
- Water Primrose (*Ludwigia spp.*)
- Waterwheel Plant (*Aldrovanda vesiculosa*)
- Yellow Floating-heart (*Nymphoides peltata*)

CASE STUDY: GIANT SALVINIA (*Salvinia molesta*)

The introduction and spread of aquatic invasive species (AIS) poses a threat to lakes, rivers, and other water bodies throughout North America. One pathway that has been shown to contribute to AIS spread is seaplanes. This case study illustrates the role seaplanes can play in the spread of AIS and the negative impacts AIS establishment can have on the environment as well as seaplane safety and operations. These case studies also illustrate the important role seaplane pilots can play to prevent the spread of AIS.

FAA Geographic Region: Western Pacific

Giant salvinia is an invasive floating freshwater fern found in the lower Colorado River basin. It is associated with southern drainages, as well as San Luis Obispo County, California. Native to Brazil and introduced to the United States for use in aquariums and decorative ponds, giant salvinia is one of many similar species of invasive floating vegetation that blanket water bodies, choking out native plants and animals and eliminating recreational opportunities.

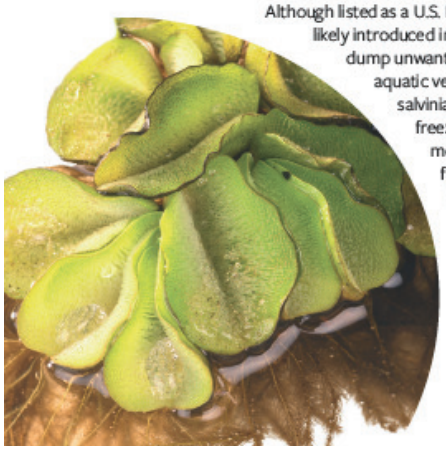
What is Giant Salvinia?

Considered one of the most problematic aquatic plants in the southern United States, giant salvinia is a robust, fast-growing, floating aquatic fern. Originally imported from Brazil for sale in the pond and aquarium trade, it grows in dense mats that can double in size in just a week under ideal conditions. Giant salvinia grows best in warm, nutrient-rich, still or slow-moving water bodies, including ditches, ponds, lakes, slow-moving rivers, and canals.

Why is Giant Salvinia a problem?

Thick mats of giant salvinia can eventually cover the entire surface of a water body, slowing water movement and dramatically decreasing available sunlight and oxygen for native plants and animals. Decaying plant matter falls to the bottom of these systems, further decreasing available oxygen. Mats of giant salvinia up to 3 feet thick have been reported, but even less dramatic densities of salvinia are known to impede navigation and eliminate recreational activities, such as swimming and fishing, while creating a beneficial habitat for mosquitos.

How can Giant Salvinia be spread by seaplanes?



Although listed as a U.S. Federal Noxious Weed and thus illegal to sell, giant salvinia is likely introduced into new areas by uninformed aquarium or pond owners who dump unwanted vegetation. Recreational activities that entrain and transport aquatic vegetation are likely responsible for the further spreading of giant salvinia. Fragments of giant salvinia, which can tolerate short periods of freezing temperatures, can easily be transported on seaplane floats, mooring lines, wires and cables, and rudders. Once established, floating clumps of giant salvinia can spread independently through flowing water, wind, and currents.

Seaplane pilots can help prevent the spread of aquatic invasive species.

Examples of other aquatic invasive species you may encounter in your region:

- European Water-starwort (*Callitriche stagnalis*)
- Feathered Mosquitofern (*Azolla pinnata*)
- Hydrilla (*Hydrilla verticillata*)
- Quagga Mussel (*Dreissena bugensis*)
- Red-rim Melania (*Melanoides tuberculata*)
- Spongeplant (*Limnobium laevigatum*)
- Water Primrose (*Ludwigia spp.*)
- Waterflea (*Daphnia lumholtzi*)
- Yellow Floating-heart (*Nymphoides peltata*)
- Zebra Mussel (*Dreissena polymorpha*)

CASE STUDY: DREISSENID MUSSELS—ZEBRA AND QUAGGA MUSSELS
(*Dreissena polymorpha, D. rostriformis bugensis*)

The introduction and spread of aquatic invasive species (AIS) poses a threat to lakes, rivers, and other water bodies throughout North America. One pathway that has been shown to contribute to AIS spread is seaplanes. This case study illustrates the role seaplanes can play in the spread of AIS and the negative impacts AIS establishment can have on the environment as well as seaplane safety and operations. These case studies also illustrate the important role seaplane pilots can play to prevent the spread of AIS.

FAA Geographic Region: Northwest Mountain

Dreissenid mussels were first found in the Great Lakes Region in 1997 where they were introduced via ballast water from global shipping. They have since spread across the United States via connected water systems, trailered watercraft, and other fouled equipment. Notable reservoirs within the Colorado River Basin are infested with quagga mussels, however invasive mussels have not been detected in most of the Pacific Northwest. The 2023 discovery of dreissenids in the Snake River, Idaho resulted in a prompt eradication attempt by the State of Idaho. Seaplane-accessible water bodies across the Northwest may be at-risk from the introduction of dreissenids by seaplanes.

What are Dreissenid Mussels?

Dreissenid mussels, also known as zebra and quagga mussels, are freshwater bivalves that can live in lakes, rivers, and reservoirs. Native to Central and Eastern Europe, dreissenids are filter-feeding mussels that can colonize both soft and hard surfaces. Much like marine mussels (and unlike native freshwater mussels and clams), adult dreissenid mussels attach firmly to hard surfaces with byssal threads. Their microscopic larval form, or veliger, floats in the water and can survive in small amounts of water.

Why are Dreissenid Mussels a problem?

Once established in a waterbody, dreissenids can colonize underwater surfaces and foul infrastructure, such as hydroelectric facility operations, water delivery systems, and submerged docks. The maintenance expenses to remove and dispose of mussels have been estimated at nearly $500,000 annually on multiple Colorado River hydroelectric facilities. Dreissenid mussels also attach and grow on aquatic invertebrates, such as native mussels and crayfish, hindering their growth and survival. Although mussels improve water clarity by filtering large amounts of water and removing suspended solids in the water column, the overall effects on a water body are negative because of increased plant growth and changes in how the water body functions (e.g., changes to fish populations).

How can Dreissenid Mussels be spread by seaplanes?

Adults and veligers can attach to surfaces that are in contact with water, therefore seaplane float and rudders are likely areas for mussel attachment. Seaplane floats that take on water can contain veligers or adults. Veligers are known to survive many days in very little water. Out of water and attached to various surfaces, adults can survive for multiple days.

Seaplane pilots can help prevent the spread of aquatic invasive species.

Examples of other aquatic invasive species you may encounter in your region:

- Brazillian Waterweed (*Egeria densa*)
- Carolina Fanwort (*Cabomba caroliniana*)
- Curly-leaf Pondweed (*Potamogeton crispus*)
- Flowering Rush (*Butomus umbellatus*)
- Infectious Haematopoietic Necrosis (*IHN Virus*)
- Parrotfeather (*Myriophyllum aquaticum*)
- Variable-leaf Watermilfoil (*Myriophyllum heterophyllum*)
- Water Primrose (*Ludwigia spp*)
- Whirling Disease (*Myxobolus cerebralis*)
- Yellow Floating-heart (*Nymphoides peltata*)

Appendix D. Outreach to Seaplane Pilots to Encourage Participation in Survey

- Direct Email to Seaplane Pilot Association Field Directors in All States with Field Directors
- Direct Email to 200 Alaska Pilots with Seaplane Ratings
- Direct Email to 41 seaplane bases
- Direct Email to State and Federal Agencies
  - Alaska USFWS and NPS pilots with seaplane ratings
  - Maine Warden Service - lead agreed to share with state agency seaplane pilots
  - BLM, BIA, USDI, USFS pilots across numerous states (102 pilots total)

- Direct Email to Airplane Pilot Associations
  - Aircraft Owners and Pilots Association (all 7 regional managers) and their digital content manager
  - Independent Pilots Association (President and Vice President)
  - National Association of Flight Instructors (President and Vice President)
  - Experimental Aviation Association

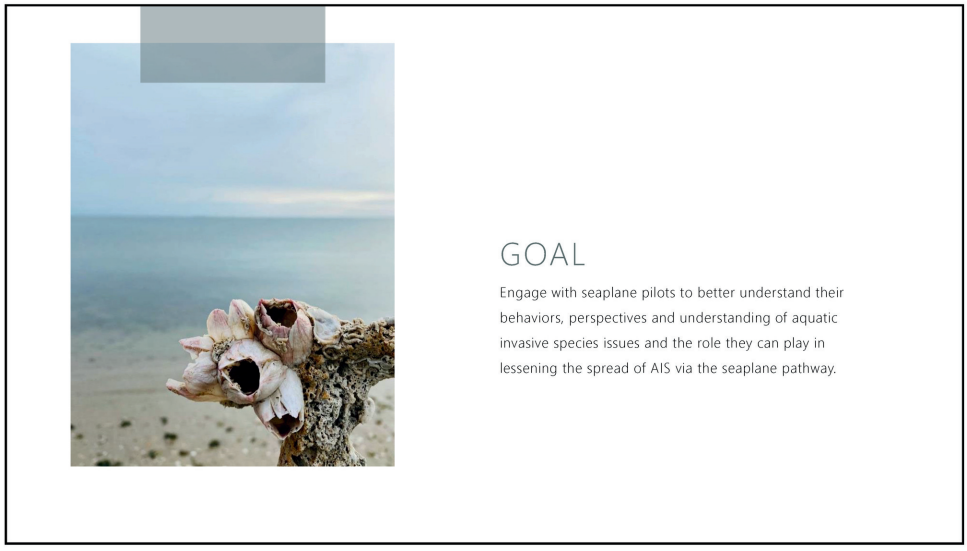
- Pilot News Outlets (sent press releases and articles for posting)
  - General Aviation News
  - Simply Flying
  - Aviation International News

- Multiple postings to pilot social media groups (In all social media post cases, there was an initial post on the survey and then multiple follow-up posts reminding people of the date the survey closes).

Appendix E. Results of Seaplane Pilot Survey

12/17/2024

1



2

METHODS

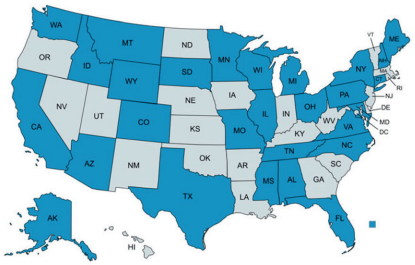
- Survey development
- Survey review by Alaska/former USFWS seaplane pilot and instructor as well as national human dimensions expert Dr. Daniel Witter
- Survey outreach
  - Social media – LinkedIn and Facebook
  - Direct email
  - Website announcement
- Survey remained open for two months

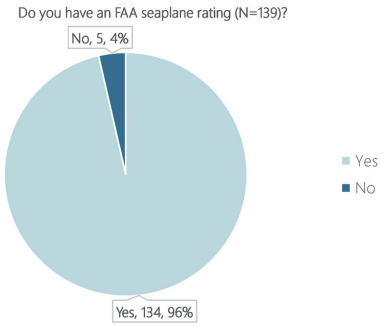
3

3

4

Total of 139 responses, of which 96% had an FAA seaplane rating. The respondents with seaplane ratings included individuals from 28 states.





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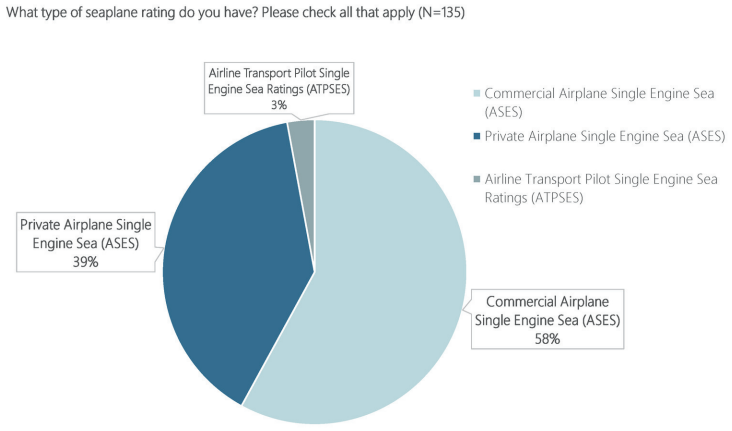

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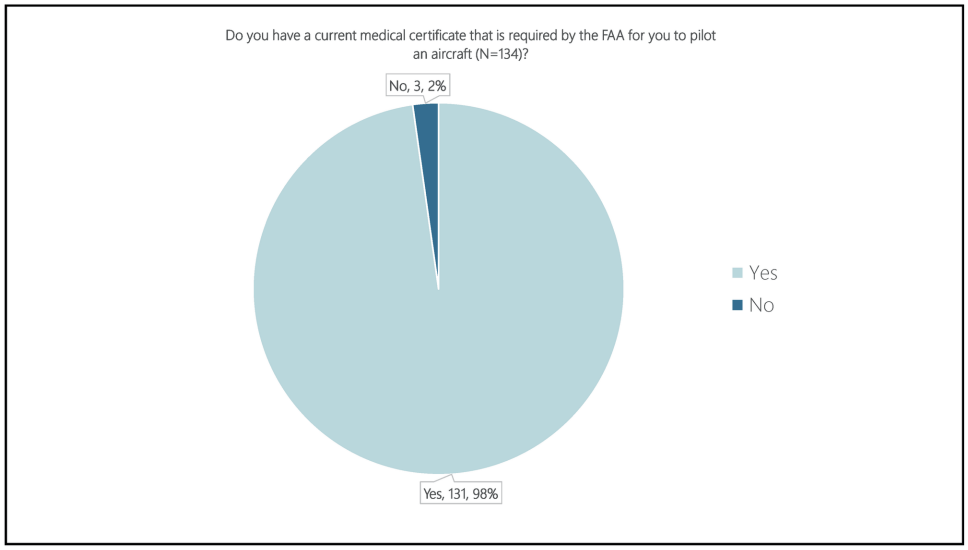
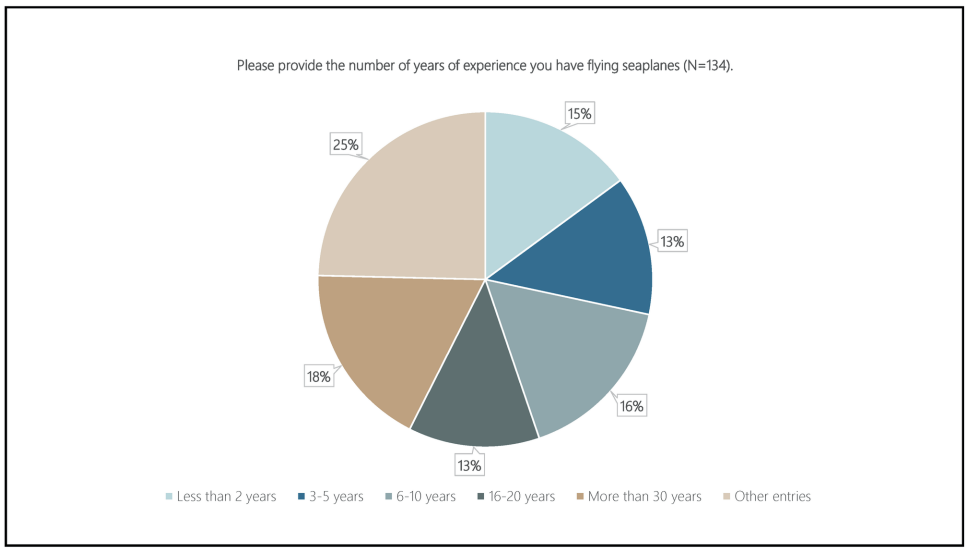
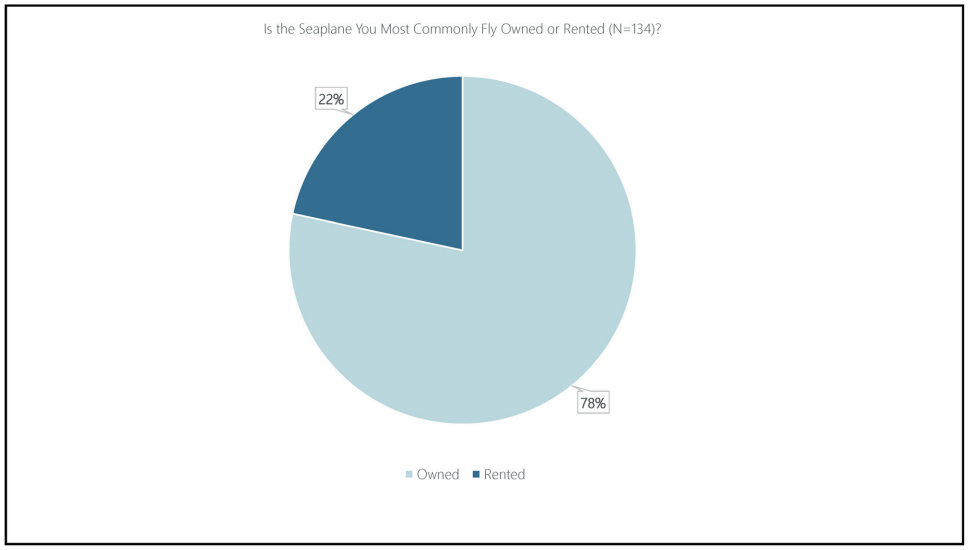

Do you have a current medical certificate that is required by the FAA for you to pilot an aircraft (N=134)?
No, 3, 2%
Yes, 131, 98%
Yes
No

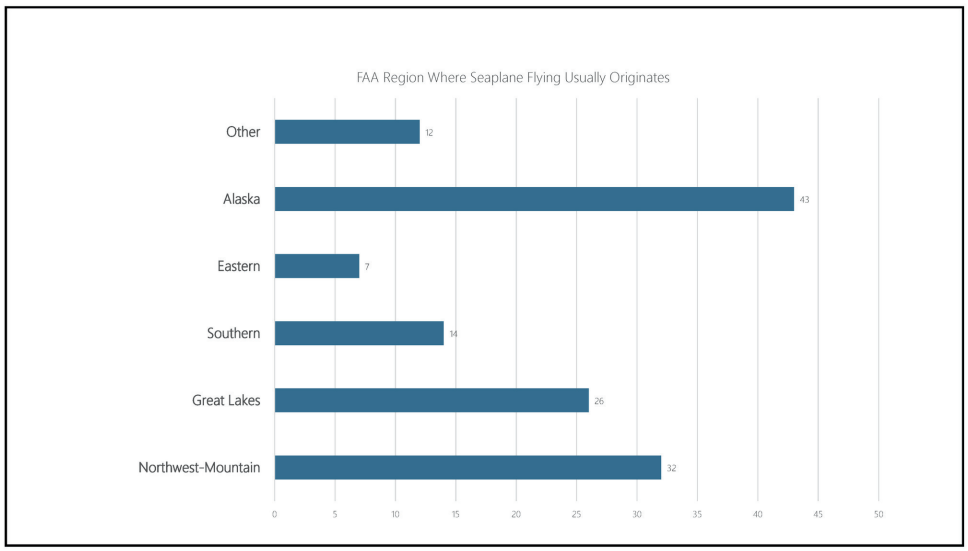
7


Please provide the number of years of experience you have flying seaplanes (N=134).
15%
13%
16%
13%
18%
25%
Less than 2 years
3-5 years
6-10 years
16-20 years
More than 30 years
Other entries

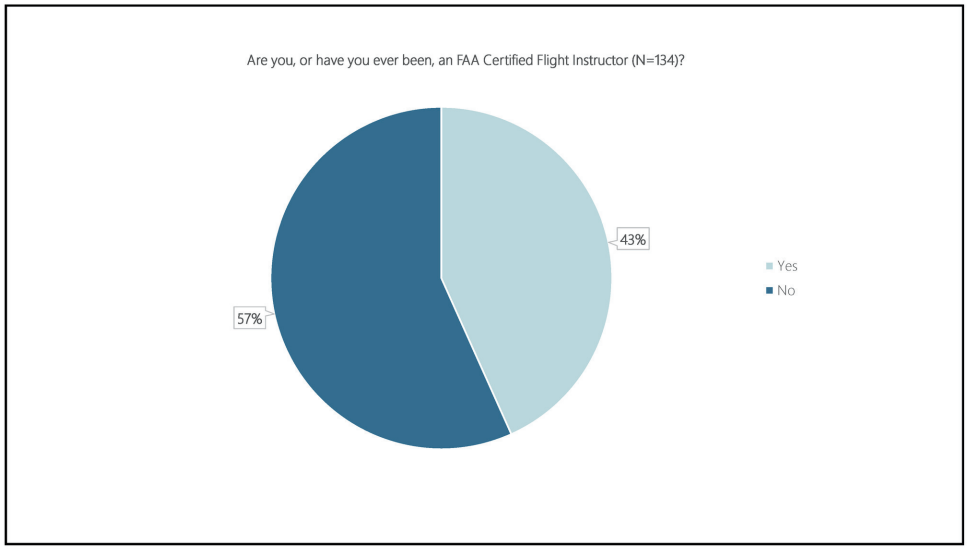
8


Is the Seaplane You Most Commonly Fly Owned or Rented (N=134)?
22%
78%
Owned
Rented

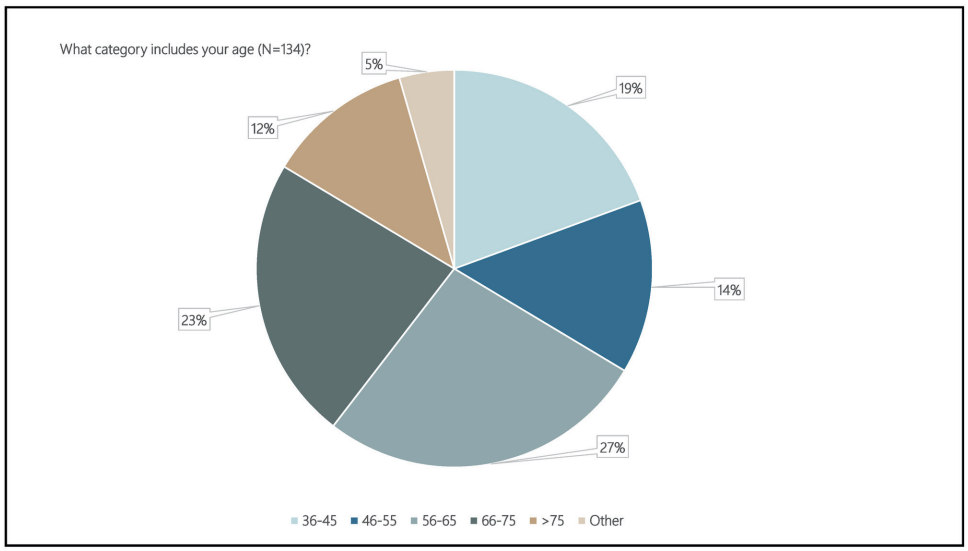
11


FAA Region Where Seaplane Flying Usually Originates
Other
12
Alaska
43
Eastern
7
Southern
14
Great Lakes
26
Northwest-Mountain
32
0
5
10
15
20
25
30
35
40
45
50

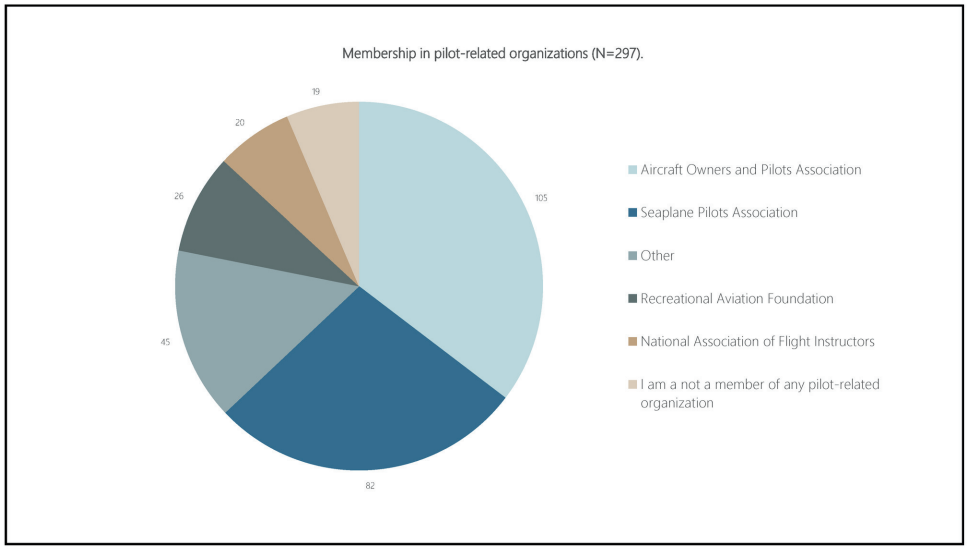
12


Are you, or have you ever been, an FAA Certified Flight Instructor (N=134)?
43%
57%
Yes
No

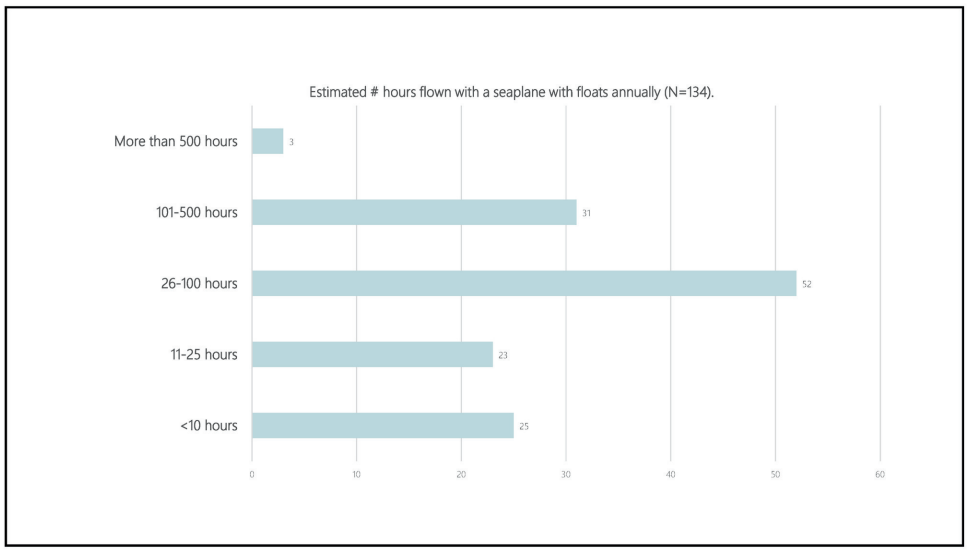
9


What category includes your age (N=134)?
5%
19%
12%
14%
23%
27%
36-45
46-55
56-65
66-75
>75
Other

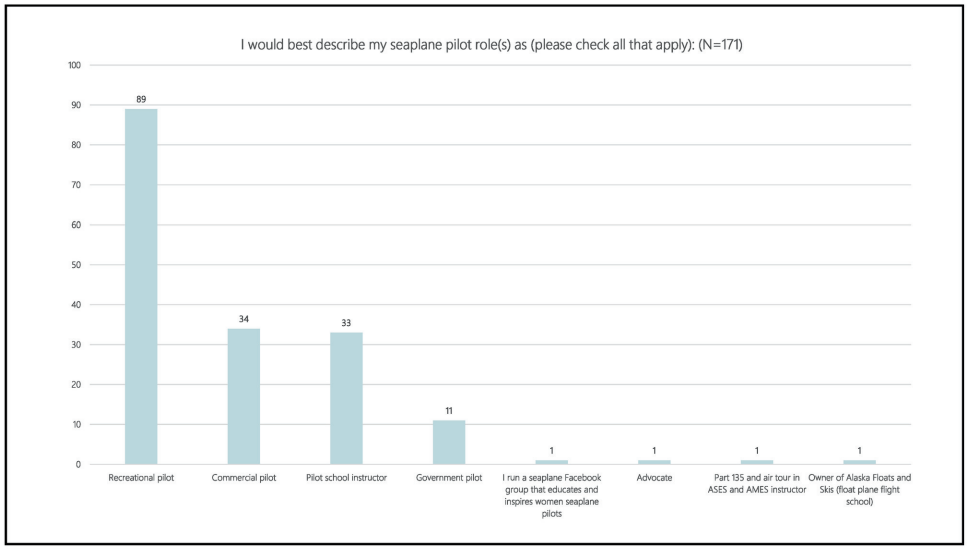
10


Membership in pilot-related organizations (N=297).
105
82
45
26
20
19
Aircraft Owners and Pilots Association
Seaplane Pilots Association
Other
Recreational Aviation Foundation
National Association of Flight Instructors
I am a not a member of any pilot-related organization

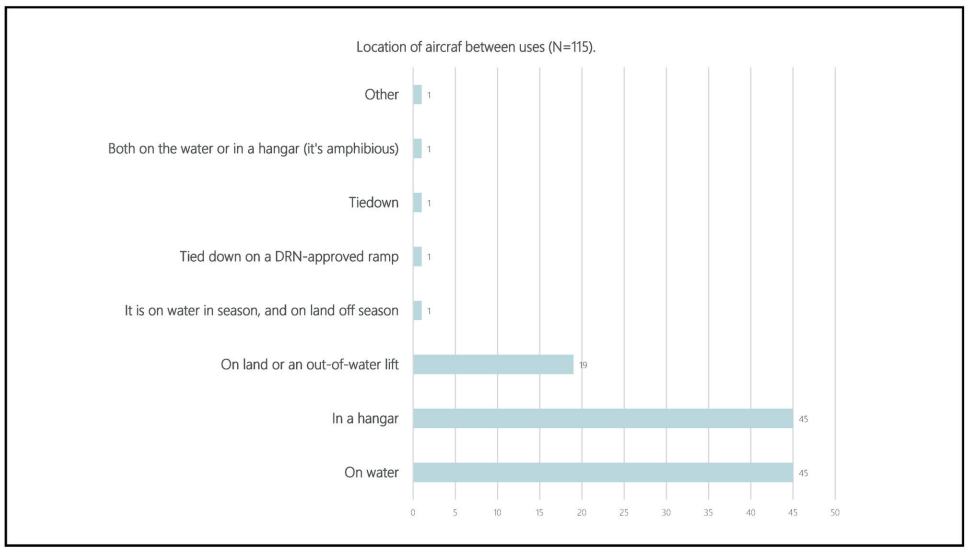
15


Estimated # hours flown with a seaplane with floats annually (N=134).
More than 500 hours
101-500 hours
26-100 hours
11-25 hours
<10 hours
3
31
52
23
25
0
10
20
30
40
50
60

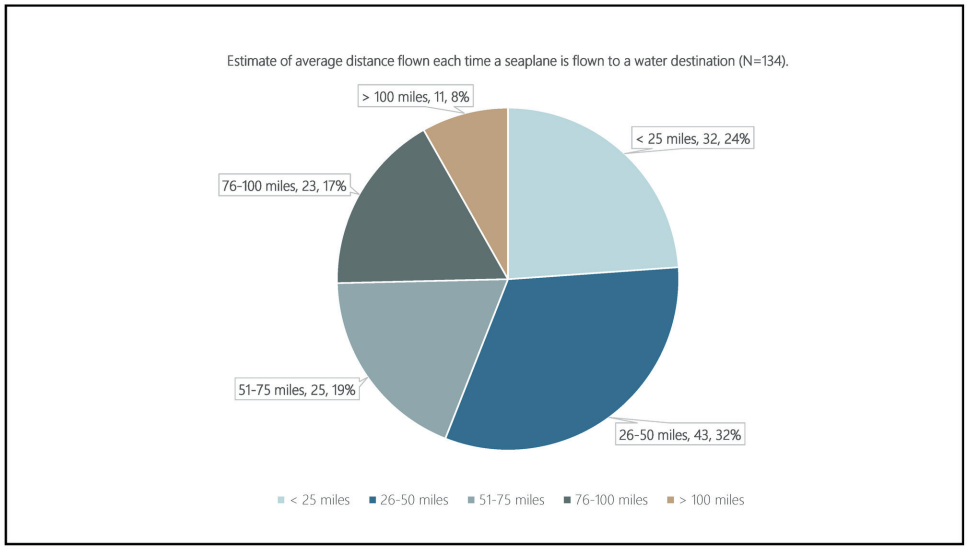
16


I would best describe my seaplane pilot role(s) as (please check all that apply): (N=171)
100
90
80
70
60
50
40
30
20
10
0
89
34
33
11
1
1
1
1
Recreational pilot
Commercial pilot
Pilot school instructor
Government pilot
I run a seaplane Facebook group that educates and inspires women seaplane pilots
Advocate
Part 135 and air tour in ASES and AMES instructor
Owner of Alaska Floats and Skis (float plane flight school)

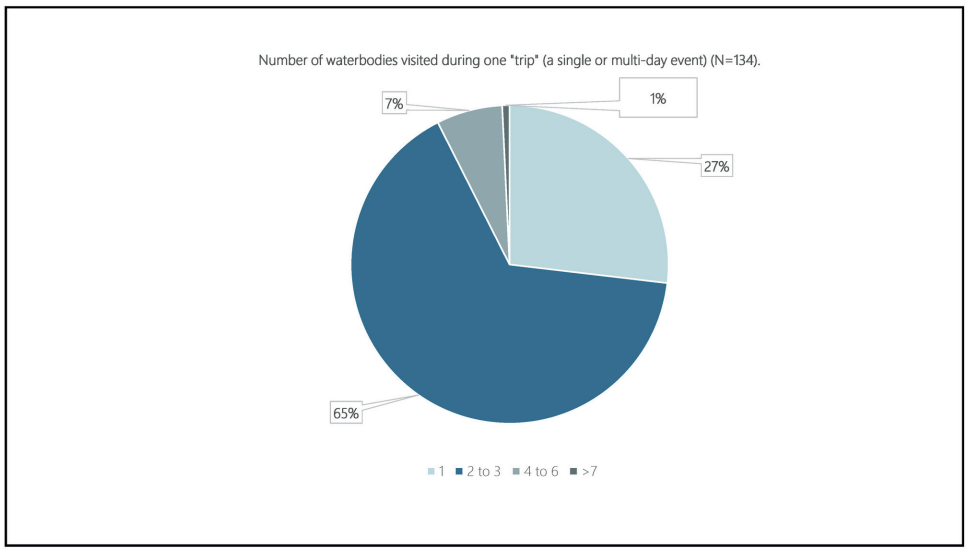
13


Location of aircraf between uses (N=115).
Other
1
Both on the water or in a hangar (it's amphibious)
1
Tiedown
1
Tied down on a DRN-approved ramp
1
It is on water in season, and on land off season
1
On land or an out-of-water lift
19
In a hangar
45
On water
45
0
5
10
15
20
25
30
35
40
45
50

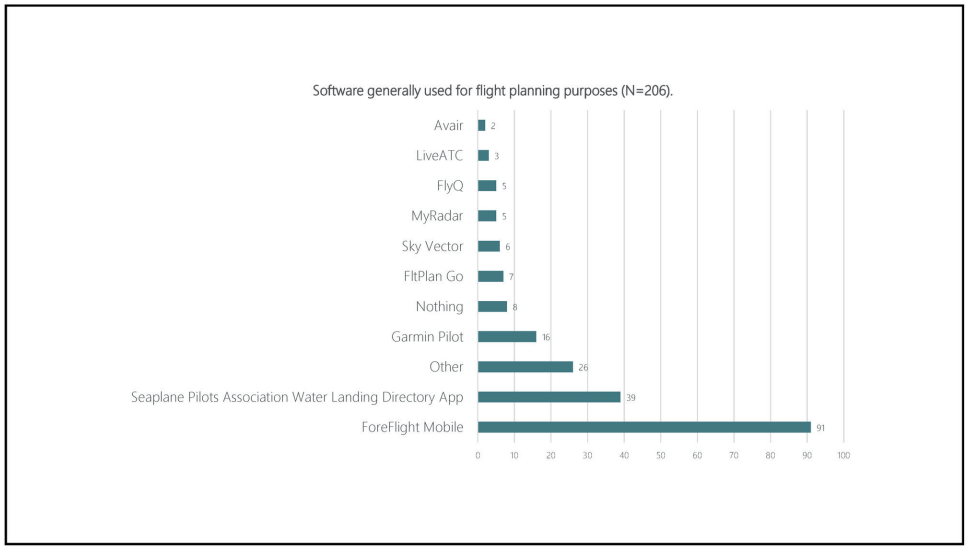
14


Estimate of average distance flown each time a seaplane is flown to a water destination (N=134).
> 100 miles, 11, 8%
< 25 miles, 32, 24%
76-100 miles, 23, 17%
51-75 miles, 25, 19%
26-50 miles, 43, 32%
< 25 miles
26-50 miles
51-75 miles
76-100 miles
> 100 miles

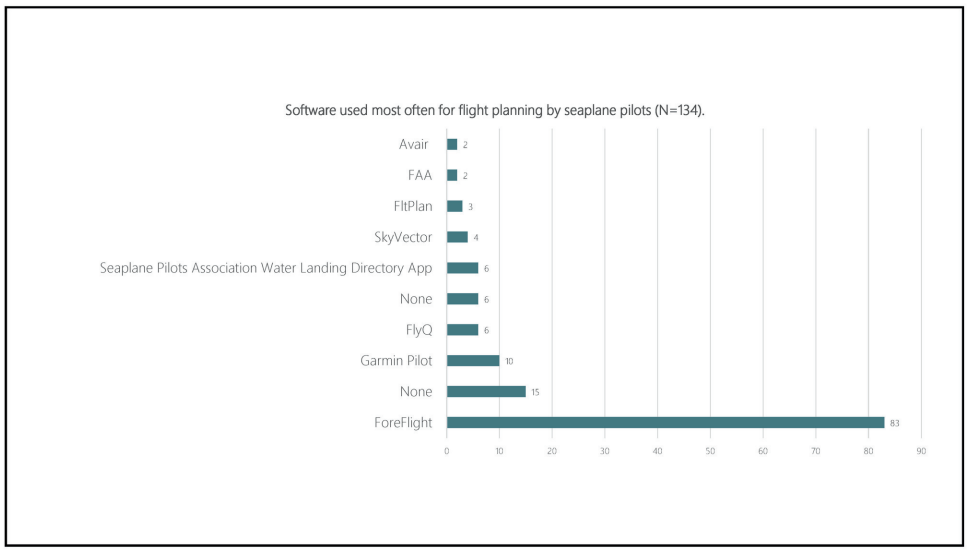
17


Number of waterbodies visited during one "trip" (a single or multi-day event) (N=134).
7%
1%
27%
65%
1
2 to 3
4 to 6
>7

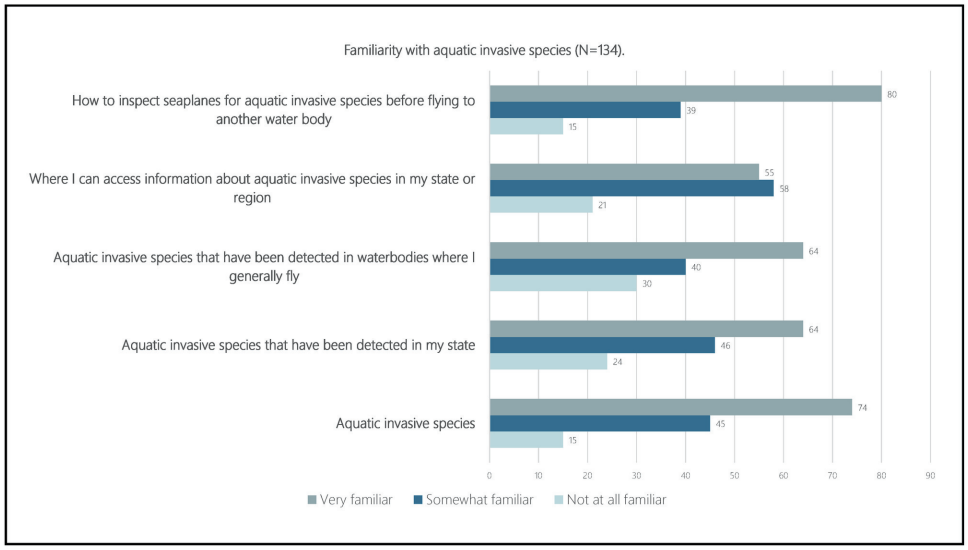
18


Software generally used for flight planning purposes (N=206).
Avair 2
LiveATC 3
FlyQ 5
MyRadar 5
Sky Vector 6
FltPlan Go 7
Nothing 8
Garmin Pilot 16
Other 26
Seaplane Pilots Association Water Landing Directory App 39
ForeFlight Mobile 91
0 10 20 30 40 50 60 70 80 90 100

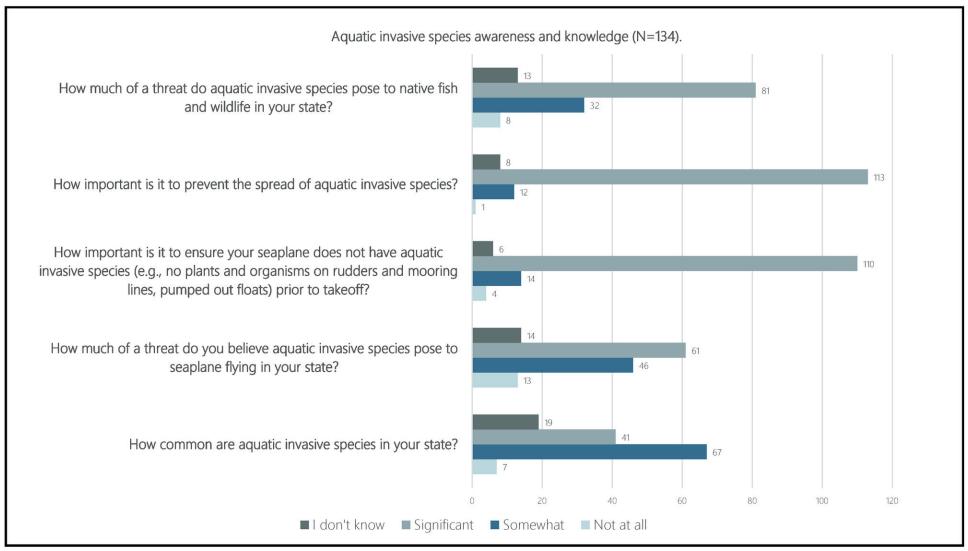
19


Software used most often for flight planning by seaplane pilots (N=134).
Avair 2
FAA 2
FltPlan 3
SkyVector 4
Seaplane Pilots Association Water Landing Directory App 6
None 6
FlyQ 6
Garmin Pilot 10
None 15
ForeFlight 83
0 10 20 30 40 50 60 70 80 90

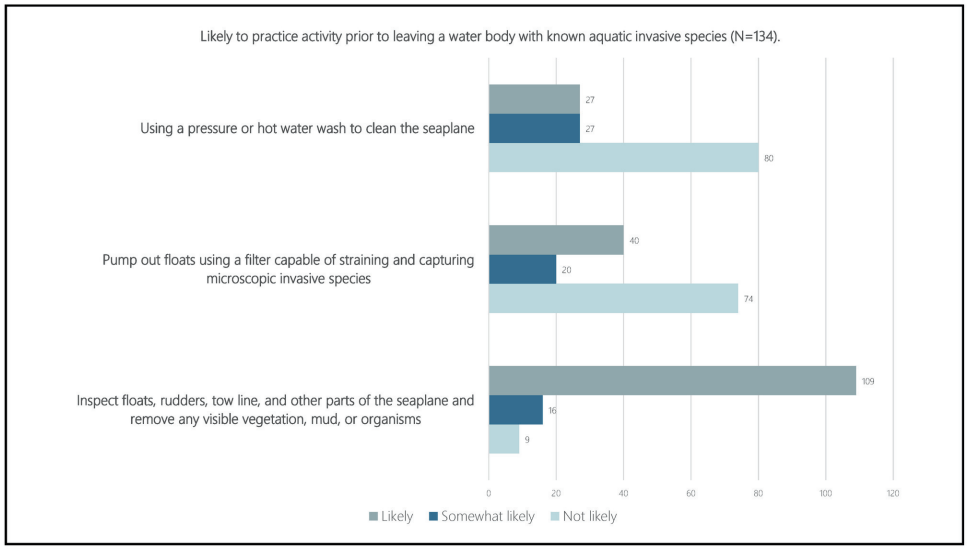
20


Familiarity with aquatic invasive species (N=134).
How to inspect seaplanes for aquatic invasive species before flying to another water body
80
39
15
Where I can access information about aquatic invasive species in my state or region
55
58
21
Aquatic invasive species that have been detected in waterbodies where I generally fly
64
40
30
Aquatic invasive species that have been detected in my state
64
46
24
Aquatic invasive species
74
45
15
0 10 20 30 40 50 60 70 80 90
Very familiar
Somewhat familiar
Not at all familiar

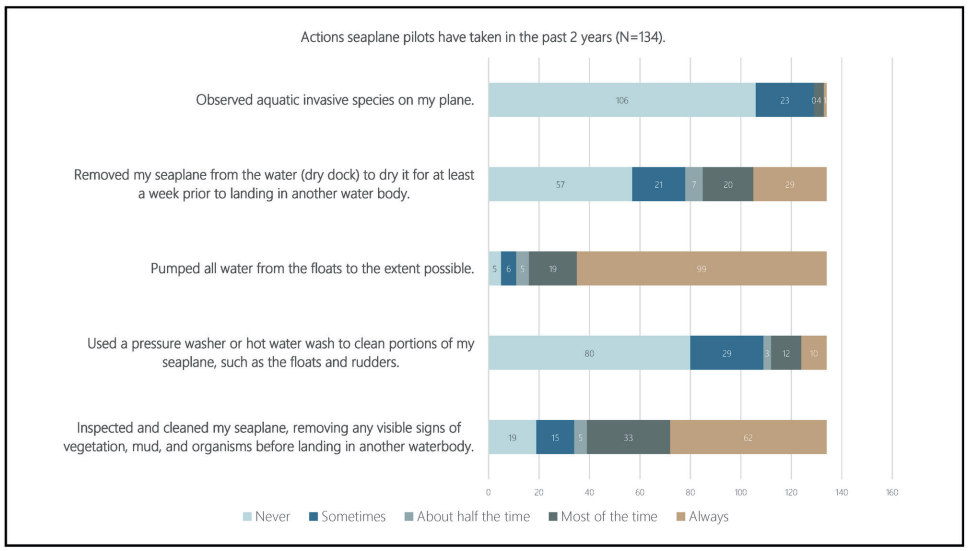
21


Aquatic invasive species awareness and knowledge (N=134).
How much of a threat do aquatic invasive species pose to native fish and wildlife in your state?
13
81
32
8
How important is it to prevent the spread of aquatic invasive species?
8
113
12
1
How important is it to ensure your seaplane does not have aquatic invasive species (e.g., no plants and organisms on rudders and mooring lines, pumped out floats) prior to takeoff?
6
110
14
4
How much of a threat do you believe aquatic invasive species pose to seaplane flying in your state?
14
61
46
13
How common are aquatic invasive species in your state?
19
41
67
7
0 20 40 60 80 100 120
I don't know
Significant
Somewhat
Not at all

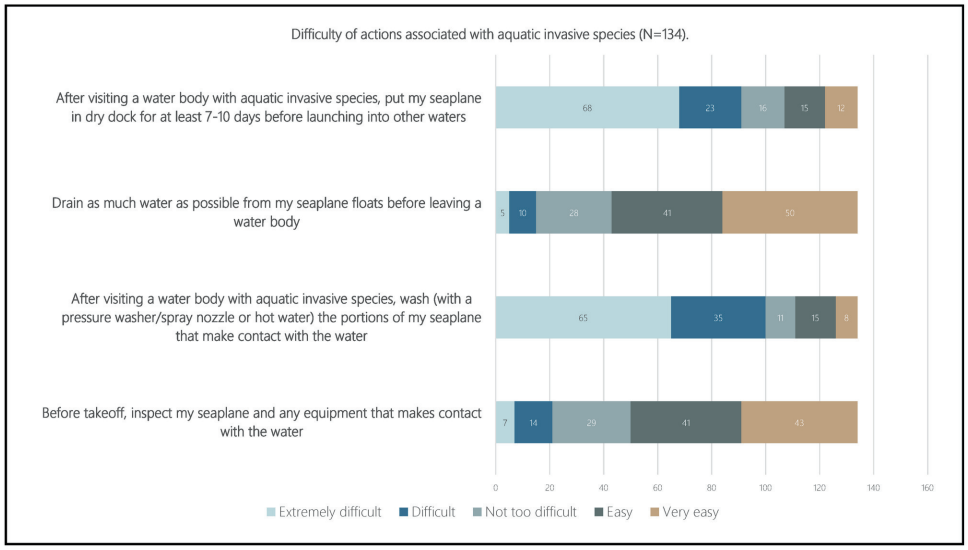
22


Likely to practice activity prior to leaving a water body with known aquatic invasive species (N=134).
Using a pressure or hot water wash to clean the seaplane
27
27
80
Pump out floats using a filter capable of straining and capturing microscopic invasive species
40
20
74
Inspect floats, rudders, tow line, and other parts of the seaplane and remove any visible vegetation, mud, or organisms
109
16
9
0
20
40
60
80
100
120
Likely
Somewhat likely
Not likely

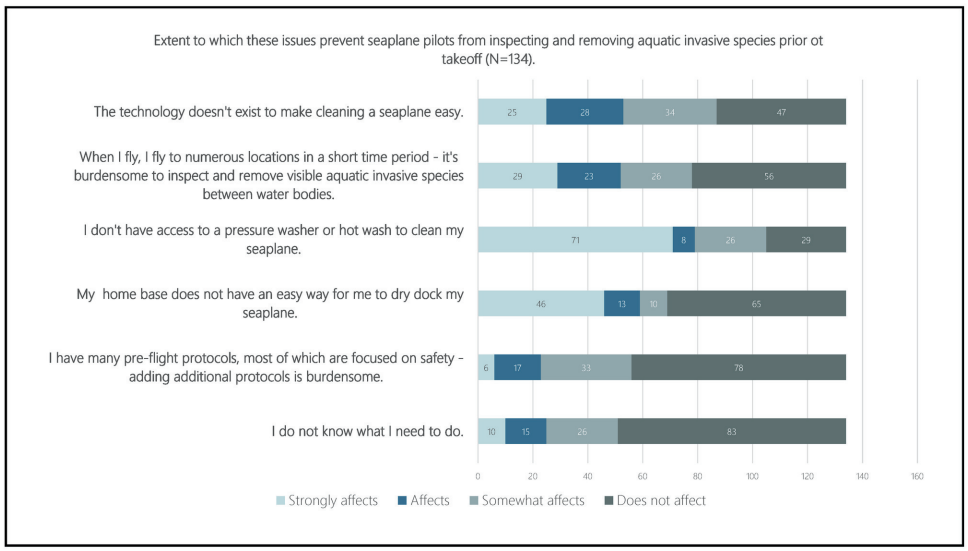
23


Actions seaplane pilots have taken in the past 2 years (N=134).
Observed aquatic invasive species on my plane.
106
23
04
Removed my seaplane from the water (dry dock) to dry it for at least a week prior to landing in another water body.
57
21
7
20
29
Pumped all water from the floats to the extent possible.
5
6
5
19
99
Used a pressure washer or hot water wash to clean portions of my seaplane, such as the floats and rudders.
80
29
3
12
10
Inspected and cleaned my seaplane, removing any visible signs of vegetation, mud, and organisms before landing in another waterbody.
19
15
5
33
62
0
20
40
60
80
100
120
140
160
Never
Sometimes
About half the time
Most of the time
Always

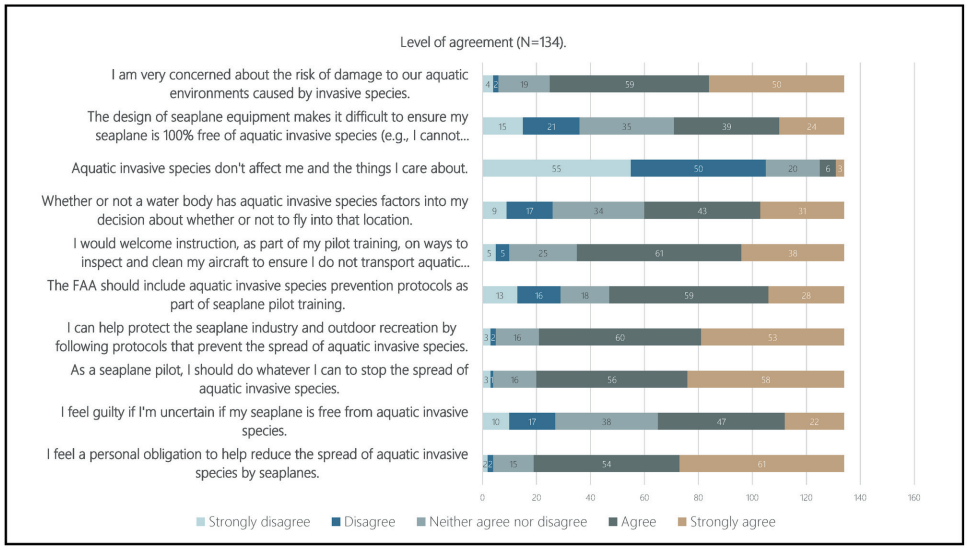
24


Difficulty of actions associated with aquatic invasive species (N=134).
After visiting a water body with aquatic invasive species, put my seaplane in dry dock for at least 7-10 days before launching into other waters
68
23
16
15
12
Drain as much water as possible from my seaplane floats before leaving a water body
5
10
28
41
50
After visiting a water body with aquatic invasive species, wash (with a pressure washer/spray nozzle or hot water) the portions of my seaplane that make contact with the water
65
35
11
15
8
Before takeoff, inspect my seaplane and any equipment that makes contact with the water
7
14
29
41
43
0
20
40
60
80
100
120
140
160
Extremely difficult
Difficult
Not too difficult
Easy
Very easy

25


Extent to which these issues prevent seaplane pilots from inspecting and removing aquatic invasive species prior ot takeoff (N=134).
The technology doesn't exist to make cleaning a seaplane easy.
25
28
34
47
When I fly, I fly to numerous locations in a short time period - it's burdensome to inspect and remove visible aquatic invasive species between water bodies.
29
23
26
56
I don't have access to a pressure washer or hot wash to clean my seaplane.
71
8
26
29
My home base does not have an easy way for me to dry dock my seaplane.
46
13
10
65
I have many pre-flight protocols, most of which are focused on safety - adding additional protocols is burdensome.
6
17
33
78
I do not know what I need to do.
10
15
26
83
0
20
40
60
80
100
120
140
160
Strongly affects
Affects
Somewhat affects
Does not affect

26


Level of agreement (N=134).
I am very concerned about the risk of damage to our aquatic environments caused by invasive species.
The design of seaplane equipment makes it difficult to ensure my seaplane is 100% free of aquatic invasive species (e.g., I cannot...
Aquatic invasive species don't affect me and the things I care about.
Whether or not a water body has aquatic invasive species factors into my decision about whether or not to fly into that location.
I would welcome instruction, as part of my pilot training, on ways to inspect and clean my aircraft to ensure I do not transport aquatic...
The FAA should include aquatic invasive species prevention protocols as part of seaplane pilot training.
I can help protect the seaplane industry and outdoor recreation by following protocols that prevent the spread of aquatic invasive species.
As a seaplane pilot, I should do whatever I can to stop the spread of aquatic invasive species.
I feel guilty if I'm uncertain if my seaplane is free from aquatic invasive species.
I feel a personal obligation to help reduce the spread of aquatic invasive species by seaplanes.
4 2 19 59 50
15 21 35 39 24
55 50 20 6 3
9 17 34 43 31
5 5 25 61 38
13 16 18 59 28
3 2 16 60 53
3 1 16 56 58
10 17 38 47 22
2 2 15 54 61
0 20 40 60 80 100 120 140 160
Strongly disagree
Disagree
Neither agree nor disagree
Agree
Strongly agree

27

Appendix F. Seaplane Industry Think Tank Agenda

Seaplane Industry Think Tank Agenda

November 15, 2024, 9am-10:30am Pacific Time

Virtual Meeting: https://meet.goto.com/createstrat/seaplanes
You can also dial in using your phone. Access Code: 548-421-517 United States: +1 (571) 317-3122
Get the app now and be ready when your first meeting starts: https://meet.goto.com/install

Meeting Objective: Convene seaplane industry representatives to discuss potential strategic and collaborative approaches industry could take to reduce the risk of transport of aquatic invasive species via seaplanes.

9:00am–9:10am	**Welcome, Introductions, Review of Agenda and Meeting Objective**
9:10am–9:30am	**The Boating Industry Example – Design and Construction of Watercraft and Watercraft Accessories in Consideration of Aquatic Invasive Species** (Brian Goodwin, American Boat & Yacht Council) A representative of the American Boat & Yacht Council, Inc. will discuss the process and outcomes used to address improving cleaning, draining, drying, inspection, and decontamination processes for watercraft and watercraft accessory manufacturers, describing specific industry-led examples **Best practices for boat design and construction** ▪ Improve visual and physical access to areas subject to inspection and decontamination ▪ Design wells and other areas for complete drainage ▪ Implement external flushing ports ▪ Seal strakes, keels, ribs, and other structural components ▪ Design bilges to prevent water-trapping features ▪ Select materials to allow complete drainage ▪ Design features that facilitate inspection without the use of tools ▪ Identifying the location and function of through-hull fittings
9:30am–9:40am	**Seaplane Components Vulnerable to Aquatic Invasive Species Transport** Review and discuss the parts of a seaplane most vulnerable to aquatic invasive species transport (Bruce Hinds, Washington Seaplane Pilots Association)
9:40am–9:50am	**Design and Construction of Seaplanes and Seaplane Accessories in Consideration of Aquatic Invasive Species** Share efforts and discussions to date to address transport of AIS by seaplanes and seaplane equipment (Steve McCaughey, Seaplane Pilots Association)
9:50am–10:25am	**Creative Design, Construction, and Modification of Seaplanes (recognizing safety constraints) and Seaplane Accessories in Consideration of Aquatic Invasive Species** Next steps – Facilitated discussion with industry representatives to discuss a path forward to define and implement strategies to improve cleaning, draining, drying, inspection, and decontamination processes for seaplanes and seaplane accessories
10:25am–10:30am	**Wrap-up and Key Next Steps**
10:30am	**Adjourn**

Appendix G. Draft FAA Advisory Circular

Subject: Best Practices to Reduce the Spread of Aquatic Invasive Species by Seaplanes

CHAPTER 1. GENERAL

1 **PURPOSE.**

This advisory circular (AC) provides guidance to seaplane pilots on best practices to inspect and clean a seaplane to prevent the spread of aquatic invasive species and ensure compliance with state and federal laws that prohibit their transport.

2 **APPLICABILITY.**

2.1 This AC affects all pilots flying any type of seaplane, including float planes and flying boats.

2.2 All seaplane pilots should read this AC.

2.3 This AC is not mandatory and does not constitute a regulation.

3 **DEFINITIONS.**

3.1 *Aquatic Invasive Species* – Refers to freshwater or marine organisms that have spread, or been introduced beyond their native range, and are either causing, or have the potential to cause, harm to the environment, economy, or human, animal, or plant health.

3.2 *Clean, Drain, Dry* – Refers to simple steps that can be completed to help prevent the spread of aquatic invasive species.

3.2.1 *Clean* off visible aquatic plants, animals, and mud from all equipment before leaving a waterbody.

3.2.2 *Drain* as much water as possible from floats using a pump with an invasive species filter that screens and prevents the release of microscopic invasive species.

3.2.2 *Dry* the aircraft while in storage and between flights, if possible.

3.3 *Inspection* – Refers to a visual examination and/or manual check to determine the condition of an aircraft or component.

4 BACKGROUND.

4.1 Aquatic invasive species (AIS) are freshwater or marine organisms that have spread, or been introduced beyond their native range, and are either causing, or have the potential to cause, harm to the environment, economy, or human, animal, or plant health. Examples of AIS include Eurasian Watermilfoil, Quagga and Zebra Mussels, and European Green Crab.

4.2 Seaplanes, like other forms of water-based equipment, can spread aquatic invasive species from one waterbody to another. Aquatic invasive species can attach to and hitchhike on to the external surfaces of floats, cables, and rudders. Microscopic AIS, such as Spiny Waterflea, and the larval forms of invasive mussels, can also enter hulls, floats, and openings when raw water seeps into seaplane equipment. The invasives are then unknowingly released and spread to other waterways when water leaks or is pumped out of the equipment.

4.3 Seaplane pilots have a vested interest in preventing the spread of AIS. The spread of AIS could affect future access to waterbodies, devastate recreational boating and fishing resources, interfere with hydropower production and shipping, and have other negative consequences. As a result, being aware of the risk flying can have on the ecology and economy of a region and taking steps to minimize that risk is important for all seaplane pilots.

5 WHAT ARE THE BEST PRACTICES TO REDUCE THE SPREAD OF AQUATIC INVASIVE SPECIES BY SEAPLANES?

5.1 *Planning a Flight*

5.1.1 Familiarize yourself with aquatic invasive species at destination water bodies, but recognize that not all water bodies are monitored for aquatic invasive species – always assume a water body has AIS.

5.1.2 If you are departing from a waterbody that has confirmed high-risk AIS, before landing at another water body, consider landing at an airport to first (if possible) to fully inspect and clean your aircraft.

5.2 *Before Entering the Aircraft*

5.2.1 Inspect and remove any visible vegetation or other debris from the aircraft. Remove any plant growth on mooring lines and dispose of any plants or identified AIS in the trash.

5.2.2 Inspect the following for the presence of aquatic invasive species:

- Floats
- Hulls
- Rudders
- Wires and Cables
- Mooring lines
- Wheel wells
- Crossmembers
- Exterior paddle
- Footwear and gear

5.2.3 Visually inspect submerged parts of the aircraft and run your hand, or use a brush, along the surfaces to check for any aquatic invasive species that may be attached, especially if the aircraft has been moored on a waterbody for more than a few hours.

5.2.4 Pump as much water as possible out of the bilge compartments using a pump with an invasive species filter (e.g., Turbo Pump) to reduce the risk of transporting microscopic aquatic invasive species.

5.3 *Before Takeoff*

5.3.1 Just prior to takeoff, raise and lower your water rudders several times to remove aquatic hitchhikers, which can cause cable stretch and affect steering.

5.3.2 Avoid taxiing through aquatic plants, but if you do, stop once in open water and manually clear vegetation from floats, hull, and rudders.

5.4 *After Takeoff*

5.4.1 After takeoff at a safe altitude, if conditions permit, raise and lower your water rudders numerous times while flying over the water body you are departing to clear aquatic plants from the water rudders and cables.

5.4.2 If aquatic plants remain visible on the plane, return to the waterbody and remove them.

5.5 *Storage and Mooring*

5.5.1 Thoroughly Clean, Drain, Dry your aircraft prior to flying to another waterbody.

5.5.2 If the aircraft floats take on water, drain and dry, to the extent possible.

5.6 *Report Invasive Species*

5.6.1 Report any invasive species you see to your state aquatic invasive species reporting system. Generally, you can contact your local fish and wildlife or conservation agency website for their reporting information.

5.7 *Spread the Word About Clean, Drain, Dry*

5.7.1 Informed seaplane pilots can make a difference in preventing the spread of aquatic invasive species.

5.7.2 Talk with your colleagues and spread the word about the steps seaplane pilots can take to minimize the spread of aquatic invasive species.

5.7.3 Expand your understanding of the types of aquatic invasive species you might encounter in local and regional waterbodies by visiting Body.

6 **REFERENCES.**

Administrative Information

Requests for Information – Office or phone number people can call for more information.

Appendix H. Draft Education Module

Seaplane Pilot Best Practices to Prevent the Spread of Aquatic Invasive Species

Aquatic invasive species (AIS) are freshwater or marine organisms that have spread, or been introduced beyond their native range, and are either causing, or have the potential to cause, harm to the environment, economy, or human, animal, or plant health. Examples of AIS include Eurasian Watermilfoil, Quagga and Zebra Mussels, and New Zealand Mudsnails.

Seaplanes, like other forms of water-based equipment, can spread aquatic invasive species from one waterbody to another. Aquatic invasive species can attach to and hitchhike on the external surfaces of floats, cables, and rudders. Microscopic AIS, such as Spiny Waterflea, and the larval forms of invasive mussels, can also enter hulls, floats, and openings when raw water seeps into seaplane equipment. The invasives are then unknowingly released and spread to other waterways when water leaks or is pumped out of the equipment.

Seaplane pilots value the waterways they visit and have a vested interest in preventing the spread of AIS. The spread of AIS could affect future access to waterbodies, devastate recreational boating and fishing resources, interfere with hydropower production and shipping, and have other negative consequences. As a result, being aware of the risk flying can have on the ecology and economy of a region and taking steps to minimize that risk is important for all seaplane pilots. Before leaving any waterbody, adding these simple steps to your routine can reduce or eliminate those risks:

Planning a Flight

Familiarize yourself with AIS at destination water bodies but recognize that not all water bodies are monitored for AIS – always assume a waterbody has AIS. If you are departing from a waterbody that has confirmed AIS, before landing at another waterbody, consider landing at an airport first (if possible) to fully inspect and clean your aircraft.

Before Entering the Aircraft

Inspect and remove any visible vegetation or other debris from the aircraft. Remove any plant growth on mooring lines and dispose of any plants or identified AIS in the trash.

Inspect the following for AIS:

- Floats
- Hulls
- Rudders
- Wires and Cables
- Mooring Lines
- Wheel Wells
- Crossmembers
- Exterior Paddle
- Your Footwear and Gear

Visually inspect submerged parts of the aircraft and run your hands, or use a brush, along the surfaces to check for any AIS that may be attached, especially if the aircraft has been moored on a waterbody for more than a few hours.

Pump as much water as possible out of bilge compartments using a pump with an invasive species filter (e.g., Turbo Pump) to limit the possibility of transporting microscopic AIS.

Before Takeoff

Just prior to takeoff, raise and lower your water rudders several times to remove aquatic hitchhikers, which can cause cable stretch and affect steering.

Avoid taxiing through aquatic plants. If you must taxi through aquatic plants, stop once in open water and manually clear vegetation from floats, hulls, and rudders.

After Takeoff

After takeoff at a safe altitude, if conditions permit, raise and lower your water rudders numerous times while flying over the waterbody you are departing to clear aquatic plants from the water rudders and cables. If aquatic plants remain visible on the plane, return to the waterbody and remove them.

Storage and Mooring

Thoroughly Clean, Drain, Dry the aircraft prior to flying to another waterbody. If the aircraft floats take on water, drain and dry, to the extent possible.

Report Invasive Species

Report any invasive species you see to your state AIS reporting system. Generally, you can contact your local fish and wildlife or conservation agency website for their reporting information.

Spread the Word About Clean, Drain, Dry

Informed seaplane pilots can make a difference in preventing the spread of AIS. Talk with your colleagues and spread the word about the importance of Clean, Drain, Dry and steps pilots can take to minimize the spread of AIS.

Expand your understanding of the types of AIS you might encounter in local and regional waterbodies by visiting https://nas.er.usgs.gov.

Summary

Cleaning procedures should be completed every time pre- and post –flight. Consider taking additional precautions if you know you are flying into a waterbody with known AIS. Removing your aircraft from the water whenever practical to better facilitate self-inspection, draining, cleaning, repairing leaking floats or the hull, and drying your aircraft as much as possible, will help prevent the spread of AIS.

If you know a waterbody is infested with AIS, consider using a nearby alternative waterbody. Following these simple steps to prevent the spread of AIS will protect our water resources and ensure your continued access to public waterways.