

Pathway Risk Analysis for Exotic Marine and Estuarine Species in Florida's Pet Trade

Steering Committee

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WHAT LIES AHEAD

- Why did we do this project?
- Risk analysis methodology
- Generic Nonindigenous Species Risk Analysis
 - Pathway description
 - Risk assessment
 - Risk management
- What did we learn?

FLORIDA'S COMPREHENSIVE WILDLIFE CONSERVATION STRATEGY

- Integrates 30 years of conservation plans →
single state wildlife action plan
- USFWS - State Wildlife Grants Program
- <http://myfwc.com/wildlifelegacy>



Photo: Daniel Roberts (FWS)
Specimens: Pier Aquarium, Inc.

Conservation Threats

Invasive Animals

Conduct a risk assessment on all commercially available exotic marine or estuarine animals in Florida's pet trade.

Prerovis volitans

RISK ANALYSIS

**Generic Nonindigenous
Aquatic Organisms Risk
Analysis Review Process
(ANSTF 1996)**

Generic Analysis

ORGANISM



PATHWAY



AQUATICSWEST.COM

GENERIC ANALYSIS

- **INITIATION**

- **RISK ASSESSMENT**

- **RISK MANAGEMENT**

■ RISK ASSESSMENT

Stakeholders

Literature & database review

Probability of establishment

Consequences of establishment

economic, environmental, social/political

RISK ASSESSMENT ELEMENT RATINGS

Low

Acceptable risk – little concern - does not justify mitigation

Medium

Unacceptable risk – moderate concern – mitigation justified

High

Unacceptable risk – major concern – mitigation justified

Risk Assessment

UNCERTAINTY CODES

VC – Very certain

RC – Reasonably certain

MC – Moderately certain

RU – Reasonably uncertain

VU – A guess

ESTABLISHMENT ELEMENTS

PRESENT	SURVIVE	INTRO/ESC	COLONIZE	SPREAD
HIGH	HIGH	MEDIUM	MEDIUM	LOW

**PATHWAY (LINK/NODE) RISK POTENTIAL =
LOWEST ELEMENT RISK RATING**



CONSEQUENCES OF ESTABLISHMENT

ECONOMIC

ENVIRONMENTAL

SOCIAL/
POLITICAL

RISK

HIGH/MED

HIGH/MED

HIGH/MED

HIGH/MED

LOW

LOW

MED/HIGH

MED

■ RISK MANAGEMENT

- ✓ Policies
- ✓ Regulations
- ✓ Operational measures

■ RISK MANAGEMENT

Policies

Regulations

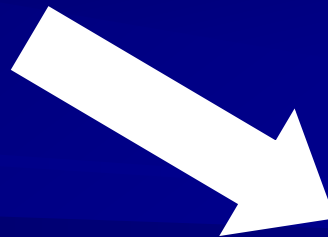
Operational measures

risk

HIGH



LOW



Adaptive risk
management plan

Our process in a nutshell...

- Literature review
- Knowledgeable stakeholders
- Pathway description
- Workshops

Literature review

■ 20 books

■ 14 journal articles

■ 13 websites

■ 12 gov't/university reports

■ 5 online databases

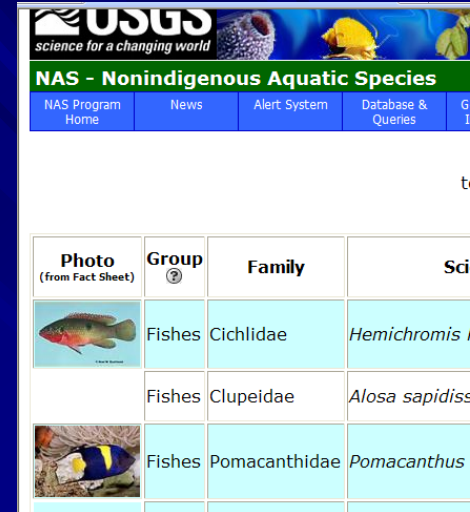


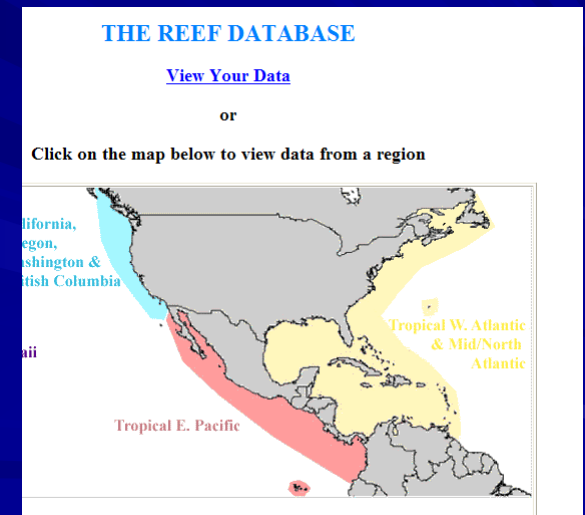


Photo (from Fact Sheet)	Group ?	Family	Sci
	Fishes	Cichlidae	<i>Hemichromis</i>
	Fishes	Clupeidae	<i>Alosa sapidiss</i>
	Fishes	Pomacanthidae	<i>Pomacanthus</i>



■ **STAKEHOLDERS (18)**

state (4) or federal agencies(1)

national or state universities (2)

commercial aquaculturists (2)

marine ornamental fish importers (3),
wholesale and retail businesses (5)

marine hobby aquarists (1)

■ WORKSHOPS

Methodology

Pathway description

Completed pathway risk analysis

Identify risk management options

PATHWAY: GLOBAL TRADE

- 20 million fish: 1,500 species
- 10 million inverts: 500 species
- 10 million coral pieces: 200 species

CONSUMERS



EXPORTERS

Map via WorldPress.org



Pathway: Federal Regulations

U.S. Fish and Wildlife Service

Authority

Convention on International Trade in Endangered
Species of Wild Fauna and Flora (CITES)

Endangered Species Act

Lacey Act

Tools

Annual Import/Export License

Declaration for Import/Export of Fish or Wildlife

17 designated ports of entry, 37 nondesignated ports of entry

Pathway: State Regulations

Florida Fish and Wildlife Conservation Commission

Authority: State Constitution

Tools

Prohibits release of nonnative aquatic organisms

Prohibits/restricts possession of certain species

Import permit required

Regulates harvest and sale of marine ornamentals:

license/reporting/equipment/methods/catch limits

Pathway: State Regulations

Florida Dept of Agriculture
and Consumer Services

Authority

Chapter 597, Florida Aquaculture Policy Act, Florida Statutes

Tools

Aquaculture Certificate of Registration/AQ#

On-Farm Inspection

Best Management Practices

Pathway: Industry Policy/Practice

Marine Aquarium Council

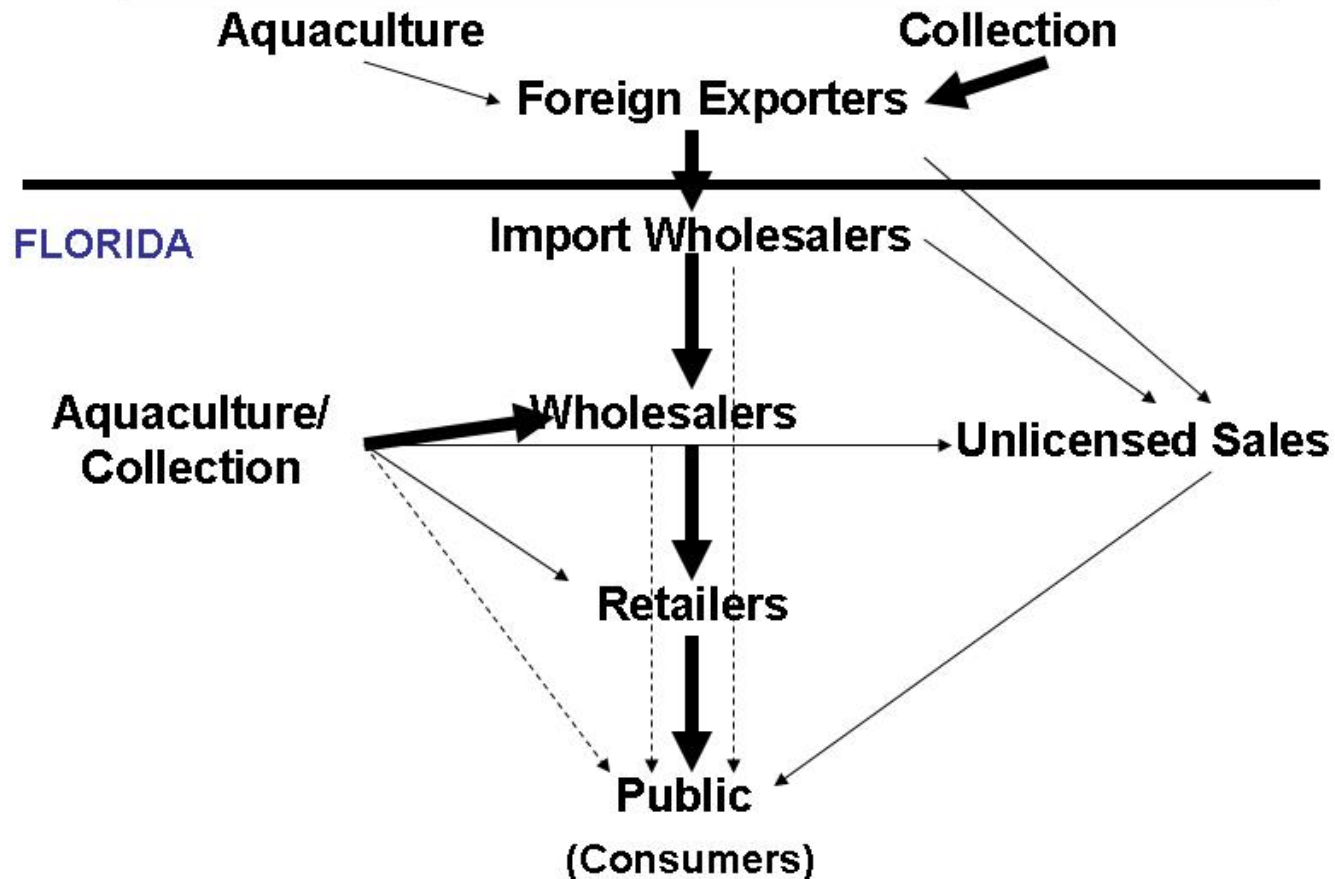
Conserve coral reefs and other marine ecosystems by creating standards and certification for those engaged in the collection and care of ornamental marine life from reef to aquarium

Certification for the Marine Aquarium Trade

International Standards

Global Marine Aquarium Database

Figure 1. The Florida Marine Ornamental Pathway



Notes: Dashed lines indicate infrequent movement/sales. Thick lines indicate primary movement/sales. Few Florida companies farm marine ornamentals and those that do may also act as wholesalers. Wholesale and retail distribution includes internet sales and hobbyist shows. Marine aquarists (public/consumers) also sell and trade amongst themselves.

LITERATURE/DATABASE REVIEW

22 ORNAMENTAL FISH SPP REPORTED

Pomacanthidae – 6 spp

Acanthuridae – 6 spp

13 spp observed at only 1 location

Max = 6 locations Emperor angelfish

Max = 5 specimens Orbiculate batfish

Photo: Daniel Roberts (FWS)
Specimen: Pier Aquarium Inc.

RED LIONFISH – ESTABLISHED IN FEDERAL WATERS

Pterois volitans

Genus and species	Common Name	Locations	Number of Fish
<i>Acanthurus sohal</i>	Sohal surgeonfish	1	not reported
<i>Naso lituratus</i>	orangespine unicornfish	1	not reported
<i>Zebrasoma desjardinii</i>	sailfish tang	1	1
<i>Z. flavescens</i>	yellow tang	1	1
<i>Z. veliferum</i>	sailfish tang	1	1
<i>Z. xanthurum</i>	yellowtail tang	1	1
<i>Rhinecanthus verrucosus</i>	bursa triggerfish	coastal SE Florida	not reported
<i>Chaetodon lunula</i>	raccoon butterfly fish	1	“seen a few times”
<i>Heniochus intermedius</i>	Red Sea bannerfish	1	1
<i>Platax orbicularis</i> - Collected	orbiculate batfish	1	5
<i>Gramma loreto</i> – Range Extension	fairy basslet	coastal SE Florida	“numerous reports”
<i>Pomacanthus annularis</i>	blue ringed angelfish	1	1
<i>P. asfur</i>	Arabian angel	3	3
<i>P. imperator</i>	Emperor angelfish	6	not reported
<i>P. maculosus</i>	yellowbar angelfish	1	1
<i>P. semicirculatus</i>	semicircle angelfish	3	not reported
<i>P. xanthometopon</i>	bluefaced angelfish	coastal SE Florida	not reported
<i>Cephalopholis argus</i>	peacock hind	2	2
<i>Chromileptes altivelis</i>	humpback grouper	4	several individuals
<i>Scatophagus argus</i>	scat	1	1
<i>Pterois volitans/miles</i> - Established	red lionfish	Numerous – Mid and South Atlantic, 1 – Gulf of Mexico	
<i>Zanclus cornutus</i>	Moorish Idol	1	1

Species	Common Name	Locations	# Fish	Information Source
<i>Acanthurus sohal</i>	Sohal surgeonfish	1	not reported	Semmens et al. (2004)
<i>Naso lituratus</i>	orangespine unicornfish	1	not reported	Semmens et al. (2004)
<i>Zebrasoma desjardini</i>	sailfish tang	1	1	REEF, USGS-NAS
<i>Z. flavescens</i>	yellow tang	1	1	REEF, USGS-NAS
<i>Z. veliferum</i>	sailfish tang	1	1	REEF, USGS-NAS
<i>Z. xanthurum</i>	yellowtail tang	1	1	REEF, USGS-NAS

Species	Common Name	Locations	# Fish	Information Source
<i>Rhinecanthus verrucosus</i>	bursa triggerfish	coastal SE Florida	not reported	Courtenay (1995)
<i>Chaetodon lunula</i>	raccoon butterfly fish	1	“seen a few times”	REEF, USGS-NAS
<i>Heniochus intermedius</i>	Red Sea bannerfish	1	1	USGS-NAS
<i>Platax orbicularis</i> (removed)	orbiculate batfish	1	5	USGS-NAS
<i>Gramma loreto</i> (range expansion)	fairy basslet	coastal SE Florida	“numerous reports”	USGS-NAS

Species	Common Name	Locations	# Fish	Information Source
<i>Rhinecanthus verrucosus</i>	bursa triggerfish	coastal SE Florida	not reported	Courtenay (1995)
<i>Chaetodon lunula</i>	raccoon butterfly fish	1	“seen a few times”	REEF, USGS-NAS
<i>Heniochus intermedius</i>	Red Sea bannerfish	1	1	USGS-NAS
<i>Gramma loreto</i> (range expansion?)	fairy basslet	coastal SE Florida	“numerous reports”	USGS-NAS

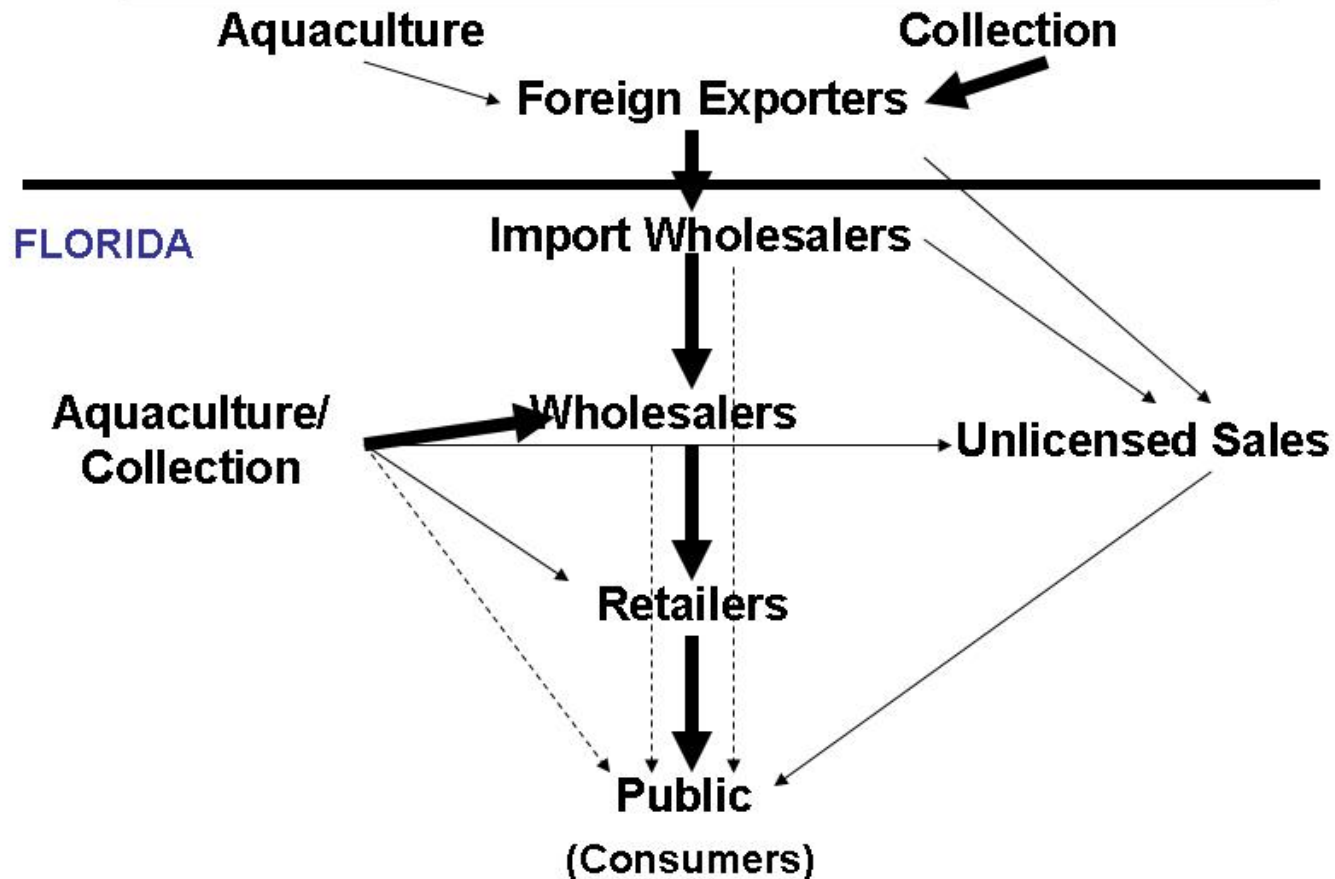
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<i>P. semicirculatus</i>	semicircle angelfish	3	not reported	Semmens et al. (2004), USGS-NAS
<i>P. xanthometopon</i>	bluefaced angelfish	coastal SE Florida	not reported	Courtenay (1995)

Species	Common Name	Locations	# Fish	Information Source
<i>Cephalopholis argus</i>	peacock hind	2	2	USGS-NAS
<i>Chromileptes altivelis</i>	humpback grouper	4	several individuals	USGS-NAS
<i>Scatophagus argus</i>	scat	1	1	USGS-NAS
<i>Pterois volitans/miles</i>	red lionfish	Numerous – Mid and South Atlantic, 1 – Gulf of Mexico		USGS-NAS
<i>Zanclus cornutus</i>	Moorish Idol	1	1	REEF, USGS-NAS

LACK OF ESTABLISHED SPECIES

- Complex life histories precludes colonization
- Low number introduced
- Unfavorable biological, physical, or chemical attributes at the point of introduction
- Abiotic, biotic, temporal, and spatial factors affect species establishment
- Regulation, trade practices, product value deter release or escape

Figure 1. The Florida Marine Ornamental Pathway



Notes: Dashed lines indicate infrequent movement/sales. Thick lines indicate primary movement/sales. Few Florida companies farm marine ornamentals and those that do may also act as wholesalers. Wholesale and retail distribution includes internet sales and hobbyist shows. Marine aquarists (public/consumers) also sell and trade amongst themselves.

PROBABILITY OF ESTABLISHMENT

FL MARINE LIFE FISHERS → **FL IMPORTERS
WHOLESALEERS**

PRESENT	SURVIVE	INTRO/ESCAPE	COLONIZE	SPREAD
LOW	LOW	LOW	LOW	LOW

LINK RISK POTENTIAL = LOW

VERY CERTAIN, GEN. KNOWLEDGE, LITERATURE

PROBABILITY OF ESTABLISHMENT

**NON-FL MARINE LIFE FISHERS
FOREIGN WHOLESALERS**



FL IMPORTERS

**FL IMPORTERS
IMPORTERS**



**FL FISH FARMERS
WHOLESALERS**

FL FARMERS

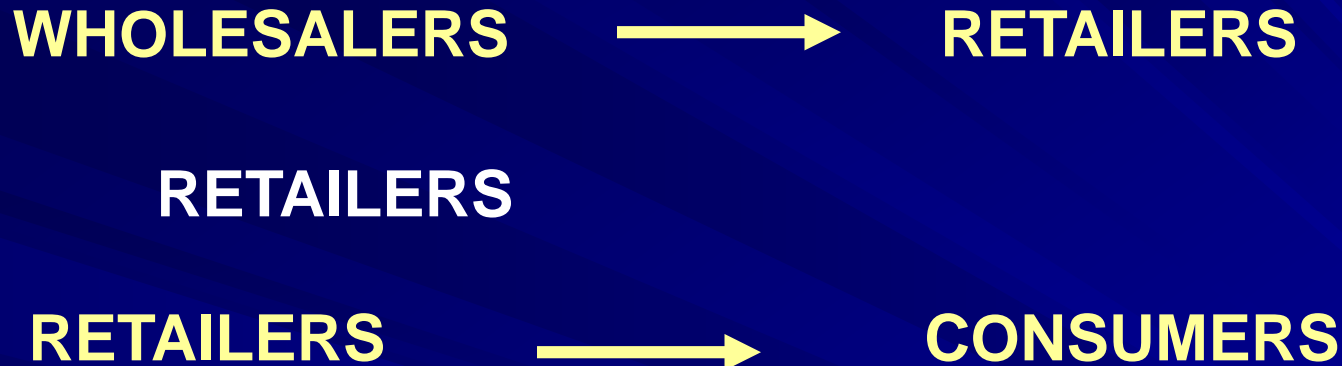
FL WHOLESALERS

PRESENT	SURVIVE	INTRO/ESCAPE	COLONIZE	SPREAD
HIGH	HIGH	LOW	LOW	LOW

LINK/NODE RISK POTENTIAL = LOW

VERY CERTAIN, GEN. KNOWLEDGE, LITERATURE

PROBABILITY OF ESTABLISHMENT



PRESENT	SURVIVE	INTRO/ESCAPE	COLONIZE	SPREAD
HIGH	HIGH	LOW	LOW	LOW

LINK/NODE RISK POTENTIAL = LOW

VERY CERTAIN, GEN. KNOWLEDGE, LITERATURE

PROBABILITY OF ESTABLISHMENT

CONSUMERS

PRESENT	SURVIVE	INTRO/ESCAPE	COLONIZE	SPREAD
HIGH	HIGH	MEDIUM	LOW	LOW
NODE RISK POTENTIAL = LOW				
REASONABLY CERTAIN				

VERY CERTAIN, GEN. KNOWLEDGE, LITERATURE

PROBABILITY OF ESTABLISHMENT

CONSUMERS $\xrightarrow{\text{UNLICENSED}}$ **CONSUMERS**

PRESENT	SURVIVE	INTRO/ESCAPE	COLONIZE	SPREAD
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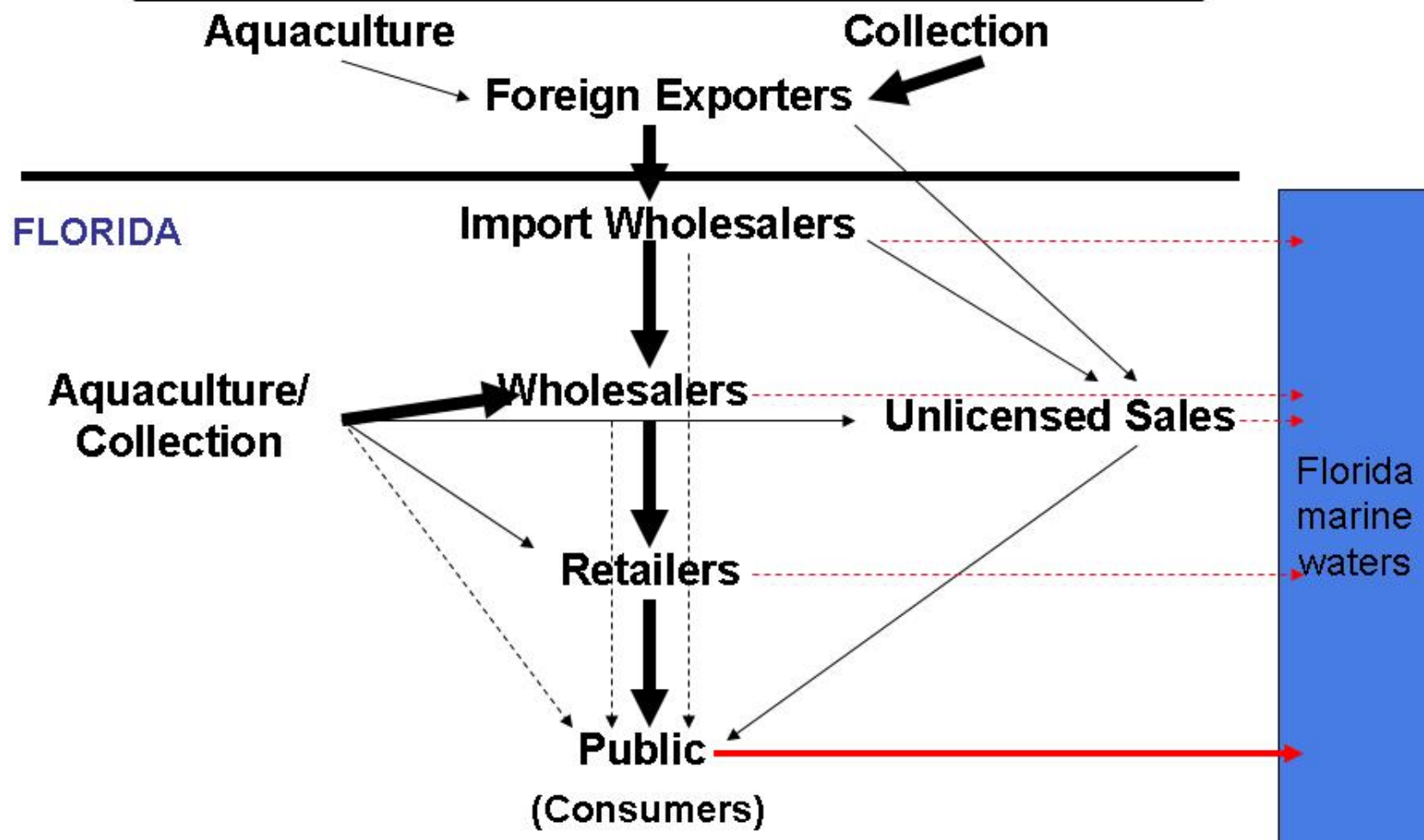
HIGH	HIGH	MEDIUM	LOW	LOW
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LINK RISK POTENTIAL = LOW

VERY UNCERTAIN

VERY CERTAIN, GEN. KNOWLEDGE, LITERATURE

Figure 2. Likelihood of Release from the Florida Marine Ornamental Pathway



Notes: Dashed lines indicate infrequent movement/sales. Thick lines indicate primary movement/sales. Likelihood of escape or release in red.

CONSEQUENCES OF ESTABLISHMENT

ECONOMIC

LOW

VC

GEN. KNOW, LIT.

ENVIRONMENTAL

LOW

VC

GEN. KNOW, LIT.

**SOCIAL/
POLITICAL**

HIGH

VC

GEN. KNOW, LIT.

PATHWAY RISK POTENTIAL = MEDIUM

Risk Management

Unlicensed Direct Sales to Consumers Link

- FWC public outreach on non-native spp:
 - hobbyist and trade pet shows
 - partner with the Florida Marine Aquarium Society
 - Florida-oriented PowerPoint on responsible keeping and disposal for use by agencies and industry
 - web-based communications (e.g., YouTube)
 - public service announcement (audio and video) educating the public not to release unwanted pets

Risk Management

Unlicensed Direct Sales to Consumers Link

- FWC regulatory efforts:
 - monitor Internet sales
 - spot check retail stores
- Florida Master Naturalist Program nonindigenous species component
- State agency support/promotion of Habitattitude™ (Do not release exotic species)
- Encourage businesses with Wholesale/Retail Saltwater Products licenses to display nonindigenous species educational information

CONSUMER NODE

- species suitability information (i.e., habitat or food requirements, maximum size) as a component of public education efforts
- develop marine aquaria educational curriculum through Florida Agriculture in the Classroom, Inc.
- encourage retailers to:
 - complete the PIJAC Animal Care educational program
 - join the Habitattitude™ campaign
 - use Habitattitude™ fish bags imprinted with the “do not release” message

CONSUMER NODE

- FL Dept. of Agriculture develop public education message supporting the Habitattitude™ “do not release” message
- Create an educational partnership between the FDACS, FWC, UF, and public aquaria to communicate responsible nonindigenous species ownership and handling message

What did we learn?

- Trade data is out-of-date and deficient
- Socio-economic data anecdotal
- Species occurrence data is deficient
- Ecological effects uncertain
- Focus is on fish

Process?

- High level of trade participation
- Focus on public education

Participants

Mr. Chris Buerner - Quality Marine, Inc. – importer

Mr. Dustin Dorton – Ocean, Reefs and Aquariums - farm

Dr. Tom Edling - Petco Corporation - retailer

Dr. Henry Feddern - marine life collector

Dr. Jeffrey E. Hill – UF-Tropical Aquaculture Laboratory

Dr. Tim Hovenac - aquatic veterinarian

Mr. Steven Lundblad - Dolphin International - importer

Ms. Jessica McCawley - Florida Fish and Wildlife Conservation Commission

Mr. Marshall Meyers - Pet Industry Joint Advisory Council

Mr. Martin Moe, Jr. - Green Turtle Publications

Mr. Kenneth Nedimyer - Sea Life, Inc. – marine life collector

Dr. Jamie Reaser – Pet Industry Joint Advisory Council

Dr. Nick Saint-Erne - PetsMart, Inc. - retailer

Mr. Elwyn Segrest - Segrest Farms – wholesaler/importer/farm

Mr. Paul Shafland - Florida Fish and Wildlife Conservation Commission

Mr. Marty Tanner - Aquatica Tropicals - farm

Mr. Jay Troxel - U.S. Fish and Wildlife Service

Mr. Forrest Young - Dynasty Marine Associates, Inc. – marine life collector

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FloridaAquaculture.com/pub.htm

or

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