



Volunteer REEF Divers in the Pacific Northwest Monitor and Remove Invasive Tunicates

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It's no fun being an illegal alien...

Invasion by non-native species has been ranked as one of the most devastating ecological impacts to affect marine and fresh waters. Once established, non-native introductions are difficult to control and often impossible to eradicate.

- Single invasion event can result in major shifts to ecosystems
- High impact on local economies
- Early detection and aggressive control measures are the most efficient way to prevent wide spread ecosystem impacts from aquatic invasive species
- Coordinated response including assessment and control / eradication is critical



REEF Divers Trevor Anderson and Janna Nichols remove invasive tunicates (*Ciona savignyi*) from Sund Rock North Wall. - Photo by Joseph D. Rowe

If you've got 'em, use 'em!

- Volunteer recreational divers can be used to provide data about where, when and in what abundance the tunicates can be found
- They can also provide valuable data from a wide geographic area over a long time frame
- Outreach and training of divers is critical for success



Front and back of laminated ID card - photos by Janna Nichols

		*April 2006 - December 2008							
		<i>Ciona savignyi</i>		<i>Styela clava</i>		<i>Didemnum sp. A</i>		Total	Total sites
		sightings	sites	sightings	sites	sightings	sites	surveys	surveyed
BC		7	6	0	0	0	0	476	114
WA		132	23	1	1	10	2	2,722	206
OR		0	0	0	0	0	0	77	15

*April 2006 is when REEF began monitoring invasive tunicates

Triple threat

Over the last few years, three species of invasive tunicates have been discovered in various locations in the Puget Sound and broader Pacific Northwest region.

- Ciona savignyi*
- Styela clava*
- Didemnum sp. A*

The Reef Environmental Education Foundation (REEF) Survey Project is a program that enables volunteer divers to collect fish and invertebrate sighting information during recreational dives. The project started in 1993 in Florida and has expanded to include all coastal areas of North and Central America, the Caribbean and Hawaii, including 8 National Marine Sanctuaries. The Project provides a standardized survey method, data management system, and Internet summary reporting.

Ciona savignyi



Styela clava



Didemnum sp. A



Photos by Janna Nichols

Invasive Tunicate sightings reported in the REEF database: 2006 - 2008



REEF diver Doug Biffard surveys a Red Irish Lord - Photo by Pete Naylor



REEF diver Rhoda Green removes invasive Didemnum from Shilshole Bay boat launch. - Photo by Janna Nichols

REEF gets into the swing of things by:

- Incorporating the three species of invasive tunicates into the existing REEF citizen science sub-tidal monitoring program for Washington, Oregon and British Columbia starting in 2006
- Training recreational divers in the classroom to recognize the invasive species underwater and to report them as part of the REEF Volunteer Survey Project.
- Partnering with WDFW, SeaGrant and others to create a waterproof ID card for divers.
- In 2007, REEF organized five *in-situ* tunicate assessment and removal efforts in Hood Canal and Puget Sound.
- Special collection permit issued by WDFW to REEF's Advanced Assessment Team to help in short-notice removal efforts.



Shannon Pt Marine Center REEF class, REEF Advanced Assessment Team invasive tunicate survey - Photos by Janna Nichols



The REEF Survey Method

REEF volunteers use the Roving Diver Technique (RDT), a non-point visual survey method specifically designed for volunteer data. During RDT surveys, divers swim freely throughout a dive site and record every observed fish species, and a specific set of invertebrates that can be positively identified. The search begins as soon as the diver enters the water. The goal is to find as many species as possible so divers are encouraged to look under ledges and up in the water column. At the conclusion of each survey, each recorded species is assigned one of four abundance categories based on about how many were seen throughout the dive [single (1); few (2-10), many (11-100), and abundant (>100)].

Following a dive, each surveyor records the species data along with location, survey time, depth, temperature, and other environmental information. A separate survey is conducted for each dive. Surveys are then submitted online.

REEF surveys are conducted as part of a diver's regular diving activities; anytime they are in the water.

Summary reports of REEF data are available online at www.reef.org and raw data files are available upon request.

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REEF diver Janna Nichols surveys in the Monterey Bay National Marine Sanctuary. - Photo by Pete Naylor